36th KERALA SCIENCE CONGRESS

8-11 February 2024

Government College, Kasaragod

ABSTRACTS

Selected Papers

Focal Theme:
Transforming Kerala's Economy through One Health Approach

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Organized by

36th Kerala Science Congress

Abstracts of Selected Papers

Focal Theme
Transforming Kerala's Economy through One Health Approach

Editor-in-Chief
Prof. K.P. Sudheer
Executive Vice President, KSCSTE &
President, 36th Kerala Science Congress

Editors
Dr. S. Pradeep Kumar
Dr. Anilkumar C.
Dr. C. Arunan
Dr. Hareesh V. S.
Dr. Jaya Mary Jacob
Dr. Naveena K.
Dr. Magesh N. S.

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Pinarayi Vijayan
Chief Minister

Government of Kerala

February 8, 2024

MESSAGE

Emerging and re-emerging infectious diseases (EIDs) are infections that have newly appeared in a population or existed previously but are rapidly increasing in incidence. The recent increase in EDIs is often caused by the interaction between humans and animals, which can create significant challenges. In this regard, the One Health (OH) Approach that focuses on promoting multisectoral activities to prevent zoonosis and potential epidemics and pandemics has been suggested as an important anticipatory strategy by validated sources. The implementation of the OH approach mandates all sectors, viz healthcare, agriculture, engineering, materials sciences, environmental sciences, etc, to work together with shared responsibilities and challenges. The Kerala State Council for Science, Technology and Environment (KSCSTE) has decided to make "Transforming Kerala's Economy through One-Health Approach" the special theme of the 36th Kerala Science Congress (KSC) in light of the implementation and operationalisation of the OH approach, particularly in Kerala.

Besides the significance of the theme, another highlight of the 36th Kerala Science Congress is the interaction with the 2022 Nobel Laureate Prof. Morten Meldal. The proposed Nobel lecture would be a privilege for the scientific community in Kerala. The mega scientific event is, hence, a collaborative effort involving the participation of experts from the scientific community in the university departments and R&D centres in the state with a view to developing an action plan that can be implemented at the grassroots level for the OH approach in the state. The focal theme lectures would deliberate the preparation of a road map to approach the problem by applying appropriate multisectoral, multi-disciplinary and collaborative measures.

The Memorial Lecture Series was established by the KSCSTE to honour famous S&T figures such as Dr. P. K. Iyengar, P. T. Bhskara Panicker, Dr. P. K. Gopalakrishnan, Dr. P. R. Pisharoty, Dr. G. N. Ramachandran, Dr. E.K. Janakiyammal, Dr. Thanu Padmanabhan and Dr. M S Swaminathan intends to pay tribute to their contributions and inspire young people. Another noteworthy event of the 36th KSC is the interaction session between bright PG science students and prominent scientists and academicians. An interactive session with the Children Scientists in Kerala is also proposed during the event. The 36th KSC is an event that aims to provide a platform for researchers to present their findings in 12 different fields. These fields are Agriculture and Food Sciences, Biotechnology, Chemical Sciences, Earth and Planetary Sciences, Engineering and Technology, Environmental Sciences, Forestry and Wildlife, Fisheries and Veterinary Sciences, Health Sciences, Life Sciences, Mathematical Sciences, Physical Sciences, and Scientific Social Responsibility.

The present volume is a compilation of papers accepted for presentation at the 36th Kerala Science Congress. I am thankful to all the contributors whose work has been included in this volume. The reviewers have done a commendable job in meticulously selecting the papers for this congress. I would like to express my sincere gratitude to all the members of the organising committee whose efforts have made this year's Kerala Science Congress a reality.

"I wish the 36th Kerala Science Congress all the best and hope for its success."

Pinarayi Vijayan

Prof. K.P. Sudheer
Executive Vice President,
KSCSTE

Kerala State Council for Science, Technology and Environment

FOREWORD

The intricate interconnectedness between human and animal interfaces in the context of emerging diseases presents formidable challenges that demand urgent attention. This complex relationship has increasingly become a focal point of concern, as it significantly influences the dynamics of disease transmission and outbreak patterns. In response to these challenges, there has been a growing recognition of the importance of adopting a holistic approach known as the One Health (OH) Approach. This approach emphasizes the integration of efforts across various sectors, including healthcare, agriculture, and environmental sciences, to address the interconnected health issues affecting both humans and animals.

In recognition of the pressing need to address these challenges, the Kerala State Council for Science, Technology, and Environment (KSCSTE) has taken a proactive stance by focusing on the theme of "Transforming Kerala's Economy through One-Health Approach" at the upcoming 36th Kerala Science Congress (KSC). This strategic emphasis underscores the council's commitment to leveraging interdisciplinary collaboration and innovative solutions to tackle emerging health crises and promote sustainable development.

Furthermore, the 36th Kerala Science Congress provides a unique platform for engagement and exchange, offering attendees the invaluable opportunity to interact with distinguished individuals such as 2022 Chemistry Nobel Laureate Prof. Morten Meldal. This interaction aligns seamlessly with the overarching goal of formulating grassroots-level action plans to advance the OH approach state wide. Additionally, the congress features a diverse array of scientific events, including the Memorial Lecture Series, specialized sessions for postgraduate students, and presentations across 12 fields of scientific inquiry. These events serve as catalysts for collaboration, knowledge exchange, and the dissemination of cutting-edge research findings.

As the culmination of these efforts, this publication showcases the papers selected for presentation at the congress, serving as a testament to the collective contributions of researchers and scientists. I extend my heartfelt gratitude to all contributors for their invaluable contributions and commend the rigorous review process led by the organizing committee.

With best wishes for success, we look forward to the 36th Kerala Science Congress serving as a catalyst for scientific advancement, innovation, and collaboration.

Prof. K.P. Sudheer

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01-AGRICULTURE & FOOD SCIENCE

ORAL PRESENTATION

01-01

INTERCROPPING INDICES OF SESAMUM AND COWPEA INTERCROPPING UNDER ROW RATIOS AND NUTRIENT MANAGEMENT

Sabitha B.1, Shalini Pillai. P.2, Usha C. Thomas3, Sheeja K. Raj4, Chitra. N.5

1Department of Agronomy, College of Agriculture, Vellayani, Thiruvananthapuram-695 522
2Department of Agronomy, College of Agriculture, Vellayani, Thiruvananthapuram-695 522
3Instructional Farm, College of Agriculture, Vellayani, Thiruvananthapuram-695 522
4Department of Organic Agriculture, College of Agriculture, Vellayani, Thiruvananthapuram-695 522
5Department of Agricultural Microbiology, College of Agriculture, Vellayani, Thiruvananthapuram-695 522

Abstract: The study was conducted at Instructional farm, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala to assess the intercropping indices of sesamum + cowpea intercropping system. The experiment was laid out in randomised block design with 3 x 2 x 2 treatments, replicated thrice. The treatments comprised combinations of three levels of recommended dose of nitrogen (RDN) (n1-100 % RDN, n2-75 % RDN, n3-50 % RDN), two row ratios (r1-4:2, r2-6:3) and application of AMF (a1-without AMF, a2-with AMF). All other cultural practices are done as per the biological indices such as, land equivalent ratio (LER), relative crowding coefficient (RCC), Aggressivity, competition index (CI), competition ratio (CR), sesamum equivalent yield (SEY), percentage yield difference (PYD) were assessed using yield data. Irrespective of the treatments, all the system showed yield advantage in terms of LER, CI and PYD. The treatment combination 100 per cent RDN at 6:3 row ratio without AMF resulted in higher LER (2.40), RCC (66.18), SEY (1801 kg ha-1) and PYD (139.87%). Among the treatment combinations higher yield advantage in terms of CI was observed (-0.06) in the treatment 75 per cent RDN at 6:3 row ratio without AMF. Cowpea proved its dominance over sesamum with positive (+) aggressivity in all the treatment combinations, while sesamum resulted in negative (-) aggressivity. Cowpea also exhibited higher CR value indicating its competitive ability over sesamum. Among the treatment combinations, 100 % RDN at 6:3 row ratio without AMF (n1r2a1) excelled in terms of LER, RCC, SEY and PYD

01-02

EFFICIENCY ENHANCEMENT AND QUALITY ASSESSMENT OF THE PRODUCTION OF VACUUM-FRIED JACKFRUIT (*ARTOCARPUS HETEROPHYLLUS*) CHIPS

N. Praveena, G.K. Rajesh, R. Surya, K. Fairoosa, Anusha K. George, S.A. Fathima Tasneem

Department of Processing and Food Engineering, KCAET Tavanur, Kerala Agricultural University,
praveenanerthethil@gmail.com

Background: Jackfruit, boasts remarkable health benefits and a distinct flavour. However, its susceptibility to high postharvest losses and seasonal availability poses a significant challenge. Value addition of ripened jackfruit using vacuum frying technology is a key solution to address this

critical issue. This innovative method provides superior health advantages, yields good texture and visually appealing results compared to conventional frying.

Method: The study encompassed two stages: Experiment I focused on optimizing pre-treatments (blanching, drying, freezing, and an untreated control) for vacuum-fried jackfruit chips based on quality attributes of fried chips. Experiment II delved into the optimisation of process parameters (frying temperature, vacuum pressure and frying time) based on quality of these chips.

Results: The untreated sample stood out, exhibiting the best qualities, such as low moisture content (0.50% wb), hardness (1.04 N), and water activity (0.49%), along with a reduced oil content (20.35%). The performance evaluation of the vacuum fryer was done in terms of frying temperature, vacuum pressure, and frying time. Under the optimal conditions (100°C frying temperature, 9 kPa vacuum for 20 minutes, with a de-oiling speed of 1000 rpm at 5 minutes), the vacuum-fried jackfruit chips demonstrated superior characteristics. Even after 30 rounds of oil reuse, the total polar compound (TPC) of the used oil remained within permissible limits (25-27%).

Conclusions: This technology with optimised condition aids in the production of good quality chips in a more effective manner without much altering the colour and flavour of raw ripened jackfruit.

Keywords: Vacuum frying, Jackfruit, Chips, Low pressure

01-14

EFFICACY OF AN AUTOMATIC HYDROPONIC SYSTEM OVER CONVENTIONAL SYSTEM FOR THE CULTIVATION OF *LACTUCA SATIVA* L. VAR. LONGIFOLIA

[1]Sheeja George E., [1]Navami Raj K. N., and [1]Dhanya C.

[1]Post Graduate Department of Botany, Sree Narayana College, Cherthala, Alapuzha District-688582, Kerala.

Background: With the steady increase in world population, there is growing demand for food production as well. But, the traditional farming systems are not adequate to meet the current and future demand of food. Moreover, the increasingly urbanized population stays away from agricultural practices due to lack of cultivable land and the busy life style they follow. Therefore, there is a real need for adopting a new farming system that could reduce the labour and time for crop production at the same time stimulating the plants to grow faster. Hydroponics is an effective, soil-less system for plant cultivation which provides a controlled and monitored environment for plants to grow. In hydroponic system, highest yield is ensured at the cost of reduced water and nutrient supply and utilizing very little area of cultivable land. Adequate supply of nutrients and optimum levels of temperature and pH are essential for the success of a hydroponic system. Maintaining correct conditions of both water and air, while keeping a close eye on changes and fluctuations is possible by using an automatic hydroponic system. Present study was aimed to analyse the efficacy of an automated hydroponic system for growing a valuable leafy vegetable - *L. sativa* by comparing the plant's growth in conventional cultivation system.

Methods: An automatic hydroponic system of DFT (deep flow technique) was constructed in which the roots are fully merged in water. The nutrients are supplied directly to the main tank and pumped to the plants in the DFT system and is then flown back to the main tank. The system is attached with

sensors that measure pH, temperature, dissolved oxygen level, light intensity and humidity. A TDS meter that measures the levels of salts, nutrients, and other concentrates in the water is also attached in the system. These measurements are critical to understanding how much water, nutrients, and oxygen your plants are currently able to absorb and let us know when to feed the plants.

Efficacy of the automatic hydroponic system for growing lettuce plants was analyzed by comparing various quantitative and qualitative parameters of the plants grown in the hydroponic system with those of the plants grown in conventional planting system. For this, twenty *L. sativa* seedlings each (after 10 days of germination) were planted in the automatic hydroponic system and conventional fertilized soil-filled grow bags. Observations on vegetative parameters like plant height, leaf size (length and width of the lamina) and number of leaves were made in every 10 days. Arc auxonomter was used to measure plant height; and the mean measures of two basal leaves of each plant were recorded as leaf size. The experimental set up was in CRD (completely randomized design) with two treatments each with 20 replications. Data were analyzed using univariate analysis of variance and the means were compared using Tuckey HSD. After harvest upon 60 days, biochemical analysis using standard tests and sensory analysis for characters like taste, color and texture were also done.

Results: With respect to the efficacy of the edible plant production with better growth of the plant and more number of large-sized tastier leaves with good texture, the automatic hydroponic culture system was more efficient than the conventional planting system for the cultivation of lettuce plants ($p< 0.05$). Average number of leaves/plant was 3.5 ± 1.3 and 16 ± 2.06 respectively on 10th and 60th day of planting in conventional planting system; while it was 5 ± 0.13 and 23 ± 0.47 respectively in automated hydroponic system. Average length of the leaf lamina was 12.4 ± 3.23 cm and average leaf width was 6.6 ± 2.32 cm in plants harvested from conventional grow bags; whereas the average leaf length was 15.1± 0.43 cm and leaf width was 9.2 ± 2.32 cm in plants harvested from automated hydroponic system. Average plant height on the 60th day of planting was 39.4 ± 1.32 cm in conventional system; and it was 82.1 ± 0.21 cm in hydroponic system. Leaves in conventional system tasted bitter and were darker green in color with thicker mid rib when compared to the leaves produced in hydroponic system which were lighter, softer and tasted less bitter.

The biochemical analysis revealed that, the plants grown in both planting systems contained proteins, phenols, flavonoids and vitamin C. Pigment concentration per gram of leaf tissue was higher in conventional system ($p< 0.05$) (2.62 mg/g chlorophyll a; 0.0087mg/g chlorophyll b and 0.242mg/g carotenoid) when compared to that in automated hydroponic system (2.10 mg/g chlorophyll a; 0.0064 mg/g chlorophyll b and 0.232mg/g carotenoid).

Conclusion: The findings of the present study put forth automated hydroponic system as an excellent system to grow fresh vegetables in the household of urban population, where lack of cultivable land and busy-scheduled life style of people are the major constraints of growing vegetable garden.

Keywords: Hydroponics, *Lactuca sativa*, lettuce, automatic system, nutrient solution

01-3

IMMUNOMODULATING POTENTIAL OF NOVEL POLYSACCHARIDE-BASED NANOPARTICLES AND A NUTRACEUTICAL PRODUCT DERIVED FROM GREEN SEAWEED (FAMILY *ULVACEAE*)

Shilpa Kamalakar Pai[1,2] *, Kajal Chakraborty[1], Ashwin Ashok Pai[1], Shubhajit Dhara[1]

[1] *Marine Biotechnology, Fish Nutrition and Health Division, Central Marine Fisheries Research Institute, Ernakulam North, P.B. No. 1603, Cochin 682018, Kerala State, India*

[2]*Department of Applied Chemistry, Cochin University of Science and Technology, Cochin, Kerala, India*

**shilpakamalpai@gmail.com (Shilpa K Pai)*

Background: An increasing demand for naturally-derived therapeutics has led to exploration of novel immunomodulatory agents.

Methods: Novel (1→4)-linked xylated rhamonoglycan polysaccharides isolated from three green seaweeds *Ulva fasciata, Ulva lactuca* and *Ulva reticulata* with potent immunomodulatory properties were subjected to develop conjugates of polysaccharide-based silver nanoparticles, which were studied for immunomodulatory and anti-inflammatory properties. Polysaccharides from these green seaweeds were fractionated over anion exchange chromatography by using diethyl aminoethylcellulose, and were studied for spectroscopic characterization before being subjected for the preparation of silver nanoparticles. Depending upon the size, stability and preliminary bioassay, anti-inflammatory activity of UF-AgNP was evaluated on LPS-induced CALU-1 cells. Silver nanoparticle (AgNP) was synthesized through the reduction of silver nitrate in the presence of sulfated polysaccharide using ultra-sonication. Primary characterizations of nanoparticles (UF-Ag^{NP}, UL-Ag^{NP} and UR-Ag^{NP}) were performed by dynamic light scattering (DLS) analyzer, where mean particle size distribution and zeta potential were assessed. Morphological characterizations of nanoparticles were carried out by using Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) analyses. The elemental composition was examined through Energy Dispersive X-ray Spectroscopy (EDX), and the interaction between silver and polysaccharide was confirmed via Fourier transform infrared (FTIR) analysis. The nanoparticles were evaluated for attenuation against pro-inflammatory enzymes 5-lipoxygenase (5-LOX) and cyclooxygenase-1,2 (COX-1,2). *In-vitro* studies on CALU-1 Cell line included quantitative estimation of inflammatory cytokines interleukin (IL)-1**β**, tumor necrosis factor-alpha (TNF-**α**), interferon-gamma (IFN-**γ**), IL-33, IL-10, IFN-**α**, and transforming growth factor (TGF)-**β** expressions. A nutraceutical product consisting of 100% natural blend of polysaccharide as bioactive ingredient, which can potentially be used to boost innate immunity has been developed.

Results: Spectral features were indicative of the typical characteristics of polysaccharides isolated from the studied green seaweeds. Monosaccharide compositional analysis of polysaccharides isolated from *U. fasciata, U. lactuca* and *U. reticulata* (UFP-2, ULP-2 and URP-2, respectively) along with spectroscopic characterization showed their major compositional units as (1→4)-linked β-glucuronic acid (unit A), (1→4)-linked α-rhamnose-3S (unit B) and (1→4)-linked β-xylose (unit C). Silver nanoparticles stabilized by polysaccharide from *Ulva fasciata* (UF-Ag^{NP}), *Ulva lactuca* (UL-Ag^{NP}), and *Ulva reticulata* (UR-Ag^{NP}) demonstrated potent inhibition (IC_{50} < 2 mg/mL) of pro-inflammatory enzymes 5-LOX and COX-1,2, with UF-Ag^{NP} exhibiting the highest selectivity index (1.98). UF-Ag^{NP}, characterized by small size (<80 nm), high zeta potential (-25 mV to -30.4 mV), and low IC_{50}, displayed noteworthy anti-inflammatory and immunomodulatory properties. UF-

Ag^{NP} at 31.25-125 µg/mL dose-dependently enhanced immunomodulatory and anti-inflammatory properties against cytokine expression. Flow cytometry analyses revealed a 2.2-fold attenuation of IL-1β and TNF-α expression. Gene expression analysis showed a 4.3-fold downregulation of IFN-γ. Fluorescence intensity assays indicated a 4.8 and 5.4-fold increase in IL-10 and IFN-α, respectively, while IL-33 and TGF-*β* exhibit reductions by 9.6 and 6 times. The nutraceutical product developed from (1→4)-linked xylated rhamonoglycan isolated from *U. fasciata* was found to inhibit the development of pro-inflammatory cytokines, such as inducible nitric oxide synthase, interleukin-1*β*/6, and tumor necrosis factor-*α* in a dose-dependent fashion. The chemical structure of the active principle is beneficial for immunity since the presence of bioactive is recognized by the body's immune cells as an alarm to develop resistance against inflammatory responses.

Conclusion: The polysaccharide-based nanoparticle from *Ulva fasciata* possesses immunomodulatory and anti-inflammatory potential, and could be utilized as a nutraceutical for health benefits to augment innate immunity.

Keywords: Seaweed derived polysaccharide-based silver nanoparticle, green seaweeds, Ulvaceae, Immunomodulatory and anti-inflammatory property.

01-04

OPTIMIZATION OF CONCHING PROCESS IN CHOCOLATE PRODUCTION

Navale Abhishek Govind, G K Rajesh, N P Shamna, M G Anjaly, R Sreeja

Department of Processing and Food Engineering, KCAET, Tavanur, KAU
rajesh.gk@kau.in

Background: In India, milk chocolate is the most popular category among consumers and contributes around 75 percent of the total sales of chocolates. Chocolate industries are fully dominated by multinational companies. There are several homemade chocolate units producing chocolate on a smaller scale. Consumers prefer branded chocolates over homemade chocolates because of their quality and texture. For a good texture, the chocolate should be properly conched and tempered. However, in the case of homemade chocolate units run by Self-help Group (SHG), there is a lack of conching cum tempering machines at affordable prices.

Method: A women friendly, small-scale conching cum tempering machine for chocolate production was designed and developed. The developed machine consists of jacketed chamber with stone base, stone rollers and spring loaded scrapers assembly, refrigeration system, motor and gear box, variable frequency drive (VFD), water tank and water pump, control panel and vibration platform. In this experiment, 3 levels of three process parameters viz. conching temperature, conching time and speed of rotation were studied and optimized based on the quality attributes of the final chocolate.

Results: Optimisation of conching parameters was carried out using the Box Behnken design of the Design Expert software 13. Further, the characteristics of conched chocolate samples were vividly analysed to decide the best treatment among the 17 trials provided by the software. The analysis of all the prescribed conching parameters revealed that there was significant effect of conching process parameters on quality characteristics viz. viscosity, particle size, moisture content, water activity and ash content. It was found to be reversed in the case of TSS and pH of chocolate sample after conching process. Optimal conditions obtained for conching process was 70 ºC conching temperature, 14 h

conching time and speed of rotation of 75 rpm.

Conclusions: The optimized chocolate samples were analysed to understand the acceptability of the sample. Results on each sensory parameter indicated that the optimized chocolate sample is accepted by the consumer in similar way they have accepted the commercial chocolate.

Key words: cocoa processing, chocolate production, conching process

01-05

ELUCIDATING PHOTOSYNTHETIC WATER USE, ANTIOXIDATIVE DEFENCE AND YIELD IN RICE FOR REPRODUCTIVE STAGE DROUGHT TOLERANCE UNDER FUTURE CLIMATE CHANGE

Athul Mohanan*, Ashish K Chaturvedi, Pravisha P.P., Naveena K, Surendran U.

Land and Water Management Research Group, Centre for Water Resources Development and Management (CWRDM), Kunnamangalam, Kozhikode - 673571, Kerala, India athulmelur95@gamil.com

Background: Rice is one of the most important cereal crop being cultivated globally as a major source of calories. After China, rice production in India and Bangladesh comes next as per the Food and Agriculture Organization Statistics.In Kerala, particularly at Northern Districts, the productivity of rice is declining in each year. Stage specific sensitivity of the rice has been worked out in several studies, however, limited with pot experiments or in growth chambers conditions particularly in Kerala. In that, reproductive stage covering panicle exertion to early grain filling is sensitive to heat as well as drought stress. Incidences of drought spells have been more frequent in recent decades having global impact on agricultural production. Conversely, limiting natural freshwater resources has further aggravated the impact of drought stress in crops particularly growing in red-fed agricultural system. Systemic field studies are warranted under known severity and duration of drought during reproductive stage tolerance which can provide novel inroads to crop improvement programs.

Methods: Field experiment was conducted with five genotypes viz. Uma, Jyothi, Vaishak, Karuthamodan and Chuvannamodan during *puncha* season (January to May) of 2021 at Centre for Water Resources Development and Management, Kunnamangalam, Kozhikode, Kerala, India. Specialized lysimetric pits were used to provide drought exposure during reproductive stage (covering panicle exertion-flowering-early grain filling) withholding wateringfor 14 days. Experiment was conducted in SPLIT-PLOT design with 5 true field replications. Daily moisture measurement were performed through Decagnon Devices Procheck soil moisture probe with GS3 sensor to measure the desired level of drought stress pits, where volumetric water content (VWC) reached to 22.25%contrary to control wherein VWC was 50.19% after 14 days of exposure, further fields were re-watered after the known duration of exposure. Different physiological traits such as net photo-assimilation, stomatal conductance, relative water content, membrane stability index etc. and biochemicalbiochemical parameters such as ROS accumulation estimated through H_2O_2 content and TBARS determines malondialdehyde (MDA) as an end product of lipid peroxidation along with osmoprotectant such as proline content were estimated in the flag leaves after stress exposure from control and drought stressed plants through standard protocols. Yield andits attributes are measured after harvesting at physiological maturity.

Results: Results revealed that drought stress caused significant reduction (P<0.001) in the membrane stability index and relative water content. There were significant differences (P < 0.001) in membrane stability index (MSI) as well as relative water content (RWC) of rice genotypes on drought stress exposure. The results were significant for genotypes, treatments and the interaction between genotypes and treatment (P<0.001, P<0.001 and P<0.01). MSI as well as RWC was significantly (P<0.001) lower in Uma, Jyothi (27-30%) under drought stress treatment compared to control. Conversely, genotype Vaishak and ChuvannaModan showed least reduction (5-9%) in both the traits. This suggests that Vaishak genotype has maintained its membrane stability index. The treatment x genotype effect was significant (P < 0.001) for all gas exchange parameters. Under drought stress, leaf photosynthetic rate (A) was significantly (P<0.001) reduced in all the genotypes. Maximum reduction (64-66%) in gas exchange attributes was in Uma and Jyothi. Similar trend was recorded for transpiration rate (E) and stomatal conductance (g_s). Vaishak and ChuvannaModan shown a reduction in photosynthesis (32-43%) under drought stress. Mechanistically the changes in photosynthetic water use efficiency attributed to the carboxylation efficiency. There was a reduction in PWUE by 4 to 43% which was minimum for Vaishak and maximum for Uma and Jyothi.

Further the the results of biochemical parameters suggests that all the genotypes shown a significant increase (1.3 to 2.7-fold) in H_2O_2 and TBARS content. The increment was lower in Vaishak compared to other genotypes. Some of the osmoprotectants which commonly accumulate in crop explaining the tolerance of the genotypes. The fold increase in Vaishak and ChuvannaModan in proline content was higher than other varieties. Phenotypic response to drought varied considerably across the different yield components. All the genotypes recorded a decrease in number of tillers and panicles. All genotypes recorded lower main panicle weight (11 to 59%), grain yield (20 to 63%), and total biomass (13 to 37%) under drought stress as compared to Control. Vaiskak and ChuvannaModanmaintained grain yield and yield components

Conclusion: Study confirmed that mechanistically the genotypes with higher intrinsic carboxylation efficiency and better antioxidative defence can sustain the drought stress as reported in the Vaishak and ChuvannaModan while the popular high yielding genotypes could reveal major yield penalty owing to source sink imbalance. Further it will be intriguing to explore the role of multiple stress combination of heat as well as drought in field environment which could provide novel traits and mechanistic understanding to explore the superior rice genotypes under northern Kerala having higher Photosynthetic Water Use and better antioxidative defence under future climate change scenario.

Keywords: Rice, Drought, Climate Change, Phenotyping, Field Experiment, Northern Kerala

01-06

ENHANCING BANANA PRODUCTIVITY: A COMPREHENSIVE ANALYSIS OF INFLUENTIAL FACTORS IN IRRIGATED ENVIRONMENTS

Santosh Onte, Naveena K, Ashish K Chaturvedi and U Surendran

Land and Water Management Research Group,
Centre for Water Resources Development and Management, Kozhikode, Kerala-673571

Background: Banana cultivation plays a pivotal role in the agricultural landscape of Kerala,

particularly in irrigated environments where the delicate balance of factors significantly influences productivity. The tropical climate and abundant water resources make Kerala an ideal region for banana cultivation, contributing substantially to the state's agricultural economy. This comprehensive analysis aims to delve into the intricate web of influential factors that shape banana productivity in irrigated environments across Kerala.

Method: Over three years, this study in Kozhikode, Kerala, employed a multi-phased approach to identify key factors influencing irrigated banana cultivation productivity. In the initial year, a comprehensive field survey using questionnaires among local banana farmers gathered insights into agronomic management parameters. Technical factor analysis, incorporating both farmers' perceptions and agronomic influences, identified key factors. Over the subsequent two years, field experiments delved deeper, examining factors such as spacing, pit size, planting method, and pre-treatment of suckers, while maintaining a constant Recommended Dose of Fertilizer (RDF). Statistical analysis, specifically principal compound analysis, was utilized to interpret the collected data.

Results: The study identified Recommended Dose of Fertilizer (RDF) as a significant factor influencing banana productivity in irrigated cultivation in Kozhikode, Kerala. Among the 23 examined agronomic practices, RDF, plant spacing, depth, and planting method emerged as key determinants. Subsequent field experiments over two years affirmed the importance of these factors, with reduced depth and spacing leading to significantly lower banana yields compared to the standard practice (spacing 6x6 feet & 50x50x50 cm depth). Additionally, the paired row planting method resulted in lower yields compared to the single-row approach. The adoption of standard recommended agronomic practices showcased positive outcomes compared to farmers' practices in Kozhikode districts.

Conclusion: This three-year study highlights the importance of following recommended farming methods, especially regarding how far apart plants are, how deep they're planted, and the way they're planted, to get the best banana yields in irrigated areas of Kozhikode, Kerala. The study showed that using the right amount of fertilizer (Recommended Dose of Fertilizer or RDF) is crucial, as supported by actual field tests. Farmers who didn't stick to the standard practices, like having the correct spacing and depth (6x6 feet & 50x50x50 cm), had noticeably lower banana yields. These findings offer practical strategies to improve banana farming, potentially benefiting the lives of farmers in Kozhikode and contributing to sustainable agriculture in the region.

Keywords: Spacing, Irrigation, RDF, Plant spacing, Planting depth, Planting method

01-07

SCREENING AND CHARACTERIZATION OF N AND K EFFICIENT GENOTYPES IN CASSAVA

Swathy Sivan[1], Revathi B S[2], Thouseem N[3]

[1]Assistant Professor, Department of Plant Breeding and Genetics, College of Agriculture, Ambalavayal, Kerala Agricultural University

[2]MSc, Department of Plant Breeding and Genetics, College of Agriculture, Vellayani, Kerala Agricultural University

[3]*Assistant Professor, Department of Plant Breeding and Genetics, Rice Research Station, Mancombu, Kerala Agricultural University*

Background: Cassava is extremely responsive to fertilizers and manures and is often grown by marginal farmers, who use chemical fertilizers recklessly, causing harsh environmental consequences. Developing nutrient-efficient genotypes and their introduction into farming systems along with low input management strategies are likely to reduce fertilizer dosage and ultimately lower the cost of cultivation. In light of this, the present study was undertaken to screen and characterize N and K-efficient genotypes in cassava identify the traits contributing to nutrient efficiency, and study their gene expression.

Method: 1 a. Screening among thirty genotypes to identify low input nutrient-efficient lines.

b. Root studies in the thirty genotypes to understand the contribution of root characters to nutrient efficiency.

2. Evaluation of the five nutrient-efficient genotypes selected from the previous experiment under different levels of fertilizers.

Results: The study identified three main nutrient efficient genotypes *viz.,* KBH18, which was the highest yielder, highest in N efficiency and third highest in K efficiency, 8S501-2, which was second highest in yield, highest in K efficiency, third highest in N efficiency and also exhibited early bulking and 15S409, which was the third highest yielder, second highest in N efficiency & K efficiency. Results also showed that from 0 to 25 % of fertilizer dose, there is an escalation in yield as well as N efficiency and K efficiency, while the values at 25 and 50% are on par.

Conclusions: The superior genotypes identified in the present study can be subjected to field trials to confirm their superiority and release as a variety.

Keywords: Cassava, Nutrient Use Efficiency, Fertilizer dose, Root characters

01-08

PERFORMANCE EVALUATION OF TEMPERATURE-BASED METHODS FOR ESTIMATING REFERENCE EVAPOTRANSPIRATION IN KERALA, INDIA

H. R. Gokul Krishnan[1], P. J. Jainet[2,3], Aiswarya Kunnath Poovakka[4], K. P. Sudheer[1,5]

[1]*Kerala State Council for Science, Technology and Environment (KSCSTE), Thiruvananthapuram*
[2]*KSCSTE- Centre for Water Resources Development & Management (CWRDM), Kozhikode*
[3]*Department of Civil Engineering, Indian Institute of Technology, Palakkad*
[4]*KSCSTE- Institute for Climate Change Studies (ICCS), Kottayam*
[5]*Department of Civil Engineering, Indian Institute of Technology, Madras*

Background: The Penman-Monteith (PM) method, as outlined by the Food and Agriculture Organization (FAO-56 report), stands out as the widely acknowledged approach for calculating reference evapotranspiration using daily weather data. It has been endorsed as the benchmark for validating the effectiveness of other models in estimating reference evapotranspiration. In regions where the weather data are limited, temperature-based models are useful in calculating reference evapotranspiration. The aim of this research was to evaluate different temperature-based approaches

for estimating reference evapotranspiration and determine the most appropriate method for Kerala, a southern state in India characterized by a humid tropical climate.

Method: Kerala was divided into (1.00 X 1.00 degree) grids and four grids which do not have more than 50% sea were selected. This study employed 12 different temperature-based methods for estimating the reference evapotranspiration, and are evaluated. The performance of each of the method is compared with the results of FAO-56 Penman-Monteith method. The performance of the temperature-based models is evaluated using the coefficient of determination (r^2), Mean Absolute Error (MAE), Root Mean Square Error (RMSE), and Percent Bias (PBIAS).

Results: The Hargreaves-1 method has estimated the reference evapotranspiration relatively better than the other models in Grid 1 and the Baier and Robertson model and the Hargreaves and Samani model performed comparatively better in Grid 2. Both the grids represent the southern regions of Kerala. The Priestley-Taylor method, along with the Ravazzani and Trajkovic methods (adaptations of the Hargreaves and Samani equation) showed good performance in both Grid 3 and Grid 4, which represent the northern regions of Kerala.

Conclusions: Hargreaves and Samani, Hargreaves-1, and Hargreaves-2 methods demonstrated superior performance in the southern regions of Kerala, while the Priestley-Taylor method, Ravazzani method, and Trajkovic method exhibited better results in the northern regions. Notably, both the Ravazzani and Trajkovic methods are adaptations of the Hargreaves and Samani equation. This suggests that temperature-based models derived from the Hargreaves and Samani equation performed more effectively in Kerala, particularly in the southern regions. With local calibration, these models have the potential for further improvement in performance.

Keywords: Reference Evapotranspiration, FAO-56 Penman-Monteith Method, Temperature-based Methods, Performance Evaluation

01-09

OPTIMIZATION OF PROCESS PARAMETERS FOR COCOA BUTTER EXTRACTION USING SCREW PRESS

NP Shamna and GK Rajesh

Department of Processing and Food Engineering, KCAET, Tavanur
Shamnaashraf1997@gmail.com

Background: Cocoa beans have high economic value, mostly due to their lipid fraction comprising of 55% fat in the form of cocoa butter. Cocoa butter extraction is a key step in the development of chocolate, which is responsible for the gloss, texture and melting property of chocolate. The most widely used method for cocoa butter extraction is the extraction using hydraulic press, which is suitable for large scale processing. However, in the case of small and marginal farmers, there is a need of small capacity cocoa butter extractor with affordable prices.

Method: The cocoa butter extractor should be suitable for small-scale processing of cocoa as well as economical. Hence, in this study, an attempt has been made to develop screw press for cocoa butter extraction suitable for homemade chocolate units, to optimize the process parameters for screw press and to check the quality of optimized cocoa butter and cocoa powder.

Results: The optimization of process parameters of screw press viz., feed rate, screw rotation speed and barrel temperature was carried out using Box-Behnken design combined with response surface methodology. Further, the characteristics of screw press viz., cocoa butter yield, power requirement and extraction time and the quality of cocoa butter and cocoa powder samples were analysed to decide the best treatment among the 17 trails provided by the software. The process parameters were optimized in order to maximize cocoa butter yield and to minimize power requirement and extraction time and to keep the fat content cocoa powder with in the recommended level. The optimal conditions for the extraction of cocoa butter are 100°C barrel temperature, 50rpm screw rotation speed and 4kg/hr feed rate.

Conclusions: The optimized cocoa butter and cocoa powder samples were analysed to understand the acceptability. Both samples retained the qualities recommended by CODEX standards.

Keywords: Screw press, Cocoa butter, Cocoa powder

01-10

ANTIOXIDANT AND ANTI-INFLAMMATORY POTENTIAL OF KODO MILLET OILS - AN *IN VITRO* STUDY

Abhirami S[1]. and A. Helen[1]

[1]*Department of Biochemistry, University of Kerala, Thiruvananthapuram*
abhisrabhi001@gmail.com,helenabios@keralauniversity.ac.in

Background: Edible vegetable oils are the rich sources of natural antioxidants that are significant active component in reducing fat oxidation. Kodo millet (*Paspalum scrobiculatum*) is one of the world's oldest grains belongs to *poaceae* family, that are rich sources of nutrients and bioactive compounds reported to have pharmaceutical benefits in various diseases. The objective of the present study was to isolate oil from kodo millet seeds in cold and hot conditions using petroleum ether and to compare their antioxidant and anti-inflammatory potentials *in vitro* model.

Methods: 50 g of powdered sample was soaked in 250 ml of Petroleum benzene for 3 days at cold condition (4º C), extract was collected through rotary evaporator and used as cold extract of Kodo millet (KCE). Extraction in hot condition was done using Soxhlet apparatus (60º-80ºC) for 72 hours, collected through rotary evaporator and used as hot extract of Kodo millet (KHE). Percentage yield of extracts was calculated. Preliminary analysis done by methods such as Total antioxidant capacity, Reducing power assay, Trypsin inhibition assay, etc. GC-MS and FTIR analysis were performed. Cytotoxicity of KCE and KHE checked in RAW 264.7 cell lines. Anti-inflammatory effect of selected dose was monitored in LPS-induced RAW 264.7 cell lines by Griess reagent method, ELISA and PCR.

Results: The oils extracted by both conditions have significant antioxidant and anti-inflammatory properties with increasing concentration against the standard. GC-MS results showed the presence of many volatile compounds and FTIR spectra revealed the important functional groups. Non-cytotoxicity of extracts observed up to 25µg/ml concentration in MTT assay. Following millet oil treatment, LPS-stimulated RAW cells showed significant rise in IL-10 levels, drop in TNF-α and IL-6 levels, and a decrease in NO release.

Conclusion: Both cold and hot oil extracts of Kodo millet have antioxidant and anti-inflammatory potential with increasing concentration. Further research and quality assessments are needed to compare the medicinal and nutritional possibilities.

Key words: Kodo millet, FTIR, GC-MS, Cytokines

01-11

ISOLATION, MOLECULAR IDENTIFICATION AND MODE OF ACTION OF PLANT GROWTH PROMOTING RHIZOBACTERIA FROM THE AGRICULTURAL LANDS OF KERALA AND ITS PHYTOSTIMULATORY EFFECT ON *MARANTA ARUNDINACEA* L.

Smitha Thomas & Lizzy Mathew

Department of Botany, St.Teresa's College (Autonomous), Ernakulam, affiliated to M.G.University, Kottayam, Kerala, India.682 011.

Background: Chemically manufactured fertilizers were used indiscriminately, with unpredictable harmful impacts on the environment, soil, & human health. The purpose of the current study is to determine how *Pseudomonas fluorescens* & *Bacillus subtilis* overcome the dosage of mineral fertilizers (N, P, & K), contribute to the enhancement of arrowroot yield & nutritional qualities, (*Maranta arundinacea* L.).

Method: Eighty Plant Growth Promoting Rhizobacteria, (PGPR) isolates were selected from various regions of Kerala & subjected to *in vitro* characterization for their morphological, biochemical, & nutrient mobilization characteristics. Two PGPR isolates, along with their genes, were identified by blast analysis.TLC & column chromatography were used for anti phytopathogenic analysis. An experimental design of six separate treatments were done in soil for *Maranta arundinacea* (arrowroot) cultivation. Statistical data were carried out.

Results: Rhizobacteria in soil, *is* an alternative to chemical methods that enhance yield, growth, & disease control of *Maranta arundinacea* L. that shows statistically significant variability in growth promoting parameters.

Conclusion: The rhizosphere's intense selection pressure favoured the emergence of plant growth-promoting rhizobacteria with substantial deposition of plant-beneficial characteristics. Unraveling the molecular biology of the observed outcomes gives a greater understanding of plant-microbe interaction, which might be the start of an evergreen revolution.

Key words: *P. fluorescens*, Disease resistance, Organic farming, Phytopathogens.

01-12

SUBSOIL ACIDITY AMELIORATION AND ITS EFFECT ON THE PERFORMANCE OF TANNIA

Sreena K. S., Shalini Pillai P., Sheeba Rebecca Isaac, Rajasree, G., B. Aparna, Pratheesh P. Gopinath

College of Agriculture, Vellayani, Trivandrum, 695 522

Background: Tannia, the underexploited tuber crop, had the potential to diminishing poverty. As it is growing on marginal land with low soil fertility, subsoil acidity is identified as the major chemical impediment to tuberization. So, the amelioration of subsoil acidity using suitable amendments and nutrient management is crucial for obtaining a profitable yield in tannia.

Methods: The Acidity of the initial soil at 15 and 30 cm depths were determined in terms of pH using the pH meter method. Available Fe, Al, and Ca were also analysed using 0.1 M HCl extraction, atomic absorption spectrophotometry, and the ammonium acetate method respectively. Based on the lime requirement of the soil, each soil amendment, was applied to identify the post-harvest status of the soil and the yield improvement.

Results: Phosphogypsum combined with compost could be recognised as the best ameliorant for addressing sub soil acidity. Supplementing KAU POP with micronutrient application of Zn and B improved the tuber yield in tannia.

Conclusion: The performance of tannia in South Central Laterite soil could be improved with proper soil amendment application and nutrient management.

Keywords: Subsoil acidity, amendment, nutrient management, lime requirement

01-13

GROWTH AND PRODUCTIVITY OF INTERCROPPING FINGER MILLET (*ELEUSINE CORACANA* (L.) GAERTN.) WITH PULSES

Dhimmagudi Ramamohan Reddy[1]., Aswathy, J. C[2*]., and Dr. Shalini Pillai, P [3]

[1]Assistant Professor, Department of Agronomy, J.C. Diwakar Reddy Agricultural College, Tadipatri.
[2] Ph. D scholar, Department of Agronomy , College of Agriculture, Vellayani, Thiruvananthapuram, Kerala.*
*[3] Professor and Head, Department of Agronomy , College of Agriculture, Vellayani, Thiruvananthapuram, Kerala *corresponding author email id :* jcaswathy@gmail.com

Abstract: A field experiment was carried out at the Integrated Farming System Research Station, Karamana, during February to May 2020. The study comprised intercropping finger millet (var. PPR 2700) with three pulses, *viz*., green gram (var. CO 8), black gram (var. DU 1) and cowpea (var. Kanakamony), in the ratio 4:1. Finger millet was raised with and without Arbuscular mycorrhizal fungi (AMF). The experiment was laid out in randomised block design with 11 treatments, replicated thrice. The treatments were T_1 – finger millet as sole crop (without AMF), T_2 – finger millet as sole crop (with AMF), T_3 – finger millet (without AMF) + green gram; T_4 – finger millet (with AMF) + green gram, T_5 – finger millet (without AMF) + black gram, T_6 – finger mille (with AMF) + black gram, T_7 – finger millet (without AMF) + cowpea, T_8 – finger millet (with AMF) + cowpea and T_9,

T_{10} and T_{11} were sole crops of green gram, black gram and cowpea respectively. The results of the study revealed that sole crop of finger millet inoculated with AMF (T_2) recorded significantly taller plants, higher tiller count, leaf area index (LAI), dry matter production, crop growth rate, relative growth rate, productive tiller count, ear length, finger length, grain yield per plant, grain yield (2.03 t ha^{-1}) and straw yield (4.76 t ha^{-1}). Across the intercropping systems tested, T_8 (finger millet with AMF + cowpea) registered higher productive tiller count (2.90 per plant), longer ears (11.47 cm), finger length, grain yield per plant, grain yield (1.64 t ha^{-1}) and straw yield (3.82 t ha^{-1}). Among the competition indices, land equivalent ratio (LER) was observed to be highest for finger millet without AMF + cowpea and it was observed that inoculating finger millet with AMF enhanced FMEY, irrespective of the pulse intercropped.

Key words: Finger Millet, Eleusine coracana, Arbuscular mycorrhizal fungi

01-14

EFFICACY OF AN AUTOMATIC HYDROPONIC SYSTEM OVER CONVENTIONAL STSTEM FOR THE CULTIVATION OF *LACTUCA SATIVA* L. VAR. LONGIFOLIA

Sheeja George E., Navami Raj K. N., Dhanya C.

Post Graduate Department of Botany, Sree Narayana College, Cherthala, Alapuzha District-688582, Kerala.

Background: With the steady increase in world population, there is growing demand for food production as well. But, the traditional farming systems are not adequate to meet the current and future demand of food. Moreover, the increasingly urbanized population stays away from agricultural practices due to lack of cultivable land and the busy life style they follow. Therefore, there is a real need for adopting a new farming system that could reduce the labour and time for crop production at the same time stimulating the plants to grow faster. Hydroponics is an effective, soil-less system for plant cultivation which provides a controlled and monitored environment for plants to grow. In hydroponic system, highest yield is ensured at the cost of reduced water and nutrient supply and utilizing very little area of cultivable land. Adequate supply of nutrients and optimum levels of temperature and pH are essential for the success of a hydroponic system. Maintaining correct conditions of both water and air, while keeping a close eye on changes and fluctuations is possible by using an automatic hydroponic system. Present study was aimed to analyse the efficacy of an automated hydroponic system for growing a valuable leafy vegetable - *L. sativa* by comparing the plant's growth in conventional cultivation system.

Methods: An automatic hydroponic system of DFT (deep flow technique) was constructed in which the roots are fully merged in water. The nutrients are supplied directly to the main tank and pumped to the plants in the DFT system and is then flown back to the main tank. The system is attached with sensors that measure pH, temperature, dissolved oxygen level, light intensity and humidity. A TDS meter that measures the levels of salts, nutrients, and other concentrates in the water is also attached in the system. These measurements are critical to understanding how much water, nutrients, and oxygen your plants are currently able to absorb and let us know when to feed the plants.

Efficacy of the automatic hydroponic system for growing lettuce plants was analyzed by comparing various quantitative and qualitative parameters of the plants grown in the hydroponic system with those of the plants grown in conventional planting system. For this, twenty *L. sativa* seedlings each (after 10 days of germination) were planted in the automatic hydroponic system

and conventional fertilized soil-filled grow bags. Observations on vegetative parameters like plant height, leaf size (length and width of the lamina) and number of leaves were made in every 10 days. Arc auxonomter was used to measure plant height; and the mean measures of two basal leaves of each plant were recorded as leaf size. The experimental set up was in CRD (completely randomized design) with two treatments each with 20 replications. Data were analyzed using univariate analysis of variance and the means were compared using Tuckey HSD. After harvest upon 60 days, biochemical analysis using standard tests and sensory analysis for characters like taste, color and texture were also done.

Results: With respect to the efficacy of the edible plant production with better growth of the plant and more number of large-sized tastier leaves with good texture, the automatic hydroponic culture system was more efficient than the conventional planting system for the cultivation of lettuce plants ($p< 0.05$). Average number of leaves/plant was 3.5 ± 1.3 and 16 ± 2.06 respectively on 10th and 60th day of planting in conventional planting system; while it was 5 ± 0.13 and 23 ± 0.47 respectively in automated hydroponic system. Average length of the leaf lamina was 12.4 ± 3.23 cm and average leaf width was 6.6 ± 2.32 cm in plants harvested from conventional grow bags; whereas the average leaf length was 15.1± 0.43 cm and leaf width was 9.2 ± 2.32 cm in plants harvested from automated hydroponic system. Average plant height on the 60th day of planting was 39.4 ± 1.32 cm in conventional system; and it was 82.1 ± 0.21 cm in hydroponic system. Leaves in conventional system tasted bitter and were darker green in color with thicker mid rib when compared to the leaves produced in hydroponic system which were lighter, softer and tasted less bitter.

The biochemical analysis revealed that, the plants grown in both planting systems contained proteins, phenols, flavonoids and vitamin C. Pigment concentration per gram of leaf tissue was higher in conventional system ($p< 0.05$) (2.62 mg/g chlorophyll a; 0.0087mg/g chlorophyll b and 0.242mg/g carotenoid) when compared to that in automated hydroponic system (2.10 mg/g chlorophyll a; 0.0064 mg/g chlorophyll b and 0.232mg/g carotenoid).

Conclusion: The findings of the present study put forth automated hydroponic system as an excellent system to grow fresh vegetables in the household of urban population, where lack of cultivable land and busy-scheduled life style of people are the major constraints of growing vegetable garden.

Keywords: Hydroponics, *Lactuca sativa*, lettuce, automatic system, nutrient solution

01-15

DEVELOPMENT AND PERFORMANCE EVALUATION OF INFRARED DRYER FOR CARROT SLICES

P. Jahana Thasneem, G.K. Rajesh, P. Anuj Sonal, Shreya Kalai

Department of Processing and Food Engineering, KCAET Tavanur, jthasneem11@gmail.com

Background: Carrot (*Daucus carota*) is a root vegetable, typically orange in color. The roots contain high quantities of alpha- and beta-carotene, and are a good source of vitamin A, vitamin K, and vitamin B6. Post-harvest decay is the major factor limiting the extension of the shelf-life of carrots and nearly 17% of total production is deteriorated during post-harvest handling. Since the carrot contains 80-89% water content, drying is an alternative method for preservation of the carrot. Carrot can be dried to improve its shelf-life, lower shipping weights, minimize the loss of

flavour and nutritional value. Inorder to prevent the significant quality loss, and to achieve fast and effective thermal processing, researches introduced several drying technologies such as microwave and infrared drying. In the modern era, IR drying has gained popularity due to its efficiency in heat transfer, retaining quality, uniform heating, lesser drying time, high energy efficiency, better process control, and reduced energy consumption.

Method: An infrared dryer was fabricated in the workshop of Kelappaji College of Agricultural Engineering and Technology, Tavanur. It consists of a drying chamber, blower, infrared heaters, motor, stainless steel trays and control panels. Fresh carrots procured from the market were cleaned, washed and sliced in 2.5 mm thickness. Prior to the development of the dryer various physical, optical, frictional and thermal properties of fresh samples were determined. 30 g of sliced carrot having 2.5 mm thickness were placed in a tray and kept in the infrared dryer at three different temperatures *viz.,* 50°C, 60°C and 70°C at constant air velocity of 1 m/s. Sample placed in a hot air oven at a temperature of 70°C was treated as a control sample. The process parameters were optimized based on the physico-chemical quality of dried carrots such as pH, beta carotene, vitamin A, color, rehydration ratio, protein and water activity. The performance evaluation of the developed dryer was done based on the thermal efficiency, capacity and the energy requirement. The operational cost of drying per year was calculated by considering the fixed and variable cost.

Results: The moisture content of raw carrot was found to be 81% and final moisture content of carrot after drying was 10%. The mean diameter and mean thickness of raw carrot slices were 23.76 mm and 2.5 mm, respectively. The average mass, bulk density, true density and porosity were 1.4 g, 3.86 g/cm3, 10.4 g/cm3 and 62.9% respectively. The colour of raw carrot and carrots dried using infrared dryer and hot air oven was expressed in terms of L*, a* and b* values. The average L*, a* and b* values of raw carrots were 46.89, 31.17 and 43.15, respectively. The L*, a* and b* values of carrots dried at 50°C, 60°C, 70°C and hot air oven dried carrots was (46.68, 30.89, 43.01), (44.3, 26, 39.8), (43.9, 23.56, 36.53) and (37.27, 23.93, 32.54), respectively. Performance evaluation of the developed dryer was conducted in terms of its capacity, thermal efficiency and energy requirement. Time required for infrared drying at 50°C, 60°C, 70°C and hot air oven drying at 70°C was 2.5 h, 1.6h, 1.5 h and 4.5 h, respectively. The capacity of the developed dryer was 6.5 kg. Thermal efficiency of the infrared dryer at 50°C, 60°C and 70°C was calculated as 68.4%, 65.51% and 53.89%, respectively. Energy requirement of the infrared dryer at 50°C, 60°Cand 70°C was found to be 5.3, 3.4 and 3.2 kWh, respectively.

Conclusions: Based on the physico-chemical quality evaluation of the dried carrot, samples dried using infrared dryer were found to be superior to hot air dried samples. Hot air oven method consumed more time to dry the carrots i.e. 4.5 hours. Among the infrared dried samples, carrots dried at 50°C and 60°C produced high quality dried products in terms of physico-chemical qualities. By considering the dryer efficiency and energy requirement of dryer, carrot slices dried in infrared dryer at 60°C with air flow rate 1 m/s was selected as the optimized parameter. The cost of the infrared dryer was found to be Rs 38400/-. The cost of operation of the infrared dryer was estimated as Rs 77.8/ hour.

Keywords: Carrot, Infrared dryer, Efficiency, Energy requirement

01-16

IDENTIFICATION OF SHORT DURATION GENOTYPES WITH CASSAVA MOSAIC DISEASE RESISTANCE FOR CROP DIVERSIFICATION IN KERALA

S Amalnath, M.N Sheela*, P.V Abhilash, Mamatha Mary Mathews

ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram
**Corresponding author Email:* sheelactcri@yahoo.co.in , sheela.mn@icar.gov.in

Background: Cassava (*Manihot esculenta* Crantz) is a staple food for millions of people in tropical and subtropical regions. Cassava is the world's third-largest source of dietary calories, after rice and maize, providing sustenance for over 800 million people worldwide. It is valued for the root starch, which accounts for about 60-70% of the dry matter and several cassava varieties are preferred for industrial use as well as for food purpose. Cassava's ability to withstand harsh environmental conditions makes it a climate-resilient crop. It can tolerate drought, heat stress, and poor soil conditions, enabling its cultivation in areas increasingly affected by climate change.

Method: Breeding population of sixteen genotypes of CMD resistant Cassava was evaluated by Randomized Block Design (RBD) for a time period of 6 months. Destructive sampling was conducted for taking biomass measurements at 5 and 6 months after planting (MAP). Sampling was done by uprooting plants at random locations per plot and analysing the harvest index, tuberous roots, stem and leaf characteristics. The tuberous root samples were then oven dried at 60-70°C till constant weight is achieved. The dried samples were then subjected to starch and sugar analysis by titrimetric method.

Result. Among the sixteen genotypes evaluated, the highest tuber weight/plant was recorded by 19S-6-4 (11.80kg), followed by PDP-CMR-1(10.28), Sree Reksha (8.13 kg), 17S-48(7.87 kg) and 15S-255(7.41 kg) and all these early bulking genotypes were found to be resistant to cassava mosaic disease too. In the present study the sugar content of tubers on fresh weight basis ranged from 0.32% (17S-1) to 1.20% (Sree Kaveri). The genotypes viz. 19S4-3, 17S247, 17S-1 and 19S6-4 recorded lower sugar content than Dibetics Kappa (0.57%) in the sixth month. Genotype 19S6-4 recorded both lower starch (16.20%) and sugar (0.53%) than Diabetics Kappa, which, recorded 18.55% and 0.57% starch and sugar content, respectively, in the sixth month. The present study identified a very high yielding CMD resistant early bulking genotype 19S6-2 with a yield potential of 145.61 t ha-1 under optimum management conditions and can be used for human consumption as well as cattle feed in Kerala.

Conclusion: The present study identified a very high yielding CMD resistant early bulking genotype 19S6-2 with a yield potential of 145.61 t ha^{-1} under optimum management conditions and can be used for human consumption as well as cattle feed.

Keywords: Short duration, cassava, tuber yield, starch, sugar, cassava mosaic disease resistance

01-17

NUTRIENT MANAGEMENT INFLUENCES AMMONIUM UPTAKE AND TRANSPORT IN RICE

Elizabeth Jose, Soni K. B., Swapna Alex, Shalini Pillai P., Beena R., Roy Stephen., Jayalekshmi V.G.

College of Agriculture, Vellayani, Kerala Agricultural University, Thiruvananthapuram

Background: Lower yield is a major challenge that impedes the large-scale adoption of organic farming. This study analyzed the expression of genes responsible for ammonium uptake and transport in four rice varieties of Kerala, namely, Jaiva, Ezhome 2, Uma, and Jyothi, under different nutrient management at different stages of crop growth and their influence on Nitrogen Use Efficiency (NUE).

Method: A pot culture experiment was conducted following a completely randomized design with four rice varieties under two nutrient management conditions (PoP, KAU and Organic PoP, KAU) and absolute control. Gene expression was analyzed using RT-qPCR, and relative fold changes were calculated using β actin gene as a reference. The promoter regions of the genes were sequenced and compared.

Results: Under organic nutrient management, all the rice varieties, except Ezhome 2, showed significantly higher expression of ammonium uptake and transporter genes in their roots. During the seedling stage, Jaiva and Jyothi exhibited 4.68 and 4.22 folds of *OsAMT1.1* and 2.83 and 3.38 folds of *OsAMT1.2* in roots under organic PoP, correlating with higher NUE. At the panicle initiation stage, Uma and Jyothi showed comparatively higher expression of these genes. Uma, particularly showed significant upregulation of *OsAMT1.1* (3.19 folds) and *OsAMT1.2* (5.24 folds) during the grain-filling stage, along with consistently higher expression of *OsAMT1.3* across all growth stages. Lower nitrogen uptake caused by the upregulation of *OsAMT1.3* resulted in lower NUE and a wider yield gap in Uma between PoP and organic PoP management. Moreover, a unique 41 bp insertion in the promoter region of the *OsAMT1.1* was identified in Uma compared to the other three varieties.

Conclusion: This study highlights the variation in the expression of ammonium uptake and transport genes in response to different nutrient management strategies, rice varieties, and growth stages. Enhanced ammonium uptake in the early stages of growth was associated with improved NUE in rice. These findings contribute valuable insights into optimizing nutrient management practices for sustainable rice cultivation and addressing yield challenges in organic farming.

Keywords: Ammonium uptake, AMT, Nitrogen Use Efficiency, Organic farming

01-18

GENETIC STOCK IDENTIFICATION IN COCOA FOR TEA MOSQUITO BUG RESISTANCE

Reshma S. Nair[1*], Minimol J. S.[2], Jiji Joseph[3]

[1] *PhD scholar, Dept. of Plant Breeding and Genetics, College of Agriculture, Vellanikkara*

[2] *Professor (Plant Breeding and Genetics), Cocoa Research Centre, Vellanikkara*

[3] *Professor and Head, Dept. of Plant Breeding and Genetics, College of Agriculture, Vellanikkara*

[*]*Email: reshmasnair1995@gmail.com*

Background: Tea mosquito bug (TMB) is one of the most significant and widely occurring insect pests of cocoa. Its incidence has become severe during the last three years in post monsoon season. Among different *Helopeltis* species*, H. theivora* is the predominant one causing damage to young shoots, cherelles and pods. As TMB is a relatively new pest of cocoa, its management measures are poorly studied. Chemical control is advocated during morning hours when TMB activity is at its peak. However, it harms the pollinator population (*Forcipomyia* sp.), which is also active during morning hours. Being a highly cross pollinated crop, this in turn reduces the total yield of cocoa plantations. The development and use of TMB resistant cocoa varieties is one of the most effective alternatives to chemical control, given its economic and ecological advantages in pest control. To achieve this, a strong resistant breeding material is essential. A significant gap in resistance breeding persists worldwide due to the unavailability of resistant genetic stock in cocoa. Therefore, identification of TMB resistant genotypes from the existing germplasm is imperative for further crop improvement. In this context, a study was undertaken at Kerala Agricultural University to investigate the resistance reaction of cocoa germplasm against *H. theivora*.

Methods: The experiment was laid out in a completely randomized design with three replications comprising five plants each. Fifteen KAU released varieties (CCRP 1 to CCRP 15) and 21 exotic germplasm were budded and subjected to artificial inoculation with *Helopeltis theivora* Waterhouse. Hundred freshly reared tea mosquito bugs (50 males and 50 females) per screening test were released into the insect net house. Based on the intensity of infestation on shoots/ leaves, the genotypes were scored and grouped into different resistant and susceptibility classes.

Results: The cocoa genotypes were classified into five groups based on their scores towards TMB screening. Out of the 36 genotypes screened, 18 were reported to be highly resistant to TMB infestation. The average number of feeding punctures recorded by genotypes GU114/P, CCRP 14, EQX 69, CCRP 11, CCRP 13 and GEBP 617/AF (ADI) was less than one. Four genotypes *viz.*, BE 3, CCRP 8, CCRP 15, and CRU 111 were included under the highly susceptible class with an average of more than 12 feeding punctures. The differential response toward tea mosquito bug attack may be attributed to the morphological and biochemical characteristics of the genotypes.

Conclusion: The cocoa genotypes respond differentially towards tea mosquito bugs. Identification of genes and metabolites imparting insect resistance and its biochemistry in identified genotypes can be used for further resistance breeding. Moreover, the polyclonal seedlings developed using the identified resistant genotypes can be used for cultivation in TMB infested areas.

Keywords: Cocoa, Tea mosquito bug, Bud screening, Resistance

01-19

COMPARATIVE STUDY OF PLANT GROWTH PROMOTING TRAITS OF PEDIOCOCCUS PENTOSACEUS ISOLATED FROM MORINGA OLEIFERA LAM. AND ABELMOSCHUS ESCULENTUS (L.) MOENCH.

Sreelekshmi K[1] and Keerthi T. R[2]

[1]*Research Scholar, School of Biosciences, Mahatma Gandhi University, Kottayam, Kerala 686560.*
[2]*Professor, Research Scholar, School of Biosciences, Mahatma Gandhi University, Kottayam, Kerala 686560.*

Background: Microorganisms play an important role in agricultural system, especially plant growth promoting bacteria (PGPB) applied as biofertilizers in crop production, constitute an environmental friendly manner to contribute to produce the food and feed needed to sustain world population. Studies on Lactic acid bacteria isolated from aerial parts of plants are scarce. Plant growth promoting lactic acid bacteria play a crucial role in enhancing plant growth by improving nutrient availability and mitigating stress factors. This holistic approach aligns with the One Health concept, acknowledging the interconnected health of plants, animals, and the environment. The present work explores the potential use of Lactic acid bacteria in promotion of plant growth.

Methods: *Pediococcus pentosaceus MBTUSKKTRF01* and *Pediococcus pentosaceus MBTUSVKTRV010* isolated from flower of *Moringa oleifera* (Muringa) and vegetable fruit of *Abelmoschus esculentus* (Ladies finger) respectively. Plant growth promoting activities of lactic acid bacteria was performed by the following methods, IAA production, ACC deaminase activity, Nitrogen fixing activity, Phosphate solubilizing activity, Potassium solubilizing activity, Organic acid, Hydrogen cyanide production, Siderophore production, Salt tolerance test and Ammonia production.

Results: The results obtained from this study shows two test strains of *Pediococcus pentosaceus* isolated from flower of *Moringa oleifera* and vegetable fruit of *Abelmoschus esculentus,* have high Nitrogen fixing capability, Phosphate and potassium solubilizing activity and high organic acid production capability, that improves fertility of the soil, increases yield of the crops, protects from harmful diseases and reduce application of the other chemical fertilizers. Salinity is one of the most common abiotic stress factors that adversely affect plant growth and crop productivity in the world. Here, two test isolates have high tolerance with 2% and 6% of NaCl. Hydrogen cyanide production of the two strains indicated the biocontrol ability of the test strains. The test isolates tested positive in indole-3-acetic acid (IAA) and ACC deaminase activity. Both test strains show absence of siderophore and ammonia production.

Conclusion: The two isolates have high plant growth promoting activity. So, these two test isolates can be used as biofertilizers as well as biocontrol agents to replace agrochemicals to improve crop productivity. Hence, these species can be further formulated and used for greenhouse and field applications.

Key words: Lactic acid bacteria, Flowers, Vegetables, Plant growth promotion.

01-20

TWO STEP DOWNSCALING FOR CLIMATE CHANGE PROJECTIONS IN SMALL AGRICULTURAL WATERSHEDS

Ambili G K

Centre for Water Resources Development and Management, Kunnamangalam, Kozhikode

Background: As watersheds are taken as units for most planning decisions, the information needed at the watershed scale should be available. As water resources planning and environmental management are often conducted in the context of watersheds, there is an urgent need to fill the information gap between the regional scale and the watershed scale in climate change impact studies.

Methods: A two-step downscaling was performed using a combination of multi-model ensembles and a stochastic weather generator to derive daily weather series. Weights were assigned by deriving skill scores based on how well the models are performing with respect to the representation of daily climate variables, long term trends, extreme value of precipitation and climate variability. Lars-WG model was used for stochastic generation of daily climate variables.

Results: The skill scores of the metrics indicate that the models simulate daily precipitation better than the temperature. No single model was found to be better performing for all the metrics considered in this study. Results from the study indicate that the weighted ensemble perform slightly better than the multi-model mean for precipitation and maximum temperature, indicating that weighted RCMs reduce biases in projections of climate variables.

Conclusions: Use of stochastic weather generator in the second step increases the reliability of projections in small watersheds. The underperformance of ensemble when compared to the observed climate indicate that additional metrics need to be selected to include those characteristics of the climate which are not included in this study, such as interannual variations, interconnection between temperature and precipitation, checking meso scale signals etc.

Keywords: Climate projections; Two-step downscaling; Performance metrics; Stochastic weather generator.

POSTER PRESENTATIONS

01-21

SUSTAINABLE CONSERVATION MODEL FOR TRADITIONAL PADDY LANDRACES

Roshni. S, Anish N. P., Manoj P. Soniya E. V., Chandrabhas Narayana

DBT-Rajiv Gandhi Centre for Biotechnology, Thycaud, Thiruvananthapuram-695 014, Kerala

Background: The District is one of the four Climate Change Hotspots of Kerala. The traditional paddy varieties are unique in their ability to adapt to climate change, medicinal properties, aroma, and taste. While interacting with the paddy farmers, it is revealed the factors impeding the cultivation of traditional paddy landraces, includes low economic return, unavailability of seeds, technology gap

in the processing of traditional paddy grains, etc. This study aimed to explore the paddy land races available with the farmers of Wayanad District, its morphological and nutritional characterization, conservation with community participation, establishment of field gene bank and providing solutions to the technology gap in the production of high quality grains.

Materials and Methods: The study was conducted with an extensive field survey among the paddy farmers of Wayanad district. Documentation was done with personal interviews using structured questionnaire, and group discussions during community meetings. Samples of paddy seed were also collected during the documentation and used for establishing the field gene bank with community participation. The distinguishing morphological and nutritional parameters of 19 traditional paddy landraces that are grown in field gene bank were studied. Awareness programs were conducted and established a community enterprise with a dedicated processing unit for traditional paddy grains.

Result: A total of 44 traditional paddy landraces were documented from the paddy fields of Wayanad District. Detailed morphologic and nutritional characterization of 19 traditional paddy varieties grown in the field gene bank was conducted. The local land races showed differences in various morphological and nutritional parameters. On-farm conservation is one of the best methods of ex-situ conservation of crop plants. In this line, seeds of 19 traditional paddy varieties were distributed to selected 20 paddy farmers and established 7.28 hectares of field gene bank. Each variety was planted in separate plots and labelled properly. Moreover, a tribal community enterprise was also created with essential commodities for their livelihood betterment and processing indigenous paddy varieties.

Key words: Morphological and nutritional characterization**,** On-farm conservation, community enterprise, field gene bank

01-22

VALIDATION OF BIOFORMULATION USING *BACILLUS* STRAINS FOR ENHANCED PLANT GROWTH AND PRODUCTIVITY IN GINGER IN DIFFERENT SOIL CONDITIONS IN KERALA.

Theertha Anilkumar M K, Dileep Kumar Bhaskaran Nair Saraswathy Amma., C. Kesavachnadran

CSIR- National Institute for Interdisciplinary Science and Technology

Background: Ginger (*Zingiber officinale* Rosc.) is an important commercial crop used worldwide as a cooking spice, condiment, and herbal remedy belonging to the family Zingiberaceae (Moghaddasi & Kashani, 2011). The utilization of chemical fertilizers and pesticides on a large scale to augment productivity and growth resulted in detrimental effects on health and the environment (Abbas et al., 2013). The adoption of bio fertilizers and bio pesticides has been advocated as a safe alternative to sustain high production levels while minimizing environmental impact (Kumar et al., 2021). Plant growth-promoting bacteria, such as *Bacillus spp.,* can colonize roots and stimulate plant growth and yield. These biocontrol organisms also play a role in promoting plant growth through the production of plant growth hormones, including Auxin, the production of siderophore, phosphate solubilization, and ammonia production (Glick., 2012). Consequently, an experiment was undertaken to develop a liquid bioformulation utilizing *Bacillus sp.,* that is economically feasible and to assess its effectiveness

in promoting growth and enhancing ginger yield in soil samples from varied conditions in Kerala.

Materials and Methods: The soil samples from varied conditions were collected from Wayanad District (hilly area), Kulathoor (hilly area), and Pappanamcode (low-lying area), both located in Thiruvananthapuram District. The plant growth-promoting *Bacillus* strains were isolated from Malampuzha, and Nelliyampathy regions in Palakkad district, Kerala, India. Ginger variety Rio-de- janeiro was used in the experiment. The bioformulation was developed using Jaggery, $MgSO_4$, KH_2PO_4, and inoculum. The bio formulations either singly or as a mixture were assessed for their efficiency in growth promotion and enhancing yield. The growth promotion was assessed by observing the growth parameters such as shoot length, leaf length, leaf breadth, and number of leaves for a period of 120 days at intervals of 20 days.

Results: The result showed that individual bacterial bioformulation led to a significant increase ($P<0.05$) in all the growth parameters and yield of ginger compared to control under greenhouse conditions. The bioformulation increased shoot length, leaf length, leaf breadth, number of leaves, and yield of ginger plants. Liquid formulations hold a very promising future, are utilised as an alternative to carrier-based formulation (Rai et al., 2023).

Conclusion: The bioformulation increased shoot length, leaf length, leaf breadth, number of leaves, and yield of ginger plants

Keywords: *Bacillus,* Bioformulation, Plant growth promoting rhizobacteria, Ginger

01-23

ULTRAMICROSCOPIC STRUCTURAL ALTERATIONS IN LEAF TISSUES OF CASSAVA INDUCED BY INFESTATION OF SPIDER MITE *TETRANYCHUS NEOCALEDONICUS* ANDRE (ACARI: TETRANYCHIDAE)

Sangeetha G. Kaimal

Department of Zoology, Providence Women's College, Calicut, Kerala, 673 009, India
drsangeethavinod@gmail.com

Abstract: Ultra-structural elucidation of leaf damage induced by feeding of *Tetranychus neocaledonicus* on *Manihot esculenta* L. (cassava) plant leaves was done using transmission electron microscopic studies to unveil the mechanical injury and for a detailed investigation into the fine structural damageto the host leaves by the feeding of mites. The severity of injury caused to the cassava leaves was directly proportional to the feeding intensity of the mites and was a function of time. Leaves with high infestation had marked reduction in thickness following disruption of epidermis and reduction of palisade and spongy mesophyll tissues. Further, there was reduction in the number of cells and chloroplasts, coagulated protoplasts, cell structure alterations, increased space in the spongy and palisade region, extensive disruption of the mesophyll cells coupled with damage to adjacent cells that were not directly attacked by the mites.

Key words: Vegetable mite. *Tetranychus neocaledonicus***,** cassava, mesophyll layer, chloroplast, Transmission electron microscopy.

01-24

VALUE ADDITION TO JACKFRUIT; LIVELIHOOD OPTION FOR RURAL COMMUNITIES

Mariya Mary Gigi, Anish N. P, Manoj P., Chandrabhas Narayana

Rajiv Gandhi Centre for Biotechnology, Thycaud, Thiruvananthapuram- 695014, Kerala

Background: Wild edible fruits play a significant role in rural areas by providing nutrient supplementary diets and generating side income for poor people. Jackfruit is the largest edible fruit plenty available in forests where all parts are edible. Due to a lack of processing and preservation methods, a huge amount of fruit and its seeds are lost. The objective of this study is to reduce the postharvest loss of jackfruit by proper processing and to generate a way of income for tribal groups of Kerala by value addition of jackfruit and its seed.

Method: Different cookies are made with raw jackfruit flour and seed flour. Jackfruit flour and seed flour is prepared by electrical drying technique (80◦c/10-12 hrs) from raw jackfruit and its seed. For preparation of cookie all ingredients are mixed and the dough is prepared by kneading (15-20minute). After leaving for 20 minutes the dough was pressed and the cookie shape has made and baked in the microwave oven at 180◦c/15 minutes and cooled. Then pack it in airtight containers for further studies.

Results: the sensory evaluation showed that the Jackfruit butter Choco cookie had more overall percentage of acceptance (92.06%). From the nutritional evaluation of Jackfruit butter choco cookie we can find out that the cookie is rich in carbohydrate (61g), protein (5.2g), and fat (27g). This cookie is also rich in minerals like calcium (38.1mg) and iron (2.2mg), and is also a good source of vitamin A (279.1mcg).

Conclusions: From this study we can conclude that raw jackfruit flour and jackfruit seed flour can be used as an alternative for wheat flour and refined wheat flour which has great potential in developing bakery products without affecting sensory qualities. Based on nutritional facts and overall acceptability it can be concluded that it is feasible to produce nutritionally value-added cookies from raw jackfruit flour and jackfruit seed flour as an alternative for wheat flour and refined wheat flour. Both of these flours are gluten free, so can be used by people suffering from gluten sensitivity or celiac diseases.

Keywords: Wild edibles, postharvest loss, processing, value addition.

01-25

MEDIA CONSTITUENTS AND ITS INFLUENCE ON CALLUS INDUCTION FROM MATURED RICE SEEDS UNDER *IN VITRO* CONDITION

J. Beslin Joshi

Centre for Water Resources Development and Management (CWRDM), Kozhikode, Kerala, India

Background: Rice is the staple food for more than half of the population providing energy and nutrition. Several decades of research has been focussed on rice improvement to prevent malnutrition and improve human health. Optimising tissue culture protocol for any crop is a basic requirement for

genetic engineering and breeding programmes.

Method: Rice seeds of the Kerala specific rice varieties namely Uma and Jaya were collected from the Krishi Bhavan. The effect of surface sterilants like ethanol, mercuric chloride and sodium hypochlorite were analyzed for its efficiency to prevent contamination. Different media (MS, N6), Amino acid (Caesin hydrolysate) and hormones (2,4-D; BAP; IAA) and its effect on callus initiation from matured rice seeds was studied.

Results: Mercuric chloride treatment at a concentration of 0.2 % for 4 min significantly reduced the contamination percentage to zero without affecting the seed germination. Among the different media compositions analysed, MS medium supplemented with 2,4-D (2.5 mg/L) and BAP (0.25 mg/L) was found to be the best for callus initiation from the mature rice seeds. While in N6, the combination of 2,4-D (2.5 mg/L) and IAA (1.5 mg/L) favour the development of friable embryogenic callus.

Conclusions: The hormone 2, 4-D favoured the callus initiation from rice seeds significantly while BAP and IAA altered the embryogenic calli formation. Caesin hydrolysate was found to have profound effect on shoot initiation. Altogether, compared to N6, MS medium is suitable for callus initiation from rice seeds

Keywords: Rice, Media, Hormones, Callus formation, Kerala varieties

01-26

DEVELOPMENT OF SAFE STORAGE GUIDELINES AND A MODEL FOR ALLOWABLE STORAGE TIME OF PEARL MILLET

Jayasree Joshi T* and P. Srinivasa Rao

*Agricultural and Food Engineering Department, Indian Institute of Technology Kharagpur, Kharagpur, West Bengal-721302, India *E-mail: jayasreejoshi48@gmail.com*

Background: Biotic and abiotic factors interact to damage grains in the storage ecosystem. Monitoring temperature fluctuations and moisture migration is crucial to control their impact on grain quality. Grains with high temperature and high moisture provide limited time for post-harvest actions. Hence is important to determine the time before spoilage for different moisture contents and temperatures. Safe storage guidelines assist farmers in scheduling different post-harvest operations such as drying, cooling, turning, etc. to avoid crop spoilage.

Method: Effect of storage variables (storage temperature, moisture content, and storage period) on the seed deterioration parameters of pearl millet was evaluated. The model for predicting the allowable storage time was developed using feed forward back propagation neural network.

Results: The storage variables had a statistically significant effect on the germination rate, FFA, and moisture content. Storing pearl millet at higher moisture levels (≥14%) for more than 2-4 weeks poses a considerable risk due to seed viability loss, increase in FFA, and early infection with visible and invisible molds. When storing pearl millet for an extended period of time, it is recommended to maintain a temperature below 20°C to ensure high quality and seed viability. The developed ANN model for safe storage time demonstrated a high level of predictability.

Conclusions: The safe storage guidelines chart and safe storage time model developed can be used

to predict allowable safe storage time and for scheduling different post-harvest operations of pearl millet.

Keywords: Safe storage guidelines, Pearl millet, Quality changes, ANN modelling.

01-27

CHRONIC IMPACT OF PESTICIDES ON HUMAN HEALTH

M. Siri Chandana[1] and K. M. Sreekumar

Department of Entomology, College of Agriculture, Padannakkad, Kerala Agricultural University, Kasaragod
Professor and Head, Department of Entomology, College of Agriculture, Padannakkad, Kerala Agricultural University, Kasaragod

Introduction: Pesticides are one among the few toxic substances released deliberately into the environment to kill the pests. Insecticides are the most consumed pesticides which account for 60 per cent of total consumption of pesticides. The use of pesticides had increased several hundred folds in the past seven decades from 154 MT in 1954 to 61,701 MT presently. There are four common ways through which pesticides can enter the human body viz., dermal, oral, eye and respiratory pathways. Due to the presence of volatile components in the pesticides, their potential for respiratory exposure is great. Also, certain areas of the body such as the genital areas and ear canal are more susceptible to pesticide absorption than other areas of the body. Based on the duration of exposure, toxicity can be divided into acute, sub chronic and chronic. Chronic toxicity is the ability of a pesticide to cause adverse health effects over an extended period or entire life. Studies have revealed the close association of pesticides and the development of cancers, neurological and reproductive problems in both children and adults. Tumours linked to immunodeficiencies include non-Hodgkin's lymphoma (NHL), leukaemia, melanoma, soft tissue sarcoma, cancers of the stomach and brain. But the difficulty in delineating a clear cause-effect relationship is expressed as the major limitation.

Conclusion: More awareness should be raised among agricultural workers and farmers about the safe use of pesticides with all precautions, as prolonged exposure to pesticides may endanger human health. To lessen the need for chemical pesticides, integrated pest control can be used. More study is required in the domain of agriculture and health to clarify the long-term effects of pesticides so that appropriate precautions can be made to preserve human health.

Key words: Pesticide, chronic toxicity, long term exposure, health effects, Agriculture workers

01-28

POTASSIUM SALT OF ACTIVE PHOSPHORUS A PROMISING MOLECULE FOR FOLIAR NUTRITION IN PULSES

Shruthi H

Background: Fertilizers are the common source that farmers depend on for supplying P and K. However, low nutrient use efficiency due to limited solubility, fixation, leaching, availability and uptake are some of the problems related with P and K based fertilizers. Potassium salt of active

phosphorus (PSAP) is a new molecule manufactured adopting catalytic technology and is highly water soluble, absorbed rapidly through the foliage and does not have any residual effect on the plant or soil. The prime objectives of the study were to assess the productivity of cowpea in response to varied doses of phosphorus and potassium supplemented with foliar nutrition, and to compute the economics.

Method: The field experiment was carried out at the Integrated Farming System Research Station, Karamana, from December 2022 to February 2023. It was laid out in randomised block design with (2 x 3 x 2) + 1 treatments, replicated thrice. The treatments comprised combinations of two levels of P (p_1-100 % RDP, p_2-50 % RDP), three levels of K (k_1 - 100 % RDK, k_2 - 150 % RDK, k_3 - 200 % RDK) and foliar application at 20 DAS and 40 DAS (f_1 - nano DAP @ 0.4%, f_2 - PSAP @ 0.4 %), compared against a control (KAU POP). The variety used for the study was PGCP-6 and the fertilizer recommendation followed was 20:30:10 kg NPK ha^{-1}. All other cultural operations were carried out as per the KAU POP.

Results: The treatment combination, $p_2k_1f_2$ (50 % RDP + 100 % RDK + PSAP @ 0.4 % at 20 DAS and 40 DAS) resulted in the highest pod yield (1892 kg ha^{-1}) and seed yield (1642 kg ha^{-1}). Contributing to significantly higher net income and benefit cost ratio (₹76,120 ha^{-1}, 2.20).

Conclusions: Considering the yield and economics application of full dose of N (20 kg ha^{-1}) along with 50 per cent recommended dose of P (15 kg ha^{-1}) + 100 per cent recommended dose of K (10 kg ha^{-1}), supplemented with foliar application of potassium salt of active phosphorus (PSAP) (0.4%) at 20 DAS and 40 DAS ($p_2k_1f_2$), could be adjudged as the best treatment for higher productivity and profitability of grain cowpea.

Keywords: Nano DAP, PSAP**,** cowpea

01-29

GENETIC DIVERGENCE ANALYSIS IN TOMATO (*SOLANUM LYCOPERSICUM* L.)

D. Wilson, Yedhuraj*, V.K, Lydia Pramitha J, Neethu Francis

Division of Genetics and Plant Breeding, School of Agricultural Sciences, Karunya Institute of Technology and Sciences, Karunya Nagar, Coimbatore 641114.
**Hire Lab Consultants Private Limited, Madurai 625007.*
Correspondence: wilsond@karunya.edu

Introduction: The tomato (*Solanum lycopersicum* L.) (2n=2x=24) is an important vegetable crop grown all over the world. Peru-Ecuador region is regarded as the origin of tomato. Although tomato is a self-pollinated and day neutral plant, some amount of cross-pollination does take place. Genetic diversity serves as the starting point for the evolution of better genotypes through selection. The potential for character improvement through selection increases with the amount of diversity present for that character in the breeding materials. The degree to which improvement is feasible after selection and the influence of environment on character expression are both determined by heritability and genetic progress Robinson et al. (1949).

Materials and Methods: The present investigation on "Genetic Divergence in Tomato (*Solanum lycopersicum* L.)" was undertaken at the Division of Genetics and Plant Breeding, School of Agricultural Science, Karunya Institute of Technology and Sciences, Karunya Nagar, Coimbatore,

Tamil Nādu during the 2022 -2023. The experiment was conducted at the North Instructional Farm of Karunya Institute of Technology and Sciences which is located in the southern parts of the Western Ghats in the foothills of Siruvani forest, with the coordinate 10° 59'18.1662" N latitude, 76° 44' 22.2458" E longitude. The experimental material consisted of 27 tomato genotypes, which were collected from different agro-climatic regions of India. The genotypes were evaluated for colour of the fruit, shape of the fruit, number of secondary branches, days to first flowering, plant height, days to first harvest, number of clusters per plant, number of fruits per cluster, fruit length, fruit breadth, FSI, number of fruits per plant, average fruit weight, seed number per fruit, seed weight per fruit, number of locules, pericarp thickness 100 seed weight, shelf life, TSS, ascorbic acid, lycopene content. Red coloured with Flat round tomato genotypes were Thirupur 2, Pusa rubi, BLPM 1, Jayanth, Chitthur, Mysore local 1 Thingalur 1, Thingalur- 2, Krishnapuram, Muthur, PKM 1, Junnur. Analysis of variance revealed significant differences among the genotypes for all the characters except for days to flowering.

Results. Genetic divergence was assessed using Mahalanobis D^2 statistics, following the method described by Rao (1952). All the genotypes are grouped into six clusters based on their similarities and differences (Table 2). Among the six clusters, clusters I had (4) genotypes, cluster II had (3) genotypes, cluster III had (7) genotypes, cluster IV had (3) genotypes, cluster V had (9) genotypes and cluster VI had (1) genotype.

Cluster V comprises the highest number of genotypes, including Kashi Aman, PKM 1, Mayanad, BLPM 1, Yellow tomato local, Chitthur, Madanapalli, Guntur medium local, Mysore local 2 followed by Cluster III consist of 7 genotypes were Vettiyar palayam, Mhingulur 2, Junnur, Muthur, Pusa rubi, Kolar medium local, Mysore local 1. Cluster I contain Bangallcot, Thengani kotai, Jayanth, Krishnapuram. Cluster II and Cluster IV contain 3 genotypes Thripur 1, Kashi, Kaziranaga local and Thingalur 1, BLPM 2, Kashi Adarsh respectively. Cluster VI contain only one genotypes was Thirupur 2. The highest inter-cluster distance was observed between cluster IV and cluster I, while the smallest distance was found between cluster VI and cluster II. Cluster III had the highest intra-cluster distance, indicating significant genetic diversity within that cluster, whereas cluster VI had the lowest intra-cluster distances

Conclusion: The results of this study showed a wide range of variation among the tomato germplasm lines for all the characters evaluated. This suggests that there is considerable potential for improving tomato cultivars through selection. Clustering of genotype based on the variability estimates facilitate the breeder to choose genetically distinct parents for hybridization to exploit heterosis.

Keywords: Tomato (*Solanum lycopersicum* L.) genetic divergence

01-30

CALIBRATION AND VALIDATION OF AEROBIC RICE USING DSSAT-CERES-RICE MODEL FOR KOZHIKODE DISTRICT, KERALA AND EVALUATING THE EFFECTS OF TEMPERATURE ON RICE PRODUCTION

P. Sruthi, and U. Surendran

Centre for Water Resources Development and Management (CWRDM), Kozhikode- 673 571

Background: Climate change is threatening rice cultivation worldwide, with drought predicted in

many Asia's rice-growing nations. This could lead to lower yields, especially in upland and rainfed ecosystems. India, the world's largest rice-growing nation, faces water shortages in lowland irrigated rice fields and upland rice fields. Aerobic rice varieties are recommended for water-scarce locations, with up to 36.4% water savings in humid tropical conditions. Researchers have used the Decision Support System for Agrotechnology Transfer (DSSAT) computer program to simulate crop growth and yield. The CERES-Rice integrated into DSSAT was used to evaluate climate change effects and identify ideal planting windows to overcome yield loss.

Methods: The study assesses the different methods of planting and nutrient management practice of aerobic rice during 2019 and 2020. Details are as follows: method of planting and different nutrient management regimes. Data on plant development and yield were gathered. Next, using the data from the field experiments, the DSSAT CERES Rice model was calibrated and verified. A temperature sensitivity study was carried out on rice production, and the adaptive strategies were evaluated.

Results: The current work used observed data from field experiments for calibration and validation of the DSSAT CERES-Rice model for aerobic rice of the Kozhikode district in Kerala to and identify genetic coefficients for the Uma rice cultivar. When a few phenological, growth, and yield parameters for both simulated and observed conditions—were recorded and compared with the simulated results, it was shown that the model fit the observed data fairly accurately. Further, a decline in the yield was predicted for different temperature sensitivity analysis, indicating the negative impact of climate change. The detrimental impact of rising temperatures on rice yield can be mitigated by planting five days ahead of the actual transplanting date. When comparing the simulated yield with the actual planting date, the five-day planting preponing enhanced the yields by 6.62 – 16.06 % in observed treatments.

Conclusions: Crop forecasting and long-term action planning can benefit from the results of the validated DSSAT-CERES-Rice model, which simulates aerobic rice cultivation. The study developed a DSS for choosing the ideal planting window and examined the extend of negative impact of the temperature increases on aerobic rice production.

Keywords: Aerobic rice, Climate change, Productivity, DSSAT Model.

02-BIOTECHNOLOGY

ORAL PRESENTATION

02-01

ANTIBACTERIAL EFFICACY STUDY OF BIOGENIC SILVER NANOPARTICLES AGAINST COMMON FOOD SPOILAGE ORGANISMS

Sumi Maria Babu and Leon Ittiachen

Department of Biotechnology, Sahrdaya College of Engineering and Technology. Affiliated to APJ Abdul Kalam Kerala Technological University, Kodakara, Kerala, 680684

Background: The antimicrobial activities of silver have been known since ancient times and its nanometric entities exhibit distinct antibacterial characteristics in contrast to the bulk metallic form. Among the different synthesis methods, biosynthesized silver nanoparticles have proven to be more beneficial since the active components in the plant extract act as capping agents on the surface of nanoparticles and thereby making it less cytotoxic. Therefore, these nanoparticles can be efficiently employed in active food packaging to combat food spoilage organisms.

Methods: The work focused on biogenic synthesis of silver nanoparticles using an aqueous extract of raw banana peel. The bio-inspired silver nanoparticles formation was confirmed using UV-Vis Spectrophotometer studies. The particles were recovered through centrifugation and characterized by Scanning Electron Microscopy and Energy Dispersive X-ray Analysis to determine physical configuration and chemical composition. The antimicrobial efficacy of these particles was assessed through agar diffusion assay, and the minimum concentration of nanoparticles solution to inhibit the microbial growth was determined against prevalent food spoilage organisms.

Results: Characterization studies revealed formation of spherical silver nanoparticles within the size range of 56-80 nm. Biosynthesized silver nanoparticles exhibited a minimum inhibitory concentration of 56.07 µg/ml and 79.32 µg/ml, along with a minimum bactericidal concentration of 156.59 µg/ml and 188.96 µg/ml against *Escherichia coli (ATCC25922)* and *Staphylococcus aureus (ATCC25923)*, respectively.

Conclusions: The biogenic synthesis of silver nanoparticles using banana peel offered a sustainable approach by utilizing industrial waste to create an antimicrobial agent. These particles exhibited increased sensitivity to Gram-negative *Escherichia coli* bacteria when compared to Gram-positive *Staphylococcus aureus*.

Keywords: Antimicrobial Activity, Industrial Waste Utilization, Nanoparticle Sensitivity, MIC and MBC evaluation

02-02

UNDERSTANDING THE PHENOLOGY OF PHOTORESPONSIVE TUBERIZATION OF SWEET POTATO TO UNRAVEL ITS POTENTIAL AS A SUPER FOOD

Reshma Maria Joseph, Shirly Raichal Anil*, Krishna Radhika N, Senthilkumar K Muthusamy

ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram
**Corresponding author Email: shirlyanil@yahoo.com,* Shirly.Anil@icar.gov.in

Background: The term ''hidden hunger'' has been in lime light recently, of which almost two billion people worldwide are being affected. Besides carbohydrates, sweet potatoes are high in minerals like calcium, potassium, copper, iron, vitamins A, B, C, bioactive compounds – anthocyanin and β-carotene, dietary fibre and protein, which can contribute in overcoming the hidden hunger or micronutrient malnutrition in the world. Sweet potato is a photosensitive crop but certain genotypes are naturally photo-insensitive and can tuberize year-round which shows that this character is genotype specific and gene regulated.

Method: Field study was conducted with five genotypes of sweet potato namely Bhu Sona, 526/7, Kanjangad Local, Sree Kanaka and SD-11. Destructive sampling was done every ten days to know the initiation of tuberization, tuber yield (g/plant) and to isolate RNA. The experiment was conducted for three seasons, kharif, rabi and summer season. The data was statistically analysed using R programming software. Potato photoresponsive tuberising gene orthologs of sweet potato was identified *in silico* and RT- PCR was done to evaluate these primers which included classes of sporamin genes and Dof Zn finger proteins.

Result: The tuber yield data showed that there is a significant effect of genotype and season on tuberization. No seasonal influence was seen in two genotypes 526/7 and SD-11. The RT-PCR results showed that all the primers expressed differently in all the five genotypes. This showed that the particular genes analysed has a role in tuberization and these are expressed in leaves but are not photoperiodically controlled.

Conclusion: The photoinsensitve genotypes identified can be utilised for more advanced analysis like transcriptomic evaluation which can lead to identification of gene expression variation in response to photoperiod.

Keywords: Photoperiodic tuberization, sweet potato, gene orthologs, RT-PCR

02-03

BIOTRANSFORMATION OF ORGANIC WASTE INTO MARKETABLE COMPOST USING INDIGENOUS MICROBES AT MUNNAR, KERALA, INDIA

P. N. Damodaran, B. Thazeem and Chikku Marin John

Integrated Rural Technology Centre (IRTC), Mundur (P.O), Palakkad (Dist.), Kerala – 678592, India.

Background: Solid waste management related challenge mounts higher, in the case of Munnar as it is a prime tourist destination. In colder regions, such as Munnar, composting is a major challenge due to the limited microbial growth, predominant low temperatures and fluctuations in the moisture

content. The scientific advancements with indigenous microbes play a vital role in overcoming these constraining factors to achieve good quality compost for agro-economic benefits.

Method: Samples were collected from the particular climatic location - Munnar, from dense forests and selected biowastes disposal sites and were screened for safe indigenous bacteria, actinomycetes and fungi. Consortium members were selected based on the results of pathogenicity test, maximum enzymatic activities and co-existence ability. Experiments started at Munnar with composting studies in biocomposter bins; were eventually extended to heaps and ended up in larger windrows.

Results: Using this microbial consortium developed at IRTC along with a polyhouse design to trap available day temperature in Munnar, several experiments were conducted to do effective composting at Munnar. The results showed that composting process was effective and faster even in the winter climate during December-January. The entire composting process took 28 days to complete.

Conclusions: At present, around 3 tons of biowastes per day are being processed regularly, leading to commercial sales of compost which is being taken up by the local body. By this way, the State will practice and achieve zero waste targets. This could eventually work out even in the colder Northern States of India.

Keywords: Bio-waste, Compost, Microbial Consortium, Munnar, Windrow Composting

02-04

FECAL SLUDGE MANAGEMENT USING AN ANAEROBIC CONSORTIUM (INOCULUM): AN ALTERNATIVE PANACEA

Chikku Marin John, B. Thazeem and P. N. Damodaran

Integrated Rural Technology Centre (IRTC), Mundur (P.O), Palakkad (Dist.), Kerala – 678592, India.

Background: Amongst all the threats, human waste is a very serious health hazard, as it is the source for viral, bacterial as well as many protozoan diseases. Anaerobic bio-degradation/digestion of human waste matter is the most preferred method of treating human feacal matter. Microbial anaerobic digestion of sewage allows the recovery of energy in the form of biogas (methane) while simultaneously reducing the concentration of organic substrates and displacing pathogens.

Method: Samples were collected from cow dung and distinct sludge from industries and exotic anaerobic locations. Biochemical identification, meticulous pathogenicity assays, their enzymatic behavior and degradation (efficacy) rates were thoroughly experimented. Lab scale fecal degradation, followed by experimenting in High Density Poly-Ethylene [HDPE] tanks in grounds is in progress with periodical physicochemical, biological and structural checks.

Results: About fifty four bacterial strains were isolated under anaerobic conditions and a microbial consortium consisting of effective anaerobic bacteria [AN3, AN21, AN18, AN54 and AN17] was formulated aseptically. As the developed anaerobic inoculum proved successful degradation at the laboratory scale, further experiments were executed to test its efficacy and practicality on farm which is exhibiting promising results within permissible limits.

Conclusions: Fecal sludge management has principal demand in the state; hence, implementation of the green technology is of prime importance. Furthermore, the efficiency of the developed inoculum in larger septic tanks and latrine linked biogas units has to be emphasized, so that inoculum based

portable public models could be suggested in near future, ensuring its bulk production and usage.

Keywords: Anaerobic Consortium, Fecal Sludge, Latrine Linked Biogas, Septic Tanks

02-05

EVALUATION OF PHYTOCONSTITUENTS AS THERAPEUTIC AGENTS AGAINST CHRONIC INFLAMMATORY PATHOLOGICAL CONDITIONS

Anu P. Abhimannue

Inflammation Research Lab, School of Biosciences, Mahatma Gandhi University, Kottayam – 686560

Department of Biology, St. Mary's College, Thrissur – 20.

Complex interactions between various immunomodulators comprising cytokines and different signaling pathways are the hallmarks of chronic inflammation. The methanolic extract of *E. scaber* Linn was evaluated for anti-inflammatory activity by determining its effects on the production of pro-inflammatory cytokines like Tumor necrosis factor-α (TNF-α) and Interleukin-1β (IL-1β) in Lipopolysaccharide (LPS) stimulated monocytes. The cytotoxicity of the extract was analyzed before the cytokine quantification assays. The effect of methanolic extract was also evaluated at expression levels by conducting q RT PCR. The extract was further subjected to UPLC MS Q-TOF to identify bioactive components present in the crude extract.

The extract was not cytotoxic against monocytes and exhibited significant inhibition in producing pro-inflammatory cytokines. The anti-inflammatory effect was also observed at expression levels. The presence of 11 components in the bioactive fraction was detected through mass spectrum analysis. The extract could be exploited further to develop effective anti-inflammatory drug components.

Keywords: Inflammation, Cytokines, TNF-α, IL-1β, UPLC MS/MS QToF, q RT PCR.

02-06

A ROTATING CASKET ARRANGEMENT FOR POSITIONING, TURNING, AND TRANSFERRING OF A HUMAN BEING

Rebin Zachria Mathew [1], P Harish Ram[1], R Rahul Dev[1], Abhiram Vinod [1], Anish K John[1], Sreekanth P[1], Sreelal S[2], Arun Anirudhan[2], Smita V [2]

[1]Government Engineering College Barton Hill, Barton Hill Colony, Kunnukuzhy, Thiruvananthapuram, Kerala 695035; [2]Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, Kerala 695011

Background: There are various conditions in which an anesthetized patient has to be turned from a supine position (lying head up) to a prone position (head and body facing down). The purpose of the current invention is to devise a new and easy method to transfer the patient with little to no interference from the medical personnel.

Methods: This work intends to develop a new device that can assist the medical personnel in rotating and transferring the human being with little to no effort. The device comprises an enclosure and base. The enclosure is where the patient will be located and the patient will be transferred with the help of the base. The base consists of a worm gear mechanism which helps rotate the patient safely.

Results: A preliminary prototype has been created and it has been noted that the base on the side near the base can withstand a load of up to 200kg.

Conclusions: While the load-carrying capacity is satisfactory on the side of the enclosure near the base the same cannot be said for the other side, new methods and strategies need to be developed to make a more stable structure.

Keywords: Supine position, Prone position, Patient transferring

02-07

CILIARY NEUROTROPHIC FACTOR (CNTF) INDUCES THE EXCITATION OF NEURONS THROUGH GLUTAMATERGIC SYNAPSES

Krishnakumar Mohandas, Ayswaria Deepti, Sayuj Koyyappurath, Baby Chakrapani P.S.

Department of Biotechnology, Cochin University of Science and Technology (CUSAT), Kochi-682022, Kerala

Background: CNTF is a Neurotrophic Factor known primarily for its neuroprotective function, and additionally in aiding neurogenesis of the Neural Stem/Progenitor Cells (NSPCs) from the neurogenic niches – the Sub-Ventricular Zone (SVZ) and the Dentate Gyrus (DG) of the brain. This study focusses on the action of CNTF in forming fully functional neurons from NSPCs by speeding up their differentiation, either directly or through the activation of BDNF. In addition, whether CNTF enhances synaptic plasticity by activating the Glutamatergic synapses in promoting the excitation of the neurons.

Method: NSPCs were isolated from the adult brain of the male *Balb/C* mice, and the cells were maintained to obtain maximum number of Neurospheres. The cells, Untreated (Control) and treatments with CNTF, BDNF, and both, were subjected to MTT assay to check the cell proliferation at desired timepoints. The Neurosphere diameters were also measured at these timepoints. Sequence Analysis was done to check for genes involved in neural development pathways. Gene expression Analysis was carried out by Real-Time PCR to quantify the genes.

Results: NSPCs had a reduced proliferation when treated with CNTF compared to the Control. Moreover, the sphere size of the CNTF-treated NSPCs were less than the Control spheres. Glutamatergic pathway was selected from the list of pathways involving genes from the Sequence analysis data. The genes linked to the Glutamatergic pathway were found to be upregulated under CNTF treatment.

Conclusion: This work has shown the influence of CNTF in differentiating the NSPCs into functional neurons, and also improving the synaptic plasticity by promoting the excitation of neurons through the Glutamatergic synapses.

Keywords: Ciliary Neurotrophic Factor (CNTF), Neural Stem/Progenitor Cells (NSPCs), Brain-derived Neurotrophic Factor (BDNF), Glutamatergic Synapses

02-08

VALIDATION OF NOVEL TYROSINE KINASE MOLECULE AS BRAF V600E INHIBITOR FOR THE TREATMENT OF COLORECTAL CANCER

Amrutha Krishnan K[1*], Sudha George Valavi[1], Amitha Joy[2]

[1]Department of Applied Science and Humanities, [2]Department of Biotechnology

Sahrdaya College of Engineering and Technology, Affiliated to A P J Abdul Kalam Technological University, Kodakara, Kerala, Email: krishnamrutha18@gmail.com

Background: Colorectal cancer (CRC) is counted as the second deadliest cancer with an overall mortality rate of 10%. One amongst the reasons for this cancer is the mutation in the BRAF gene. The amino acid valine (V) is substituted with glutamic acid (E) at the 600th position of BRAF gene. This gene encodes for BRAF protein which plays an important role in cell growth and its regulation. Although several tyrosine kinase inhibitors have been reported against this condition, seldom were found to be effective.

Method: In this study, several in-vitro analyses have been carried out to validate 3-chloro-4-(1,3-dioxo-2-azaspiro[4.4]nonan-2-yl) N[3(trifluoromethyl)phenyl]benzenesulfonamide (B1) as a potential drug candidate against the treatment of CRC. HT-29 human colon cancer cell lines have been cultured. Subsequently, clonogenic assay have been conducted to calculate the cell growth, apoptotic studies to figure out the cell vitality, Reactive Oxygen Species (ROS) studies to calculate the amount of ROSs present, and Indirect ELISA tests to quantify the total protein concentration have been carried out in both control sample and B1 incorporated sample.

Results: The molecule B1 substantially reduced the colony formation, increased the cell death and increased the concentration of ROSs. The ERK concentration (downstream protein of BRAF) was also substantially decreased in the B1 sample, which indirectly implies that the compound B1 is an effective inhibitor of BRAF protein. All the results pointed to the fact that B1 can be used as an effective BRAF V600E inhibitor.

Conclusion: This work established the effectiveness of the molecule 3-chloro-4-(1,3-dioxo-2-azaspiro[4.4]nonan-2-yl) N[3(trifluoromethyl)phenyl]benzenesulfonamide as an effective tyrosine kinase inhibitor for the treatment of CRC.

Keywords: tyrosine kinase inhibitor, clonogenic assay, indirect ELISA, apoptotic studies, ROS generation

02-09

BUILDING UP REPOSITORY OF PYOCYANIN BIO-PARTS FOR ENHANCED PRODUCTION TO CONTROL PATHOGEN IN AQUACULTURE IN LIEU OF ANTIBIOTICS AS PART OF ONE HEALTH APPROACH THROUGH SYNTHETIC BIOLOGY

Jini Jimmy & I. S. Bright Singh

National Centre for Aquatic Animal Health, Cochin University of Science and Technology, Cochin-16

Background: Pyocyanin produced by *Pseudomonas aeruginosa,* one of the phenazine derivatives

has broad spectrum activity against bacteria and fungi. It has been identified as the key molecule produced by *P. aeruginosa* and inhibits growth of pathogenic Vibrios in aquaculture systems. Pyocyanin has been found to be biodegradable leaving less or no residue. These facts imply that Pyocyanin can be used as a therapeutic agent in lieu of antibiotics for sustainable aquaculture.

Commercial pyocyanin is unaffordable in aquaculture and a microbial production process with enhanced output and effective downstream are essential, and this requirement prompted to undertake the present venture. Considering the scope and merit, Synthetic Biology route has been chosen for the above because attainment of cell factory level production of the compound would address the economic viability. The prime step in the process is the generation of bio-parts of the gene complex. This paper deals with how did the bio-parts of the pyocyanin biosynthetic gene including the pyocyanin operon got generated and what would be its significace in the synthetic biology production of the drug.

Methodology: Pyocyanin biosynthetic genes are split in to three modules: PhzM ,PhzS and the operon PhzA-G. Primers were designed for the amplification of Pyocyanin biosynthetic genes using Primer3 software. Amplified genes were cloned in to pJET vector, Sequenced and phylogenetic tree constructed using MEGA software. Primers for the amplification of pyocyanin bio parts were designed by adding sequences from the vector to carry out Gibson cloning in to the destination vector for further expression to attain enhanced pyocyanin production.

Results: Pyocyanin biosynthetic genes including the 5Kb operon were amplified and cloned in to pJET cloning vector and created a repository of pyocyanin bio-parts, sequenced and Phylogenetic tree constructed and deposited in the Repository of Bio-parts for synthetic biology of National Centre for Aquatic Animal Health, Cochin University of Science and Technology.

Key words: Pyocyanin, *Pseudomonas aeruginosa,* Operon, Bio-part

02-10

EVALUATION OF ANTIMICROBIAL POTENTIAL AND PHYTOCHEMICAL COMPOSITION OF *OCIMUM TENUIFLORUM* LEAF EXTRACTS

Sangeetha Gopal, Leon Ittiachen

Department of Biotechnology, Sahrdaya College of Engineering and Technology, Affiliated to APJ Abdul Kalam Technological University, Kodakara, Thrissur, Kerala, India, 680684.

Background: *Ocimum tenuiflorum* (Krishna tulsi), has been revered in traditional medicine for its therapeutic properties. With the intensifying global antibiotic resistance challenge, exploring alternative antimicrobial sources, particularly medicinal plants, is imperative. The present study focuses on understanding the phytochemical composition of *Ocimum tenuiflorum* leaf extracts and their effectiveness against microbes.

Methods: Dried *Ocimum tenuiflorum* leaves underwent extraction by decoction and digestion methods. Preliminary qualitative analysis was conducted to identify the presence of various phytochemicals. Extracts were evaluated for Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC)/ Minimum Fungicidal Concentration (MFC) against *Staphylococcus aureus, Escherichia coli,* and *Aspergillus niger*.

Results: The initial phytochemical analysis identified alkaloids, steroids, flavonoids, and terpenoids in the decoction extract, and alkaloids, saponins, and steroids in the digestion extracts of O*cimum tenuiflorum* leaves. These extracts exhibited notable antimicrobial activity against gram-positive bacteria, gram-negative bacteria, and fungi, as indicated by observed zones of inhibition in agar well diffusion assays.

Conclusion: The findings of this study provide valuable insights into the pharmacological properties of *Ocimum tenuiflorum*, paving the way for further research on potential therapeutic applications and the plant's potential as natural preservative. The presence of diverse phytochemicals and the observed antimicrobial effects hints at its potential multifaceted therapeutic benefits.

Keywords: Antimicrobial activity, Minimum inhibitory concentration, Phytochemical analysis, Traditional medicine

02-11

EFFECT OF SESAMOL ON MARKERS OF INFLAMMATION AND ENDOTHELIAL DYSFUNCTION IN OXIDIZED LDL INDUCED ENDOTHELIAL CELLS

Mohammad Kazan and Saja K.

University of Kerala, Karyavattom, Thiruvananthapuram, Kerala 695581, India

Background: Atherosclerosis, a systemic condition that affect Medium to large arteries marked by the buildup of lipids, fibrous materials, inflammatory cells recruitment, SMC migration, and stenosis [1]. Endothelial dysfunction is the initial event of Atherosclerotic followed by LDL (low-density lipoprotein) retention and intimal modification [2,3]. Sesamol is a natural organic compound, which is a component of sesame seeds with anti-inflammatory, antioxidant properties. This study aims to investigate the effect of sesamol on markers of inflammation and endothelial dysfunction on oxidized LDL (oxLDL) induced endothelial cells.

Methods: The endothelial cells were isolated from a male, one to two months old Sprague Dawley rat. The cells were maintained in culture in the presence of oxidized LDL (50 ug /ml) and different concentrations of Sesamol (25 uM and 50 uM) for 48 hours. After cell harvest and media collection, markers of inflammation (IL-6, TNF-alpha, NF_Kb,) and endothelial dysfunction markers (ICAM, VCAM, MMP2, MMP9, TIMP-1, TIMP-2, and nitrite) were measured. One Way Anova test was performed to study the statistical significance of tested parameters by using graphpad prism 5.

Results: Markers of inflammation and endothelial dysfunction were raised significantly in Oxidized LDL induced endothelial cells compared to control. However, the sesamol treatment significantly down regulated this effect.

Conclusions: Sesamol showed anti-inflammatory and atheroprotective effect by alleviating the inflammation and endothelial dysfunction markers in oxidized LDL induced endothelial cells. Sesamol can be used as therapeutic agent for management of atherosclerosis by down regulating the markers of inflammation and endothelial dysfunction.

Keywords: Sesamol, endothelial cell, endothelial dysfunction, atherosclerosis, inflammation, oxidized LDL.

02-12

GENOMIC AND ANTIBACTERIAL PROFILING OF STREPTOMYCES MELANOGENES WPF1

Abhirami C.R.[1], Vipin Mohan Dan[2], Sarika A. R.[3]

[1]Division of Microbiology, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Thiruvanathapura
[2]Division of Microbiology, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Thiruvanathapuram
[3]Kerala Biotechnology Commission (KBC)Kerala State Council for Science, Technology and Environment,Thiruvanathapuram.

Background: Antimicrobial resistance (AMR) poses a formidable global health challenge, necessitating the exploration of novel sources for antibacterial agents. Actinomycetes, particularly Streptomyces species, have historically yielded bioactive compounds with therapeutic potential. In this context, Streptomyces strain WPF1, isolated from the biodiverse Vagamon Pine Forest in Kerala, India, assumes significance. The genomic exploration of WPF1 becomes imperative against the backdrop of rising antibiotic resistance, offering insights into potential solutions for combating multidrug-resistant bacteria.

Methods: The study utilized high-throughput sequencing (Illumina, Novaseq 6000) to unravel the 6.17 Mb genome of Streptomyces strain WPF1. Genomic analysis, including rMLST and AntiSMASH, provided taxonomic classification and highlighted biosynthetic gene clusters associated with bioactive secondary metabolites. Concurrently, the investigation into antibiotic resistance focused on WPF1's antibacterial and anti-biofilm activities. Techniques such as TLC-bioautography were employed to isolate and identify compounds from the ethylacetate extract, emphasizing their potential in combating AMR.

Results: Streptomyces WPF1 exhibited robust antibacterial and anti-biofilm activities, as evidenced by low MIC, MBC, and MBIC values. AntiSMASH analysis revealed the genetic potential for bioactive compound production, while TLC-bioautography identified multiple bioactive compounds within the ethylacetate extract. Notably, WPF1 demonstrated efficacy in inhibiting Staphylococcus aureus biofilm formation, showcasing its promise as a therapeutic agent against antibiotic-resistant strains.

Key words: Actinomycetes, Whole Genome Sequencing, Bioactive Compounds, Streptomyces melanogenes, Antimicrobial resistance

02-13

MICRORNA-532-3P: A KEY PLAYER THAT SUPPRESSES COLORECTAL CANCER THROUGH REGULATION OF FOXM1

Ketakee Mahajan, Dr. Asha Nair

Cancer Research Programme-4, Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram, India.

Introduction: FOXM1, a pivotal transcription factor, is widely overexpressed in cancers, playing a crucial role in tumorigenesis. Investigating FOXM1's regulatory dynamics is essential

for understanding this process. A previous study in our lab revealed its ability to bind to specific microRNA promoters. MicroRNAs, short regulators of gene expression, inhibit mRNA translation. This study focuses on identifying and validating microRNAs regulating FOXM1.

Methods: Database mining identified potential microRNA candidates, with seven selected for validation through a luciferase reporter assay in HEK293T cells. Overexpression of selected microRNA in CRC cell lines in various assays led to assessing its impact on cancer-related phenomena.

Results and Discussion: MiR-532-3p exhibited the most significant interaction with *FOXM1* 3'UTR, reducing luciferase activity notably. Overexpressing miR-532-3p decreased FOXM1 and cyclin B1 levels. Surprisingly, despite altered cyclin B1 expression, cell cycle progression remained unchanged. MiR-532-3p reduced cellular proliferation, validated by clonogenic assays and decreased PCNA levels. Wound healing and matrigel invasion assays confirmed suppressed migration and invasion in SW480 cells, supported by altered EMT markers.

Conclusion: This study highlights miR-532-3p's interaction with *FOXM1*, resulting in decreased protein levels and subsequent suppression of cellular proliferation, migration, and invasion in CRC cells. MiR-532-3p emerges as a potential prognostic marker.

Keywords: MicroRNA, Colorectal Cancer, FOXM1, Metastasis

02-14

EVALUATION OF ANTI-INFLAMMATORY ACTIVITY OF DIFFERENT FRACTIONS OF METHANOLIC EXTRACT OF *MOLLUGO PENTAPHYLLA.*

Jijin R and P G Biju

Department of Biochemistry, University of Kerala, Thiruvananthapuram

Background: Plants are an essential source of natural compounds with important pharmacological properties, and since ancient times, plants and their extracts have been used to treat a variety of ailments. *Mollugo pentaphylla* Linn. commonly known as five-stem carpet weed, is a traditional medicinal plant extensively referred to in traditional healing, including Ayurveda and Siddha systems of medicine, for its antiseptic and fever-mitigating potential. In this study, we have evaluated the anti-inflammatory properties of the different fractions of methanolic extract of *Mollugo pentaphylla.*

Methods*: In vitro* studies for the evaluation of the anti-inflammatory properties of different fractions of MP- ME were carried out in RAW 264.7 murine macrophages. The methanolic extract of *M. pentaphylla* was subjected to anti-inflammatory activity-guided fractionation by liquid-liquid partition and obtained four fractions, Hexane fraction, Ethyl acetate fraction, Butanol fraction and Aqueous fraction. In cell culture *in vitro* models, LPS is an important initiator of acute inflammation and widely studied in RAW 264.7 macrophage cell lines used LPS (1µg/ml) as the inducer of inflammatory response and studied the anti-inflammatory effect of different fractions.

Results: Our results indicated that the treatment with HF (100µg/ml) exhibited the most significant downregulation of the pro-inflammatory cytokines like TNF-α, IL-6, IL-1β and the chemoattractant cytokine CCL2 post-LPS Challenge. HF has a significantly higher anti-inflammatory effect when compared to other respective fractions such as EAF, BF and AF.

Conclusions: The findings of this study revealed the hexane fraction as an active fraction for further investigations and confirmed the anti-inflammatory efficacy of the methanolic extract of *Mollugo pentaphylla.*

Keywords: *Mollugo pentaphylla*, lipopolysaccharide, Hexane fraction

02-15

GENOTYPING OF WILD CASSAVA VARIETIES EXCLUSIVE TO TRIBAL AREAS IN KERALA: IMLICATIONS FOR CONSERVATION AND AGRICULTURE INNOVATION

Deepthi Mohan, P Manoj, Anish N.P., Anu Theresa Antony, Chandrabhas Narayana

Rajiv Gandhi Centre for Biotechnology

Cassava (Manihot esculenta Crantz) is an essential staple crop that greatly enhances the food security of rural communities in Kerala. Several land races/varieties of cassava have been documented from the tribal farmers. The purpose of this study was to examine the morphological and genetic diversity of cassava varieties.

Comprehensive field surveys were conducted to document the morphological features, and Inter Simple Sequence Repeat (ISSR) markers were employed for the genetic study. A thorough morphological examination was conducted, covering important features such petiole characteristics, leaf morphology, tuber characteristics, and general plant architecture. The morphological observations were documented and analyzed in order to identify differences between the cassava varieties/landraces.

Genomic DNA was extracted from 23 varieties/landraces collected from the tribal areas across Idukki District. The ISSR markers were employed to generate DNA profiles, enabling the identification of unique genotypic patterns for each variety. The obtained molecular data were subjected to statistical analyses to assess the genetic relatedness and diversity among the cassava varieties.

Based on the ISSR marker analysis, the results showed a considerable degree of genetic variation among the cassava landraces/varieties collected under the study. Clustering analysis provided insights into the relationships and distinctiveness of these varieties, reflecting the complex evolutionary history of the tubers and adaptive strategies within tribal farming communities. The result significantly clusters out five traditional varieties exclusive to this area namely Kariveppu kappa, Ambakkadan kappa, Ceylon kappa, Pathinettu kappa, Etha kappa. The overall polymorphic percentage varies between 43- 89% and grouped population analysis of 23 varieties specifies a value of gene diversity 47%.

Combining molecular and morphological data enabled a thorough characterization of the native cassava germplasm in Kerala's tribal areas. Morphological comparisons revealed differences in important traits, providing complementary insights into the phenotypic diversity of cassava varieties.

This study provides essential data for gametic wealth of cassava for future crop improvement programs and improving the adaptability of cassava crops to shifting environmental circumstances.

02-16

ISOLATION AND SCREENING OF BIOFLOCCULANT MICROBES FROM NOVEL SOURCES AND DETERMINATION OF ITS FLOCCULATING EFFICIENCY

Mufeeda k[1], Benu George[2] and Suchithra T.V[2]

[1]*University of Calicut, Thenhipalam, Malappuram*
[2]*National Institute of Technology, Calicut, Kerala*

Background: Bioflocculation is the clumping together of fine, dispersed organic particles and is considered as an active process caused by living cells due to the production of exopolymeric macromolecules. Traditionally, chemical flocculants were used in water treatment systems and downstream processing and have proved to be toxic and detrimental to both human health and nature due to their non-biodegradability and harmful secondary pollution. Hence, in recent years bioflocculants attained much attention.

Method: The samples were collected from novel sources like spoiled fruits, vegetables and marine clam in saline solution. The samples were then plated and colonies with particular morphology were screened. They were then cultured in a fermentation broth, incubated for 72 hours and then tested for flocculating efficiency against kaolin clay suspension. The optical density of clarifying liquid was measured using a spectrophotometer at 550nm.

Results: Out of all samples, marine sample *Ruditapes philippinarum* conglutination mud (RPM) showed best flocculation rate of 88.77%, which is followed by spoiled *Manilkara zapota* which showed a flocculation rate of 72.85%. The sample *Abelmoschus esculentus* also showed appreciable flocculation of 54.29%. The flocculating efficiency of cell-free supernatant of almost all samples showed a much higher flocculation rate.

Conclusion: This work examined flocculating efficiencies of microbes isolated from novel sources and found appreciable results. As the cost of raw materials is one of the limiting factor for the industrial scale production of bioflocculants, this work finds its relevance.

Keywords: Bioflocculant microbes, novel sources, flocculation rate, kaolin suspension

02-17

OPTIMIZATION OF HYDROLYTIC ENZYME COCKTAIL PRODUCTION BY *BACILLUS CEREUS* MCCB 101 USING RESPONSE SURFACE METHODOLOGY

Limmy T P, Valsamma Joseph, Riya George and I S Bright Singh

National Centre for Aquatic Animal Health, Cochin University of Science & Technology, Lake Side Campus, Kochi, Fine Arts Ave, Ernakulam, Kerala 682016

Background: Probiotics in aquaculture, particularly *Bacillus* species, enhance digestion and nutrient assimilation. The use of Soybean meal as a plant-based substrate is gaining attention due to its high nutritional value, contributing to the demand for sustainable aquaculture.

Method: This study aims to simultaneously produce eight hydrolytic enzymes from a single medium by utilizing *Bacillus cereus* MCCB 101 with Soybean meal as the substrate. Optimization

involved statistical approaches, including One Factor at a Time and Response Surface Methodology, to identify the ideal conditions for enzyme production, considering factors such as temperature, pH, salinity, and substrate concentration.

Results: Statistical optimization, employing One Factor at a Time and Response Surface Methodology, pinpointed optimal conditions for enzyme production: temperature at 44°C, pH at 7.5, salinity at 25 ppt, and substrate concentration at 3.5%. The optimized model led to significantly increased enzyme activities.

Conclusion: This study successfully showcased the production of a multi-enzyme cocktail from the probiotic *Bacillus cereus*, utilizing Soybean meal as a substrate for fish feed supplementation. The application of Response Surface Methodology (RSM) emerged as a robust method for optimizing probiotic culture conditions, promising enhanced digestive potential.

Keywords: Probiotics, Bacillus, Soybean meal, Response surface methodology

02-18

TYROSINASE- PRODUCING BACTERIA ASSOCIATED WITH CORALS: POTENTIAL PROBIOTIC FOR OXIDATIVE STRESS ATTENUATION

Jibin James, Nizam Ashraf, Anas Abdulaziz*

CSIR-National Institute of Oceanography, Regional Centre Kochi, Kerala-682018, India
**Corresponding author:* anas@nio.org

Abstract: Coral reefs are biologically diverse ecosystems that provide several ecological services. Corals show visible responses to indicators of climate change and undergo bleaching. Reactive molecules mediate many of the deleterious effects caused by climate change indicators, and organisms generate different antioxidant molecules to protect their cellular processes from oxidative stress. Microorganisms are known to secrete several molecules, such as melanin, carotenoids, heat shock proteins (HSPs), and antioxidant enzymes, which protect themselves and their host cells from oxidative stress. Melanin is a dark-colored photoprotective biopolymer synthesized through different enzymatic processes in which tyrosinase forms a key enzyme. We found that 238 bacteria isolated from corals (*Acropora muricata, Porites lobata, Pocillipora damicornis, Podabacea crustacea*, and *Pavona venosa*) in Lakshadweep produce tyrosinase, and 50% of them showed production above the median level (0.7 U) of enzyme. The isolates that exhibited the highest tyrosinase production were isolated from *Acropora muricata* and *Porites lobata*, and these bacteria were identified as *Brachybacterium* sp., *Bacillus* sp., *Kushneria* sp., *Psychrobacter* sp., *Staphylococcus* sp., *Halomonas* sp., and *Salinicola* sp. The findings of this study propose that tyrosinase-producing bacteria are potential candidates for designing probiotics to attenuate oxidative stress.

Key words: tyrosinase, corals, oxidative stress, antioxidant, melanin

02-19

PROTEOGENOMICS INSIGHTS INTO ELICITOR-BASED INNATE IMMUNE RESPONSES IN *PIPER NIGRUM* L.

Chidambareswaren Mahadevan[1,2]*, Mahesh Chandran[3], Abdul Jaleel[3] and Manjula Sakunthala[1*]

[1]Plant Biotechnology & Disease Biology, Rajiv Gandhi Centre for Biotechnology (RGCB), Thycaud Post, Poojappura, Thiruvananthapuram - 695 014, Kerala, India
[2]Present address: The Plant Chemetics laboratory, Department of Biology, University of Oxford, South Parks Road, Oxford OX1 3RB, United Kingdom
[3]DBT-SAHAJ National Facility for Mass Spectrometry, Rajiv Gandhi Centre for Biotechnology (RGCB), Thycaud Post, Poojappura, Thiruvananthapuram - 695 014, Kerala, India
** corresponding authors:* chidambareswaren.mahadevan@biology.ox.ac.uk, smanjula@rgcb.res.in

Abstract: In this study, we explore the proteogenomics of the innate immune responses in *Piper nigrum* L. (black pepper), a spice crop of significant commercial and culinary value. Historically, the genomic and proteomic exploration of spice crops like *P. nigrum* has faced limitations due to the lack of comprehensive studies. We leverage the recently sequenced genome of *P. nigrum* to investigate its innate immune components, focusing on responses to two major plant immune elicitors: flagellin and chitosan. Employing flg22 and glycol chitosan, we analyze the foliar proteome of black pepper, uncovering differential proteomic responses. Our approach includes 1D-label-free quantitative proteomics, through which we identify and annotate approximately 2100 proteins. We also use AlphaFold for the structural prediction of key proteins integral to the immune response. This study not only provides a first look at the differential response of black pepper's foliar proteome but also annotates over 2100 proteins, highlighting varied responses to significant plant immune elicitors. Our findings underscore the importance of studying innate immune components in non-model crops and open new avenues for proteomic exploration in spice crops.

02-20

INVESTIGATION OF ANTIBIOTIC RESISTANT BACTERIA IN KUWAIT'S ENVIRONMENT AND AWARENESS AMONG CHILDREN

Reema Jafar and Reeya Jafar

8th grade, Indian Community School Kuwait, Amman (ICSK, Amman)

Abstract: Microorganisms are an essential part of our everyday life. They are a necessary evil. We need them and yet it also has the chance to harm us. We often use antibiotics to cure our illness. But when bacteria are continuously exposed to these antibiotics, they produce antibodies to fight against these antibiotics and develop resistance against them. These are then termed as antibiotic resistant bacteria (ARBs). It is often noticed that these ARBs enter the marine water in many places through the human waste. In this study, we examined the presence of ARBs by testing polluted water samples collected from a waste water discharge to the sea in Kuwait. This outfall directly discharges the contaminated water into the sea. In our study we have used Standardized disk diffusion method. We dispensed five antibiotic discs onto each inoculated media where the bacterial colonies were observed using sterile forceps. In the first inoculated media, we have dispensed the following four antibiotics.

1. Ampicillin (10 µg)
2. Erythromycin (15 µg)
3. Ciprofloxacin (5 µg)
4. Tetracycline (30 µg)

In the second inoculated media, we have dispensed another five antibiotics as listed below:

5. Gentamicin (10 µg)
6. Chloramphenicol (30 µg)
7. Kanamycin (30 µg)
8. Doxycycline (30 µg)
9. Meropenem (10 µg)

They were then incubated for 24 hrs by keeping this prepared sample in the incubator to allow the inhibition to take place. We have used two samples for each antibiotic discs. We observed the pathogenic bacteria, namely *E-coli* in the marine waters. Our results show that the bacteria were resistant to one of the antibiotics (Erythromycin antibiotic) and susceptible to the remaining eight antibiotics that we have tested for. In the second part of our project, we have conducted a survey questionnaire among children of age 13-16 years to understand how ARBs affect children. The results show that 47.4% of the people leave some portion of the antibiotics unused and 90.5% of the people dispose these leftover antibiotics just like any other waste. This is an alarming concern, therefore, it is necessary to conduct awareness programs about the use of antibiotics and its disposal in order to reduce the spread of ARB's.

POSTER PRESENTATIONS

02-21

EXPLORATION OF ANTIPARKINSONIAN POTENTIAL OF CURCUMENOL BY EMPLOYING DIVERSE *IN SILICO* TECHNIQUES

Nivya R. M. and Dr. Amitha Joy

Department of Biotechnology, Sahrdaya College of Engineering and Technology, Thrissur-680684, APJ Abdul Kalam Technological University Kerala.

Background Repurposing of available, natural bioactive molecules has become one of the well-received and successful strategies in drug discovery. Among many naturally derived bioactive molecules, curcumenol is a prospective therapeutic solution against numerous chronic health ailments. The current work explores the antiparkinsonian ability of curcumenol via different *in-silico techniques.*

Method The ADME properties and toxicity prediction were conducted as preliminary screening steps using the SWISS ADME online tool and ProTox II webserver accordingly, which were further proceeded with molecular docking studies using Parallel open babel and Auto-dock pipeline (POAP) against the key proteins reported to be overly expressed in the PD pathway including; Polo-

like kinase 2 (PLK2), Glycogen synthase kinase-3 (GSK3), and Protein deglycase DJ-1 (Parkinson disease protein 7). The validation studies were conducted using Molecular dynamics simulation studies for 100ns via Desmond Maestro software provided by Schrodinger Inc.

Result The initial screening revealed the curcumenol to be blood-brain barrier permeable, Lipinski's rule-following, and non-toxic. The docking score of curcumenol against PLK2, GSK3, and DJ1 protein was -7.7 kcal/mol, -7.2 kcal/mol, and -5.7 kcal/mol, respectively. The molecular dynamics simulation studies further validated the interactional stability of curcumenol with the target proteins in a dynamic physiological system with RMSD values less than 3 Å.

Conclusion The current therapeutic solution for Parkinson's disease does not prevent or revert the occurring neurodegeneration instead, it supplements the lost dopamine or suppresses the clinical manifestation of the disease. In such a scenario the need for a drug candidate which can interact with the pathogenic proteins in the pathophysiology of PD is needed. In the *in-silico* analysis done in the current study, curcumenol proves to be a better choice by having fairly acceptable molecular inhibitory and interactional characteristics.

Keywords Bioactive, Neuroprotection, Drug Repurposing, Molecular docking, Molecular dynamic simulation.

02-22

ELUCIDATING THE ROLE OF RV18XX-HDAC1 REPRESSOR COMPLEX IN MYCOBACTERIAL INFECTION

Arjun M Menon, Abhinand Kuniyil, Geetha B Kumar, Bipin G Nair, Aravind Madhavan

School of Biotechnology, Amrita Vishwa Vidyapeetham, Amritapuri, Kerala, India.

Background: *Mycobacterium tuberculosis*, known for its resilient multidrug-resistant nature, poses a significant threat to public health. In light of the escalating resistance to traditional antibiotic treatments, there is a growing impetus to investigate alternative therapeutic approaches, particularly those focusing on host-directed therapies. This study aims to unravel the complex interactions between histone deacetylases (HDACs) and the intracellular persistence mechanisms employed by *M. tuberculosis* within human macrophages. As conventional antibiotic regimens face mounting challenges, understanding the role of HDACs in the context of *M. tuberculosis* infection may provide valuable insights for the development of innovative treatment strategies.

Methodology: The Rv18xx gene was overexpressed in *Mycobacterium smegmatis* via a plasmid vector, confirmed by Western blot analysis. These strains infected THP1-derived macrophages, and survival dynamics were monitored. An inhibitor, determined through preliminary studies, was used, and autophagy indicators were visualized via confocal microscopy. ELISA quantified autophagy indicators. Additionally, qRT-PCR assessed transcriptional changes induced by Rv18xx overexpression, providing insights into molecular mechanisms. This approach ensures a comprehensive understanding of interactions between Rv18xx-overexpressing *M. smegmatis* and THP1-derived macrophages.

Top of Form

Result: Rv1899c overexpression in *M. smegmatis* suppressed ROS production in THP-1

macrophages. The protein also increased the intracellular survival of M. smegmatis in macrophages. Treatment with the Rv1899c inhibitor resulted in a significant reduction in bacterial survival, and combinatorial treatment with HDAC1 inhibitor and isoniazid showed enhanced bactericidal activity. The Rv1899c inhibitor also induced autophagy-related gene expression and increased the colocalization of bacteria with LC3 autophagosomes.

Conclusion: Inhibition of Rv1899c enhances the release of IL-12p40, promotes bacterial colocalization with autophagosomes, and induces autophagy-mediated killing of intracellular mycobacteria. Combining Rv1899c inhibition with HDAC1 inhibitor and isoniazid demonstrates a significant reduction in *M. smegmatis* survival within macrophages.

Keywords: Histone Deacetylases, *Mycobacterium smegmatis*, Macrophages, Host-Directed Therapies.

02-23

ENHANCING THE PRODUCTION OF APIGENIN FROM ADVENTITIOUS ROOT CULTURES OF *JUSTICIA GENDARUSSA* BY METHYL JASMONATE AND SALICYLIC ACID

Vinaya Chandran, Maya Rajan and Linu Mathew

School of Biosciences, MG University, Kottayam -686560

Background: Extracting and purifying bioactive metabolites from field-grown plant roots is tedious. Adventitious root culture is a viable alternative for commercially producing bioactive compounds. Hence, adventitious root cultures were initiated from the leaf explant of *Justicia gendarussa* to elicit apigenin production.

Methods: Adventitious roots were induced from leaf explants with different IBA, IAA, and NAA combinations. Biomass accumulation and apigenin production were evaluated in four-week-old adventitious roots. Six-week-old cultures were elicited with different concentrations of methyl jasmonate and salicylic acid for apigenin production.

Results: Maximum root biomass was obtained in 1 mgL^{-1} IAA and 1 mgL^{-1} IBA each. HPLC and LC-MS/MS analysis confirmed the presence of apigenin in the adventitious root cultures. Maximum production of apigenin was confirmed in 6-week-old cultures. The addition of methyl jasmonate triggered the production of the flavonoid apigenin.

Conclusion: adventitious root cultures initiated from *Justicia gendarussa* have positively responded to methyl jasmonate and salicylic acid elicitation.

Keywords: adventitious root cultures, *Justicia gendarussa*, IAA, IBA, Methyl jasmonate, Salicylic acid, HPLC, Apigenin.

02-24

ANTIMELANOMA EFFICACY OF A SYNERGISTIC COMBINATION OF THE BIOACTIVE COMPOUND, CUCURBITACIN B AND THE BRAF INHIBITOR, VEMURAFENIB

Amrutha Nisthul A[1], Meghna Sudhesh[1], Aiswarya US[2], Ruby John Anto[2], Sadasivan C[3], Smitha VB[1]*

[1]Department of Biotechnology, University of Calicut, Thenhipalam, Kerala-673635
[2]Rajiv Gandhi Centre for Biotechnology, Poojappura, Thiruvananthapuram, Kerala-695014
[3]Department of Biotechnology and Microbiology, Kannur University, Palayad, Kerala-670661

Melanoma is a type of skin cancer that develops in the pigment-producing cells called melanocytes, accounting for over 80% of skin cancer deaths. BRAF is one of the most frequently mutated oncogenes recognized in melanoma. Vemurafenib is the first chemotherapy drug developed to target the oncogenic BRAF-serine-threonine kinase (BRAF V600E) for the treatment of melanoma. Vemurafenib is known to develop resistance during the treatment period. The feedback activation of the MAPK/ERK pathway via MEK has been reported as an important mechanism by which development of chemoresistance to BRAF inhibitor monotherapy occurs. Hence, BRAF-MEK inhibitor combinations are currently used in the clinic, which, however, cause deleterious side effects.

Cucurbitacin B is a plant-derived triterpene isolated from the plant family of *Cucurbitaceae*, which is reported to have potent antimelanoma efficacy via downregulating the MAPK signaling (Aiswarya et. al; 2022). The present study has demonstrated via molecular docking studies that cucurbitacin B bind to MEK allosteric binding site more effectively compared to the FDA approved MEK inhibitor cobimetinib.

Hence, we are exploring the possibilities of using cucurbitacin B as a chemotherapeutic agent in combination with B-RAF inhibitors currently used in the clinic against melanoma. In this study we show the antimelanoma efficacy of the synergistic combination of vemurafenib and cucurbitacin B *in vitro*. We show that a combination of cucurbitacin B and vemurafenib exert synergistic antiproliferative effect in melanoma cells. The combination also demolished the clonogenic potential of melanoma cells. Further, we give evidence for the apoptotic mode of cell-death induced by the combination in melanoma cells. The study demonstrates the combination involving Cucurbitacin B and Vemurafenib holds promise as a prospective treatment strategy against melanoma.

02-25

BIOWASTES MANAGEMENT AND ITS USE IN AGRICULTURE AT PULLUNDASSERY WATERSHED, PALAKKAD, KERALA, INDIA

Dr. B. Thazeem, Chikku Marin John and Dr. P. N. Damodaran

Integrated Rural Technology Centre (IRTC), Mundur (P.O), Palakkad (Dist.), Kerala – 678592, India.

Background: Palakkad is known as the Granary of Kerala and its economy is primarily agricultural. Pullundassery watershed is situated in Srikrishnapuram Block Panchayat, Palakkad that acted as project implementation site to conduct skill-based trainings on composting and vermicomposting and its use in agriculture.

Method: The training programme aimed to facilitate people on all aspects of composting so that they can then work in and with their communities to promote composting and organic waste prevention. The project provided a mix of technical information and a hand on experience and, as part of the programme, demonstration units were built.

Results: The training programme under BIRD project successfully facilitated awareness programs, followed by hands-on training in composting, vermicomposting and inoculum mixing skills to the beneficiaries. As proposed, beneficiaries were facilitated with biocomposter bins, kitchen bins, VAM fungi and inoculum's significance and safe handling practices. Portable vermicompost units added weightage to the program, as many beneficiaries were interested in vermicomposting and earthworms handling. Maximal Information, Education and Communication [IEC], with effective training sessions paved the way for the betterment and income generation, in terms of buyback of composts and vermicomposts, in the target area.

Conclusions: Overall, a positive social and environmental impact was observed at the watershed, through this skill-based training programme. Thus, to cater to the needs of the growing population, effective waste management is increasingly being looked at as an essential public service for the sustainable development of spaces, communities and resources.

Keywords: Agriculture, Compost, Microbial Consortium, Pullundassery, Vermicompost

02-26

IMPACT OF DISEASE ASSOCIATED TUBA1A TUBULIN ISOTYPE MUTATIONS ON MICROTUBULE DYNAMICS

Remya C P [1], Kathiresan Natarajan [1]*

[1]*Transdisciplinary Biology, Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram, Kerala, 695014, India.*

**Corresponding Author: Email ID:* kathiresan@rgcb.res.in, *remyaramani9@gmail.com*

Background: Microtubules exhibit a remarkable degree of structural homology across diverse eukaryotic organisms, underscoring their significance as a fundamental component of the cytoskeleton. Their functional specialization is achieved through interactions with microtubule-associated proteins (MAPs), and the evolutionary conservation of α and β-tubulin isotypes has been well-established. Recent advancements in the study of tubulin isotypes, particularly in the context of human brain malformations collectively termed tubulinopathies, have heightened interest in elucidating the functional roles of tubulin.

Method: The diverse range of brain malformations observed in patients suggests that distinct missense mutations in TUBA1A could interfere with various phases of neuronal maturation. Consequently, mutations causing disease in TUBA1A offer a valuable avenue to explore the multitude of neurodevelopmental stages dependent on TUBA1A and the precise regulation of microtubules necessary for each stage to proceed appropriately. This research project specifically focused on the in-silico analysis of mutations in the Tuba1a tubulin isotype, revealing alterations in tubulin dynamics.

Result and conclusion: Our findings shed light on an unexpected role of the Tuba1a isotype in neurodevelopmental disorders. To deepen our understanding, comprehensive in vivo and in vitro

analyses of Tuba1a mutants are essential.

Keywords: Microtubules, Cytoskeleton, Tubulin isotypes, Tuba1a, Neurodevelopmental disorders.

02-27

STUDIES ON ANTIBIOFILM ACTIVITY OF ENDO-SYMBIOTIC BACTERIA ISOLATED FROM *PLEUROTUS GIGANTEUS* TARGETED AGAINST *STAPHYLOCOCCUS AUREUS*

Anagha B, Vipin Mohan Dan, CK Pradeep

Microbiology division, KSCSTE-Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Trivandrum, Kerala
E-mail: anaghabdevan@gmail.com

Background: The alarming increase in multidrug resistance among human microbial pathogens and the clinical importance of biofilm has impelled the need to find novel antibiofilm agents. Unlike antibiotics, which impose a selection pressure on microbes, the antibiofilm agents interfere with the bacterial communication system needed for virulence and biofilm formation, thereby decreasing the likelihood of resistance development. *Staphylococcus aureus* forms biofilms that cause serious life-threatening medical conditions and leads to development of antimicrobial resistance. Mushrooms harbour plethora of medicinal properties and many studies have been conducted on the antibacterial property of mushrooms, even-though the study on endo-symbiotic bacteria from mushrooms are comparatively low.

Method: In this study, three bacterial isolates from *Pleurotus giganteus* were investigated. The isolates were screened for production of antibiofilm agents and one isolate designated PG-A showed effective antibiofilm activity against *Staphylococcus aureus*. Crystal violet assay was employed to quantify the biofilm.

Results: Screening of ethyl acetate extract of isolates for antimicrobial activity determined that two isolates, PG-A and PG-D, showed inhibition of *S. aureus* growth. PG-A extract showed higher zone of inhibition registering at 12mm compared to PG-D (6mm). PG-A showcased effective antibiofilm activity against *S. aureus* with a concentration 0.02% (V/V) of the extract recording an inhibition of 97.30 ± 0.10%. At a concentration of 0.5%(v/v) the extract attained 100 % of inhibition of biofilm formation.

Conclusion: The study for the first reports endophytic bacteria from *Pleurotus giganteus* that showcases efficient antibiofilm activity against *S. aureus*. The study promises the presence of efficient agents that can curb biofilm formation and thus demands further exploratory research to find the candidate molecule.

Keywords: *Pleurotus giganteus,* Mushroom, Endo-symbiotic bacteria, Biofilm, *Staphylococcus aureus.*

02-28

A PATTIE MAKING DEVICE

P Harish Ram[b], Amith S Nair[b], Dev Narayan[b], Rahul Das AH[b], Devika S Nair[b], Anish K John[b], Sanjay HM[a], Gowtham M[a], Easwer HV[a], Prakash Nair[a], Arun Anirudhan[a]

[a]Sree Chitra Tirunal Institute for Medical Sciences and Technology,
[b]Government Engineering College Barton Hill, Thiruvananthapuram, Kerala

Background: Cotton patties, or surgical patties, are used for a variety of applications, especially in neurosurgery. By placing a cotton patty between the brain and the barrier, the absorptive force can be distributed uniformly, removing just the collected fluid and protecting the brain from harm. The cotton patties can also be used in various ways, such as covering the brain with it to prevent direct pressure when using self-retaining retractor. To further accomplish pressure homeostasis, moist patties might be positioned across the field. The surgical patty has one significant drawback, which affects these and numerous other applications. The possibility of developing a gossypioma when losing a patties in the operating field. Adding a suture tail to the remaining portion of the patties would be an easy fix.

Method: The steps involved in manufacturing patties are as follows. 1. A cotton roll is fed into the machine. 2. The length and breadth wise cutting of cotton is carried out. 3. A tail is attached to the patty using a sewing machine. 4. Patties come out of the machine in a rolled form for ease of packing. Motors, rollers, conveyor belts, circular blades and a sewing machine are used for the process.

Results: The patty/cottonoid making device is a machine designed to make neurosurgical patties or cottonoids of different dimensions and dispense them in specific numbers, i.e., a pack of 10 or 20. This machine is intended to be placed in the instrument assembling area/packing area of neurosurgical suite. It is designed to be operated by any personnel who is a working member of the neurosurgery team with the technical competence and knowledge regarding the simple steps to operate this device. The manufacturing process for the device has started.

Conclusions: Manual preparation of patties before / during the surgery is cumbersome, since it is difficult to predict the number and size of the patties used during a procedure. The process of making patties manually during the procedure (tailing them and rounding off to appropriate sizes) diverts the attention of the scrub nurse, attention that is better served by staying with the surgeon and following each surgical step. This machine thus is a much needed solution with unique attributes to enable preparation of patties of different dimensions in adequate numbers

Keywords: Cotton pattie, Neurosurgery

02-29

EFFECT OF ANTIBIOTIC-INDUCED DYSBIOSIS ON MATERNAL AND OFFSPRING WELL-BEING AND HEALTH

Rishikesh[1], Krishnapriya[1], Dayamrita K K[1], Dr Unnikrishnanan Sivan [2], Dr Baby Chakrapani P S[1]

Centre for Neuroscience, Department of Biotechnology - CUSAT[1], Department of Microbiology - KUFOS[2]

Introduction: Dysbiosis is any adverse alteration in microbial communities. With dysbiosis, there is an alteration in the microbial metabolic output. Also, the gut and brain are connected through the Gut-Brain-Microbiota Axis. which is a bidirectional communication link in which microbiota plays a crucial role. Dysbiosis during pregnancy may affect the foetal developmental trajectory. Which is a relatively underexplored field.

Materials and methods: The female C57BL/6 were administered with an antibiotic cocktail followed by a faecal parameter assessment. The following parameters were assessed faecal pellet size, pellet number and water content in the pellets. Also, the change in the body weight of the test vs control vs noted.

Results and Discussions: All these assessments show that despite there being no significant difference between the test and control groups the trend is pointing towards a different picture.

Keywords: Dysbiosis, intestinal comorbidities, pregnancy

03-CHEMICAL SCIENCES

ORAL PRESENTATION

03-01

A NOVEL AGGREGATION-INDUCED EMISSIVE BIOPROBE FOR ANTICANCER AND ANTICOVID STUDIES

K. K. Mohammed Hashim and E. Manoj

Department of Applied Chemistry, Cochin University of Science and Technology, Kochi, Kerala 682 022, India

Background: The invention of new luminescent materials has been of significant interest, and a lot of fluorescent bioprobes have been designed and developed for fluorescence imaging and made remarkable impacts on the biological researchers. Its applications range from improved bioimaging to the development of innovative biosensors and the deeper exploration of biomolecular interactions. AIEE luminogen's with exceptional biomolecular binding capabilities offers a range of exciting possibilities for anticancer and anticovid application studies.

Method: Synthesize a novel 1,3-diaminoguanidine based AIE luminogen, and characterized by single crystal X-ray diffraction (SCXRD), MALDI-TOF MS, ^{1}H-NMR, ^{13}C-NMR, IR and UV-visible spectroscopic techniques.

Results: We report a novel and bioactive multidentate luminogen proligand 1,3-bis(2-hydroxy-3,5-diiodophenyl-methylideneamino)guanidine (H_5L) with aggregation-induced emission enhancement (AIEE) properties, which is a suitable candidate for biomedical applications. The emission features of the compound in solution and solid states are found impressive with AIEE characteristics and is attributed to restricted intramolecular rotation, which is confirmed through fluorescence lifetime decay studies. Strong interaction of the compound with calf thymus DNA was explored experimentally and found to align with *in silico* molecular docking results. *In vitro* anticancer assessment on MCF-7 human breast cancer cells show better activity and signifying its potent cytotoxic properties. H_5L demonstrated putative binding to the SARS-CoV-2 protein with remarkable binding energy, suggesting its utility as a bioprobe for related biological processes.

Conclusion: Given the critical role of luminescent bioprobes in enhancing detection sensitivity in nucleic acid and immunological assays, this novel aminoguanidine-derived luminogen would open up exciting possibilities for monitoring and studying the apoptotic mechanisms of either breast cancer or SARS-CoV-2 and associated biological phenomena.

Keywords: Aminoguanidine, X-ray diffraction, Aggregation-induced emission enhancement (AIEE), anticancer, DNA, SARS-CoV-2.

03-02

GREEN PREPARATION OF CO_3O_4/GRAPHENE NANOCOMPOSITE FOR ELECTROCATALYTIC OXYGEN REDUCTION REACTION

Haritha Valiyaveettil Padi, Suvarna K Subrahmanian, Kavya Vadakkumpurath palliyal, and Binitha N Narayanan

Department of Chemistry, University of Calicut, Thenhipalam, Malappuram, 673635, Kerala, India

Background: Metal air batteries and fuel cells are green alternatives energy options with zero emission as the by-product is water. The electrochemical, cathodic oxygen reduction reaction (ORR), uses commercial Pt/C electrodes having least methanol tolerance; frequent side reactions limit their efficiency, and lowers the cycling life. Thus, developing a better alternative cost-effective cathode material for ORR is highly is essential.

Method: Here, ball mill exfoliation of graphite with sucrose and the hydrothermal treatment of the obtained graphene dispersion with cobalt precursor resulted in Co_3O_4/graphene nanocomposite. ORR performance of the Co_3O_4/graphene electrocatalyst was investigated by CV and LSV in CHI-760E Electrochemical Analyser (CH Instruments, USA). Methanol tolerance was also studied.

Results: Structural investigations revealed the formation of Co_3O_4/graphene. It showed good ORR performance with a reduction peak around 0.45 V and onset potential of 0.74 V (vs RHE), indicative of a good-performance ORR electrocatalyst. The The number of electrons was calculated as 3.92, indicating a four-electron transfer process.

Conclusions: Eco-friendly prepared Co_3O_4/graphene showed a high ORR activity relevant to its applications as cathode material in fuel cells and metal-air batteries. Also, in contrary to Pt/C, Co_3O_4/graphene exhibited good methanol tolerance.

Keywords: Co_3O_4/graphene, green preparation, oxygen reduction reaction, electrocatalyst, methanol tolerance.

03-03

RED EMITTING BIMETALLIC AU/AG NANOCLUSTERS STABILISED BY LYSOZYME FOR THE NANOMOLAR DETERMINATION OF HEMIN

Keerthi Kodakat and K. Girish Kumar

Department of Applied Chemistry, Cochin University of Science and Technology, CUSAT, Kochi-682022, Kerala, India

Background: Recently, more attractive advantages have been reported for Au-Ag bimetallic nanoclusters over their monometallic counterparts. The combined effect of both metallic nanoclusters is expected to provide greater stability, dispersibility and better opto-electronic properties.

Method: The present study discusses the development of a highly sensitive and selective turn-off fluorescence sensor for hemin, an important component of many physiological processes in human body, based on red-emitting Au and Ag bimetallic nanoclusters using lysozyme as the stabilizing agent (Lys-AuAgNCs).

Results: The bimetallic nanoclusters, Lys-AuAgNCs, were successfully synthesised via a one-pot method at room temperature. It exhibited bright red fluorescence at 605 nm when excited at a wavelength of 335 nm. The nanocluster was successfully characterized using TEM, UV-Vis, EDX and fluorescence spectroscopic techniques. Under the optimized analytical conditions, the quenching of fluorescence of Lys-AuAgNCs by hemin was linear in the concentration range from 9.00×10^{-7} M to 5.00×10^{-8} M with a detection limit of 2.00×10^{-9} M. The mechanism behind the sensing was found to have contributions from electrostatic, static and dynamic interactions. The practical utility of the sensor was further verified in synthetic physiological fluids.

Conclusion: This work establishes the applicability of a bright red-emitting bimetallic Au-Ag nanocluster protected by lysozyme for the highly sensitive and selective determination of hemin.

Keywords: Bimetallic nanocluster, Hemin, Fluorescence sensor, Lysozyme

03-04

DIASTEREOSELECTIVE SYNTHESIS OF FUSED TRICYCLIC PYRIDOPYRIMIDINES *VIA* TANDEM CYCLIZATION OF ALLENOATES AND CYCLIC AMIDINES

Athira C. S,[a, b] Basavaraja D,[a, b] Siddalingeshwar V. D,[a, b] Aiswarya Siby,[a] Praveen Kumar V [a, b] and Sasidhar B. Somappa *[a, b]

[a]Chemical Sciences & Technology Division, CSIR-National Institute for Interdisciplinary Science & Technology (NIIST), Thiruvananthapuram-695019, Kerala, India.
[b]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India.

Background: Bicyclic amidines, DBN (1,5-diazabicyclo[4.3.0]non-5-ene) and DBU (1,8-diazabicyclo[5.4.0]undec-7-ene), which are "non-nucleophilic strong bases", are widely used in organic synthesis. Though often considered as hindered and non-nucleophilic strong bases, they nonetheless uphold nucleophilic behaviour which mediate organic reactions and may lead to the formation of compounds containing DBU and DBN scaffolds. So far, significant efforts have been devoted to the development of synthetic strategies which demonstrate the nucleophilic properties of these amidines. Among these, the synthesis of fused tricyclic pyridopyrimidines is currently attracting attention.

Method: Herein we report a 100% atom economic unprecedented novel annulation principle of allenoates and cyclic amidines that leads directly to the formation of pyridopyrimidines fused with functionalized heterocyclic systems; octahydro-6*H*,10*H*-pyrido[2',1':2,3]pyrimido[1,2-*a*] azepine and hexahydro-1*H*,5*H*-pyrido[1,2-*a*]pyrrolo[2,1-*b*]pyrimidine. This approach for the first time exploits the reactivity of DBU and DBN with easily accessible allenoates for the synthesis of tricyclic pyridopyrimidine scaffolds.

Results: The reaction products were obtained within a minute, at room temperature, under neat conditions, averting aqueous workup, which meets the sustainability in organic synthesis (35 examples, 32 – 85% yields). We have also demonstrated the synthetic utility of the protocol by performing late-stage diversification of the obtained pyridopyrimidines into new molecular hybrids of pharmaceutical relevance.

Conclusions: In summary, an unprecedented 100% atom economic annulation of allenoates with cyclic amidines has been achieved for the synthesis of functionalized tricyclic pyridopyrimidine scaffolds. High reaction efficiency, ease of operation, very short time, mild and solvent-free reaction conditions, with wide substrate scope are the key advantages of the present annulation protocol.

Keywords: Pyridopyrimidines, allenoates, cyclic amidines

03-05

SURFACE PASSIVATION AIDED TURN-ON FLUORESCENCE SENSOR FOR INTESTINAL CARCINOID BIOMARKER, 5-HYDROXYINDOLE ACETIC ACID BASED ON BIOMOLECULE STABILIZED GOLD NANOCLUSTERS

Amoolya Chandran, K. Girish Kumar*

**Department of Applied Chemistry, Cochin University of Science and Technology, Kochi, Kerala, India -682022 *giri@cusat.ac.in*

Back ground: 5-Hydroxyindoleacetic acid (5-HIAA), which is a prominent metabolite of the neurotransmitter serotonin, is a recognised biomarker for many fatal disease conditions. Upsurged concentration of urinary 5-HIAA can be observed due to intestinal carcinoids, cystic fibrosis, and autism. Declined concentration of 5-HIAA is noticed in case of obsessive-compulsive disorder, sepiapterin reductase deficiency, and multiple sclerosis. Thus, the periodic monitoring of 5-HIAA is necessary for the early detection of these diseases.

Method: Customisation of fluorescence metal nanoclusters (MNCs) for acquiring desired properties can provide a strong basis for the novel researches in material chemistry. Enzyme protected gold nanoclusters- based fluorescence turn on sensor has been effectively employed for the selective and nanomolar determination of 5-HIAA.

Result: Enzyme mediated gold nanoclusters were successfully synthesised via facile, one-pot synthesis method without the addition of any other reducing agents. It has been characterised using Fluorescence spectroscopy, EDX, TEM, DLS, Zeta potential, UV-visible, FTIR, XRD and XPS techniques. Enhancement in fluorescence intensity was observed by the incremental addition of 5-HIAA into a fixed volume of the probe. Wide linear range with low limit of detection is obtained for 5-HIAA. Surface passivation of the nanoclusters in the presence of analyte is found to the reason behind fluorescence enhancement of the fluorophore.

Conclusion: A simple and sensitive turn-on fluorescence sensor was developed using enzyme capped gold nanoclusters for 5-HIAA. Under the optimised experimental conditions, nanomolar detection of the analyte was achieved and the sensing mechanism was observed to be passivation of surface states of MNCs through the amine group of 5-HIAA. The selectivity offered by the sensor was also investigated and the application studies were conducted in synthetic physiological fluids by spike recovery analysis.

Keywords: Gold nanoclusters, 5-Hydroxyindoleacetic acid, Limit of detection

03-06

ORTHOGONAL SPIROBORATE ESTERS DERIVED FROM NATURALLY OCCURING ALPHA-MANGOSTIN: SYNTHESIS, PHOTOPHYSICAL STUDIES AND ANION RESPONSIVE BEHAVIOUR

U.S. Swathy, C. L. Lekshmi, H. Simimole and S. Sumalekshmy

Post Graduate and Research Department of Chemistry, T.K.M. College of Arts and Science, Kollam

Background: Highly emissive organic conjugated molecules have become a focused area for research nowadays because of their potential applications in organic light emitting diodes, sensors, and so on. Recently, it has been substantiated that embodiment of boron into organic conjugated frameworks offer considerable promise for the development of new functional materials with phenomenal properties. α-mangostin (MN), a natural xanthonoid, derived from mangosteen fruit is characterized by the presence of a β-keto-enol moiety. Taking advantage of the presence of O, O-donor ligands, we reengineered the keto-enol skeleton of α-mangostin into a spiro borate complex (MBO) there by developing a platform suitable for biological and optoelectronic applications.

Methods: α-mangostin was isolated from pericarp of mangosteen fruit and purified by column chromatography. MBO was synthesized from α-mangostin and characterized.

Results: MBO was characterized using various spectroscopic techniques. The complex exhibited orthogonal arrangement, good thermal stability, remarkable optical properties and showed selective response towards anions.

Conclusion: The present study employs a one step and facile approach for the synthesis of spiro borate complex of α-mangostin. The complex could be employed as a suitable platform for the detection of anions.

Keywords: α-mangostin, spiro borate, orthogonal, anions

03-07

SILICON DIOXIDE CAPPED ZINC OXIDE QUANTUM DOTS EMBEDDED NON-ISOCYANATE POLYURETHANE SMART COATINGS INTERCALATED WITH ZINC OXIDE NANORODS FOR UNDERWATER ACOUSTICS

Deepthi Anna David[a], P. M. Sabura Begum[a,*], Prasanth Raghavan[b,c,d,*]

[a]*Department of Applied Chemistry, Cochin University of Science and Technology (CUSAT), Kerala, India-682022*

[b]*Materials science and NanoEngineering Lab, Department of Polymer Science and Rubber Technology, Cochin University of Science and Technology (CUSAT), Kerala, India-682022*

[c]*Scotland's Rural College (SRUC), Edinburgh EH9 3G, UK*

[d]*Department of Materials Engineering and Convergence Technology, Gyeongsang National University 501 Jinju-daero, Jinju 52828, Republic of Korea*

**Corresponding authors:* prasanth@cusat.ac.in *Orcid Id: 0000-0002-9888-665X (Prasanth Raghavan),* pmsabura@cusat.ac.in *(P. M. Sabura Begum)*

Background: Polyurethanes (PU) with its excellent strength-to-weight ratio, improved elasticity,

flexibility, toughness, insulation properties, and durability, serves the plethora of versatile smart coating applications. Nonetheless, the toxicity of the isocyanate-based PU is to be concerned. Phosgene-based commercial synthesis of PU as well as the toxic reaction of isocyanate (-N=C=O) group in PU with the functional groups (-OH, -COOH, $-NH_2$) present in the living organism limits the application of PU. As an effective alternative, silicon dioxide capped zinc oxide quantum dots (ZSQ) embedded zinc oxide nanorods (ZNR)/NIPU nanocomposites (ZSQ/ZNR/NIPU) were developed by isocyanate and phosgene free method. The nanocomposites are studied for sound damping property for underwater acoustic applications.

Method: ZNR and ZSQ were synthesised from zinc nitrate hexahydrate and zinc acetate dihydrate, respectively. NIPU were synthesised by *transurethane reaction using dimethyl carbonate, polyol and amine as precursors.* The structural and morphological properties were done using Fourier-Transform Infrared Spectroscopy (FTIR), Attenuated Total Reflection (ATR), Raman Spectra, UV-Vis- Spectra, XRD-Pattern, Matrix Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry (MALDI-TOF MS), Field Emission Scanning Electron Microscope (FE-SEM), and Transmission Electron Microscopy (TEM). Mechanical properties of the developed nanocomposites were done using Universal Testing Machine (UTM). Thermals studies were done using Thermogravimetric analysis (TGA). The sound damping property were primarily studied using Dynamic Mechanical Analysis (DMA).

Results: The synthesised ZNR is having typical hexagonal wurtzite structure which was confirmed from FE-SEM, and XRD. The synthesised ZSQ is having <10 nm size which was confirmed from TEM. Characterisations done on ZSQ/ZNR/NIPU nanocomposites shows excellent mechanical and thermal properties compared to commercial polyurethanes along with enhanced hydrophobicity. Also, ZSQ/ZNR/NIPU shows excellent sound damping property and thus can be used for underwater acoustic applications.

Conclusion: Novel multifunctional acoustically transparent ZSQ/ZNR/NIPU nanocomposite were developed and studied for the sound damping property. The developed nanocomposite shows excellent damping property and thus can be used for underwater acoustic applications.

Keywords: Non-Isocyanate Polyurethane; Zinc Oxide Nanorods; Silicone Dioxide, Quantum Dots, Smart Coatings, Underwater Acoustics

03-08

ELECTRICAL AND CHARGE TRANSFER CAPABILITIES OF ANTHRAQUINONES AS P TYPE ORGANIC SEMICONDUCTORS

Neenu Krishna P.U., Muraleedharan K.*

Department of Chemistry, University of Calicut, Malappuram, 673635, India
*kmuralika@gmail.com

Context: Organic semiconductors (OSCs) had a great deal of interest in recent days. OSCs include various types, among which the small molecules have various inherent benefits. Since the area is in its developing age, a deeper understanding is preferable for developing this new class. The recent focus is on creating naturally occurring small molecules for OSCs. OSCs with nonlinear optical (NLO) characteristics offer a significant advantage. Thus, this study theoretically investigates

naturally occurring anthraquinones like Chrysophanol and Rhein as potential OSCs, along with their NLO properties. The calculated properties include; reorganization energy(λ), ionization potential (IP), electron affinity (EA), and bandgap (E_g). FMO energy levels together with E_g, IP, and EA suggest the semiconductor nature of the studied compounds. Calculated values of λ_h together with transfer integrals ($V_{h)}$ using simulated crystals suggest the p-type character of both molecules. Rhein possesses the lowest λ_h, $E_{g,}$ and highest $V_{h,}$ predominating for the better p-type character. CDD analysis points to the LE type n-π * excitations. Polarizability values rise due to the presence of an electron-withdrawing substituent, leading to better NLO performance of Rhein which is supported by its lower LUMO and E_g values.

Methods The structures of the studied molecules are optimized with the DFT/B3LYP-GD3/6-31+G(d,p) method using the Gaussian 16 software. The crystal structure is simulated with BIOVIA Materials Studio 7.0 and the transfer integrals are calculated with the ADF package. The calculations in the excited state are carried out using the TD-DFT method. CDD analysis and DOS plots are obtained with the Multiwfn 3.8 program.

Keywords: Organic semiconductors; NLO; CDD; Reorganization energy; Transfer integral

03-09

UNDERSTANDING THE ACTIVITY OF $NI_XCU_{(1-X)}CO_2O_4$ TRIMETALLIC SPINEL CATALYSTS TOWARDS UREA OXIDATION REACTION

Shilpa Santhosh[a], Annie Cleetus[b], Alex Schechter[b], and Nandakumar Kalarikkal[a,c,d]
[a]International and Inter University Centre for Nanoscience and Nanotechnology,

Mahatma Gandhi University, Kottayam 686 560, Kerala, India.
[b]Department of Chemical Sciences, Ariel University, Ariel 40 700, Israel.
[c]School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam 686 560, Kerala, India.
[d]School of Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam 686 560, Kerala, India.

Background: Urea oxidation reaction (UOR) catalysts are extensively studied for direct urea fuel cells (DUFCs), employing simultaneous wastewater treatment and electricity generation strategies. To date, the synergic contribution of trimetallic $Ni_xCu_{(1-x)}Co_2O_4$ catalyst towards UOR has never been reported through fundamental electrochemical analyses.

Method: Herein, we carried out the synthesis of three catalysts: NCC-1 ($Ni_{0.25}Cu_{0.75}Co_2O_4$), NCC-2 ($Ni_{0.50}Cu_{0.50}Co_2O_4$), NCC-3 ($Ni_{0.75}Cu_{0.25}Co_2O_4$) using thermal decomposition technique. Physical characterizations, including ICP-OES, XRF, XRD, UV-vis spectroscopy, SEM, and TEM, were conducted to explain the compositional, structural, optical, and morphological parameters. UOR and stability of the catalysts were studied through CV and CA analysis, respectively.

Results: Among the three catalysts, the NCC-3 catalyst showed a long crystalline order, the lowest optical bandgap, continuous morphology, and higher Ni molar concentration dispersed on a long-range crystalline spinel matrix, which resulted in the highest urea oxidation current. Additionally, the NCC-3 catalyst produced a stable current for about 10 hours, the NCC-2 catalyst for 7 hours, and NCC-1 for 5 hours before dropping to lower or almost zero current.

Conclusions: The NCC-3 catalyst with 25 percent Cu content and 75 percent Ni content showed enhanced urea oxidation activity due to long crystalline order, lower optical bandgap, and highest ECSA, lower UOR onset potential.

Keywords: DUFCs, urea oxidation, spinel catalysts, Cu-based catalysts, nitrate product analysis.

03-10

TAILORING OF CALIX[4]RESORCINARENES FOR EFFICIENT IODINE CAPTURE

Gopika Jagannivasan[a], Suja Haridas[a,b]

[a]*Department of Applied Chemistry, Cochin University of Science and Technology*
[b]*Inter University Centre for Nanomaterials and Devices*

Background: Iodine capture is particularly relevant while contemplating the management of nuclear wastes. Considering the volatile nature of iodine, possible interference with metabolic processes and the exceptionally high lifetime of the radioactive isotopes, there is a high need for development of new adsorbent materials for iodine capture. While porous materials are the most explored adsorbents, nonporous macrocyclics like pillerarenes have been investigated for their iodine sorption. The present study scrutinizes the potential of calix4resorcinarenes as a potential material for iodine capture.

Method: In this work, Calix [4] resorcinarene (C4R) a class of non-porous macro cycles has been synthesized *via* a novel green protocol by using heteropolyacid vanadotungstophosphoric acid (HPVW) as the catalyst. The synthesized derivatives are screened for iodine capture capability. The adsorption is conducted at elevated temperatures to mimic the conditions tenable at nuclear power plants.

Results: Heteropolyacid synthesized and used for one-pot synthesis of C4Rs. Various C4R derivatives have been synthesized and characterized through several spectroscopic techniques like NMR, MALDI and FT IR. The nitrogen-rich C4R exhibited notable iodine sorption. The presence of adsorbed iodine was confirmed by PXRD, Raman spectroscopy, FTIR and UV DRS. Gradual release of iodine in hexane solvent was also scanned.

Conclusion: In conclusion, a series of C4Rs were synthesized by in a near solventless manner employing HPVW as the catalyst. A comparative study of the iodine adsorption capability of synthesized C4Rs was screened under elevated temperatures. While halogen-substituted C4Rs gave negligible adsorption, nitrogen-rich C4R (DEAS) gave surprisingly high adsorption of 5.22 g/g which is higher than most reported systems.

Keywords: Heteropolyacids, Calix[4]resorcinarene, iodine capture.

03-11

ECO-FRIENDLY PREPARATION OF FUNCTIONALISED GRAPHENE - CARBON SPHERE NANOCOMPOSITES FOR CHROMIUM ADSORPTION

Suchitra Vattapparambil Chandran[1], Sowmya Balasubramanyan[2] and Binitha N N[1*]

1Department of Chemistry, University of Calicut, Calicut University (PO), Thenhipalam, Malappuram (DT), Kerala - 673635, India

[2]Department of Chemistry, Sree Neelakanta Government Sanskrit College (Affiliated to University of Calicut) Pattambi, Palakkad, Kerala -679306, India

Background: With the rapid development of industry, heavy metals have become a serious threat to public health and the ecosystem, causing a variety of diseases. Their bioaccumulation and high toxicity, even at very low concentrations are dangerous [1]. As a result, heavy metal removal has drawn more attention of researchers. Adsorption is the easiest and most successful method for the removal of them. Apart from traditional adsorbents like clays, metal oxides, activated carbon etc., highly efficient hybrid carbonaceous nanomaterials are used now to achieve improved performance [2].

Method: The aqueous dispersion of a ball-milled graphene-sugar mixture was stirred with ammonium persulphate (APS), and treated hydrothermally to produce functionalized graphene-carbon sphere (FGCS). The morphology and the structure of the prepared materials were identified through various analytical techniques; FGCS was used as effective adsorbent for the removal of Cr(VI).

Results: XRD patterns indicated amorphous nature of carbon sphere and the functionalization of graphene, and TEM images revealed the layered morphology of graphene decorated with carbon sphere. Surface morphology and distribution of functional groups containing N, O and S are clear from the FESEM images and elemental mapping respectively. XPS studies confirmed the presence of N, O and S as well as their nature. Among the FGCSs, the one prepared with a high ratio of APS showed the highest surface area and adsorption efficiency.

Conclusions: An eco-friendly method for the preparation of FGCS is developed, which is highly effective in removing Cr(VI) ions from aqueous solution suggesting its extended use to treat industrial effluents with Cr(VI) ions.

Keywords: Green preparation method, graphene-carbon, functionalization, Cr(VI) adsorption

03-12

NON-SULFATED STEROIDAL GLYCOSIDES CISTOINDOSIDES A-B FROM MARINE OCTOPUS *CISTOPUS INDICUS* ATTENUATE PRO-INFLAMMATORY LIPOXYGENASE

Silpa Kunnappilly Paulose[1,2]* Kajal Chakraborty[1]

[1]Marine Biotechnology Fish Nutrition and Health Division, Central Marine Fisheries Research Institute, Ernakulam North P.O., P.B. No. 1603, Cochin-682018, Kerala, India

[2]Department of Chemistry, Mangalore University, Mangalagangothri, Karnataka, India

Background: Steroidal glycosides form a significant chemical class of natural products from marine

invertebrates by reason of their exceptional structural diversities and varied biological potentials. Cephalopod mollusc has been acknowledged as high-value nutritional food source and culinary delicacies, especially in the Asian countries attributable to high economic value. The biochemical examination of an economically important seafood marine octopus, *Cistopus indicus* (family Octopodidae) resulted in two non-sulfated steroidal glycosides, cistoindosides A-B.

Method: Bioactivity-directed chromatographic fractionation of ethyl acetate:methanol extract of *C. indicus* afforded two non-sulfated steroidal glycosides, cistoindosides A and B analogs. Isolated metabolites were subjected to free radical scavenging and pro-inflammatory enzymes cyclooxygenase and lipoxygenase inhibition assays using *in vitro* models. Structure-activity relationship studies were performed with molecular descriptors, hydrophobic, electronic, and steric descriptors. *In silico* molecular modeling analyses against lipoxygenase were performed to evaluate attenuation potential and drug target interaction in the active site of the enzyme.

Results: Among the two isolated steroidal glycosides, the bioactivities of cistoindoside B were observed to be noticeably greater as compared to cistoindoside A. Cistoindoside B displayed considerably superior ABTS/DPPH radical quenching activities (IC_{50} 1.0–1.4 mM) as well as attenuating the pro-inflammatory enzymes COX-2 and 5-LOX (IC_{50} 2.0-3.0 μM) when compared to cistoindoside A and standard anti-inflammatory drug zilueton (IC_{50} 3.76 μM). Perceptibly, the greater (>1) selectivity index (anti-COX-1/anti-COX-2) of cistoindosides A-B than the commercial drug diclofenac (0.96) also corroborates to their promising anti-inflammatory properties. Promising anti-oxidant property for cistoindoside B could possibly substantiate its attenuation potential against pro-inflammatory enzymes COX-1/2 and 5-LOX causing inflammatory disorders. Sizeable greater electronic properties, balanced hydrophobic-lipophilic properties (log P_{OW} 4.0) and lower steric factors were corroborated to their bioactivities. Molecular simulation studies with of 5-lipoxygenase displaying lesser binding energies and inhibition constant (K*i*) with positive drug-likeness score (0.95) of cistoindoside B could be correlated with anti-inflammatory properties.

Conclusion: The study demonstrated that the previously undescribed non-sulfated steroidal glycoside derivatives, cistoindosides A-B, isolated from an economically important marine octopus, *Cistopus indicus* could be developed as a promising therapeutic lead against inflammatory diseases.

Keywords: Marine octopus; *Cistopus indicus*; steroidal glycosides; cistoindosides A-B; cyclooxygenase; lipoxygenase

03-13

A THEORETICAL STUDY ON THE EVALUATION OF ANTICANCER AND ANTIOXIDANT PROPERTIES OF TRANILAST

Sumayya P.C., Muraleedharan K.*

Department of Chemistry, University of Calicut, Malappuram, 673635, India, kmuralika@gmail.com

Background: Tranilast or N-[3' ,4' -dimethoxycinnamoyl]-anthranilic acid) is an analog of tryptophan mainly used as an antiallergic agent with limited side effects. Since compound possesses the structural similarity with the natural product Avenamthramides, the electronic features and protein- ligand interactions were studied.

Method: The Geometry optimisation of the compound was carried out. Using the energy minimised

structure, the chemical reactivity parameters was calculated. The protein structure with desirable property with the molecule was identified with inverse docking. Then the molecular docking studies were calculated

Results: The compound exhibits potent antioxidant activity with reference to standard molecule quercetin. From the targets, the Serine/threonine-protein kinase 6 (PDB ID: 1MQ4) was selected as a better target for anticancer activity as revealed by the molecular docking studies.

Conclusion: The work establishes the anticancer property and which was analysed using computational tools and docking studies.

Keywords: Tranilast, Multi-targeted bioactivity, Antioxidant activity, Anticancer properties, Inverse docking.

03-14

ADVANCED ELECTROSPUN POLYMER NANOFIBERS: A TOOL FOR POLLUTION FREE ENVIRONMENT

Princy Philip[1], Tomlal Jose E.[2]

[1]*Department of Chemistry, St. Thomas College, Pala, Kottayam, Kerala, India*
[2]*Department of Chemistry, SB College, Changanassery, Kottayam, Kerala, India*

Background: Preparation of three types of PMMA nanofibers with different architectures like pure, surface roughened and coaxial hollow forms through electrospinning of very rare combination of PEO – PMMA nanofibers are dealt here. Adsorption properties of synthetic materials are not that much reported. Adsorption properties of synthetic PMMA nanofibers are dealt here. Productive use of human resources leads to better and safe economic developments of the society. A healthy environment only can lead to healthy human resources. To make the environment healthy, it should be pollution free. To make the environment pollution free, electrospun polymer nanofibers can play a leading role.

Method: Pure PMMA nanofibers are prepared by dissolving PMMA in mixture of chloroform and acetone, followed by electrospinning. Surface roughened PMMA nanofibers and coaxial hollow PMMA nanofibers are prepared by selective dissolution of PEO from PEO–PMMA blend and coaxial electrospun nanofibers. Structural modification and advanced structural and optical properties of PMMA nanofibers with different architectures are proved by FESEM, TEM, FTIR etc. Adsorption properties of three types of PMMA nanofibers to dyes are carried out by isotherm studies and spectroscopically.

Results: Pure PMMA nanofibers are 60-150 nm, PEO – PMMA blend nanofibers are 75-150 nm and PEO – PMMA coaxial nanofibers are 110 nm in diameters. All the three types of PMMA nanofibers show adsorption properties to an extent since they are porous in nature. Structurally modified PMMA nanofibers are found to be better adsorbents than pure PMMA nanofibers for various water pollutants.

Conclusion: Superiority of structurally modified PMMA nanofibers opens the door to replace pure PMMA with structurally modified PMMA which enhances the applications of PMMA nanofibers in various fields. The work also lights the way to explore the possibilities of electrospinning to prepare

synthetic adsorbents and to further improve their properties. PVDF-PMMA system is already using for water purification. Here the PMMA can be replace by applying structurally modified PMMA in the place of pure PMMA which will enhance their adsorption.

Keywords: PMMA, Nanofiber, Polymer, Structural Modification, adsorption

03-15

ANTICANCER AND ANTIBACTERIAL STUDIES OF NITROGEN RICH PROLIGANDS AND POLYMORPHISM

M. Sooraj, M. J. Krishnapriya and E. Manoj

Department of Applied Chemistry, Cochin University of Science and Technology, Kochi, Kerala 682 022, India

Background: The high toxicity and tolerance associated with targeted anticancer therapies results in the development of new biologically active drug molecules in cancer treatment. Conversely, drug-resistant bacterial infections are becoming more prevalent and endangering our capacity to treat common illnesses. Schiff base derivatives have significant bioactivities with minimal toxicity and recently have significant interest in pharmaceuticals.

Method: The proligands were synthesized by the condensation reaction of 4-pyridine carboxaldehyde with 1,3- diamino guanidine mono hydrochloride or thiocarbohydrazide respectively in acidic medium. Physicochemical methods were employed for characterization, while *in vitro* studies carried out for biological implications.

Results: The synthesized compounds 1,3-bis(pyridin-4-ylmethylideneamino) guanidine hydrochloride (H_3L^1) and 1,5-bis (4-pyridine carboxaldehyde) thiocarbohydrazone (H_2L^2) are characterized by spectroscopic methods and the polymorphism of H_2L^2 are confirmed by the SCXRD method. The intermolecular interactions of polymorphic crystal structures are quantified by Hirshfeld surface analysis and the dominant contacts from H_2L^2. H_2O and H_2L^2. $2H_2O$ are found to be N···H and C···H contacts respectively. Band gaps of both the compounds were examined experimentally and theoretically and ADMET properties are estimated to predict the drug-likeness. The anticancer activity of the compounds against human breast cancer cells (MCF7 cell line) showed increased activity with an increase in concentration. Also, both the compounds are found to exhibit potential antibacterial activity against *S. aureus* (Gram-positive) and *E. coli* (Gram-negative) bacterial species.

Conclusions: The compounds are found to be effective against human breast cancer cells, while their antibacterial activities are promising against *S. aureus* and *E. coli* bacterial strains. The biological implications, drug-likeness, and polymorphism indicate the usefulness of the compounds for drug development.

Keywords: Single crystal X-ray diffraction, Polymorphism, DFT, Anticancer, Antibacterial

03-16

NATURAL PRODUCT-BASED PHARMACOPHORIC DESIGN AND SEMI-SYNTHESIS OF LABDANE CONJUGATES ACTIVE AGAINST MULTI-FACETED INFLAMMATORY TARGETS

Sangeetha Mohan,[a, c] Lekshmy Krishnan,[a] Naveen Vankadari,[d] Jayamurthy Purushothaman,[b, c, *] and Sasidhar B. Somappa[a, c, *]

[a]Chemical Sciences and Technology Division, CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram - 695 019, Kerala, India
[b]Agro Processing and Technology Division, CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram - 695 019, Kerala, India
[c]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201 002, India.
[d]Department of Biochemistry and Pharmacology, Bio21 Institute, The University of Melbourne, VIC 3052, Australia.

Background: Prolonged inflammation leads to the genesis of various inflammatory diseases. Due to the excessive cost and hostile side effects associated with existing therapies for inflammation, there is an unmet medical need to develop new, therapeutically improved and cost-effective drugs to treat inflammation and associated diseases.

Method: We present the rational design and synthesis of novel phytochemical entities (NPCEs) through a linker-based molecular hybridization of aromatic / hetero-aromatic fragments with the labdane dialdehyde, isolated from the rhizomes of *Curcuma amada*. We employed a comprehensive *in-vitro* study assessing its inhibitory effect on COX-2 enzyme and other inflammatory mediators *viz.* NO, TNF-α, IL-6 and IL-1α, in bacterial lipopolysaccharide-stimulated macrophages, as well as *in-silico* molecular modelling studies targeting the inflammation regulator COX-2 enzyme.

Results: Among the synthesized compounds, **5f** exhibited the highest anti-inflammatory potential by inhibiting COX-2 enzyme (IC_{50} 17.67 ± 0.89 μM), with a four-fold increased activity than the standard drug indomethacin (IC_{50} 67.16 ± 0.17 μM). **5f** also significantly reduced the levels of LPS-induced NO, TNF-α, IL-6, and IL-1α. Molecular mechanistic studies revealed that the anti-inflammatory effect of **5f** was associated with the inhibition of NF-κB signalling pathway.

Conclusions: The results suggested that the compound **5f** holds the potential as a novel promising anti-inflammatory agent. The study clearly emphasizes the role of semi-synthetic modifications in the enhancement of the bioactivity of natural products.

Keywords. *Curcuma amada*, labdane-conjugates, TNF-α, IL-6, IL-1α, cytokines, COX-2

03-17

PYRAZOLE APPENDED HETERO-HYBRIDS: BIOISOSTERIC DESIGN, SYNTHESIS AND *IN VITRO* ANTIBACTERIAL EVALUATIONS

Anjali. S[1,2], Sangeetha M[1,2], Nithya. M[1,2], Gopika V. Krishnan[2,3], Sunil Varughese[1,2], B. S. Dileep Kumar[3], Srikantamurthy N[4], Shridevi. D[1,2], Sasidhar. B. Somappa[1,2,*]

[1]Organic Chemistry Section, Chemical Sciences and Technology Division, Council of Scientific and Industrial Research (CSIR)-National Institute for Interdisciplinary Science and Technology (NIIST),

Thiruvananthapuram-695019, India.
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201 002, India.
[3]Agro-Processing and Technology Division, Council of Scientific and Industrial Research (CSIR)-National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram-695019, India.
[4]Department of Chemistry, Vidyavardhaka College of Engineering, Visvesvaraya Technological University, Mysore-570 002, Karnataka, India.

Background: The need for novel antibiotics is primarily driven by the emergence of super resistant bacterial strains, such as MRSA, VRE, CRE, etc., that are resistant to conventional antibiotics. The development of novel antimicrobials that can effectively combat antimicrobial resistance is a challenge faced by the scientific community.

Method: In the present investigation, we adopted bioisosteric based design and synthesis of pyrazole appended "New Molecular Hybrids" to develop antibacterial agents that are efficient against multidrug resistant bacteria. Following SAR studies of the compounds' effectiveness through docking studies, we conducted an *in vitro* antibacterial assessment of novel compounds.

Result: From the zone of inhibition evaluation, most potent compounds were identified and whose MIC values were determined. Among this compound 6c was the most effective, having an MIC of 5 µg/mL.

Conclusion: This work establishes the development of novel hybrids of pyrazole appendages via bioisosteric approach with antibacterial efficacy which can be further utilized for the in-depth pharmacological and mechanistic evaluations.

Keywords: Antimicrobial resistance, Pyrazole, Antibacterial, SAR studies.

03-18

FUNCTIONALIZED COBALT PHTHALOCYANINE AS AN ELECTROCATALYST FOR THE OXIDATION AND DETERMINATION OF SEROTONIN

S. Shamna and R. Leena

Cochin University of Science and Technology, Kochi-682022, Kerala, India

Background: Serotonin, commonly known as 5-hydroxytryptamine, or 5-HT is an important biogenic monoamine neurotransmitter and neuromodulator. It is essential for several physiological functions, such as liver regeneration, sleep regulation etc. Inadequate serotonin levels in the human body may contribute to mental health disorders, while heightened levels have been associated with sudden infant death syndrome (SIDS). Consequently, the evaluation of serotonin is crucial for diagnosing various diseases, making it a central focus for research with biological and pharmacological perspectives.

Method: Cobalt phthalocyanine can act as a good electrocatalyst for the detection of biomolecules, attributed to its highly conjugated structure, remarkable chemical stability and superior electrical conductivity. A glassy carbon electrode (GCE) modified with 8-hydroxyquinoline functionalized cobalt phthalocyanine (CoPcHQ) and poly para toluene sulphonic acid (*p*-PTSA) was fabricated, referred to as CoPcHQ/*p*-PTSA/GCE for the highly sensitive determination of serotonin.

Results: The characterization of the newly developed sensor includes the utilization of FT-IR, FE-

SEM and Electron Impedance Spectroscopy. The study delved into the mechanistic aspects of electro-oxidation process of the analyte through the use of the linear sweep voltammetry technique. The sensor's analytical parameters were fine-tuned, a linear response to serotonin concentration within the range of 2.0×10^{-6} to 9.0×10^{-5} M was obtained, achieving a correlation coefficient of 0.998. The limited of detection (LOD) was calculated to be 4.6×10^{-7} M. The exceptional electrochemical performance of the modified electrode is ascribed due to the synergistic effect of CoPcHQ (reducing the overpotential) and *p*-PTSA (enhancing the peak current). The application study was carried out in artificial blood serum and urine sample.

Conclusions: 8-hydroxyquinoline functionalized cobalt phthalocyanine (CoPcHQ) composite with poly-para toluene sulphonic acid (*p*-PTSA) fabricated glassy carbon electrode (CoPcHQ/*p*-PTSA/GCE) is used for the oxidation and sensitive electrochemical determination of serotonin.

Keywords: Phthalocyanine, Electrocatalyst, Oxidation, Serotonin, Limit of detection

03-19

IMPROVED STABILITY OF CSPBBR$_3$ PEROVSKITE QUANTUM DOTS ASSEMBLED WITH SULFONIC ACID FUNCTIONALIZED SBA-15

Athira M P[a] and Suja Haridas[a,b]

[a] *Department of Applied Chemistry, Cochin University of Science and Technology, Kochi, Kerala, India.*
[b] *Inter-University Centre for Nanomaterials and Devices, Cochin University of Science and Technology, Kochi, Kerala, India*
sujaharidas@cusat.ac.in

Background: All-metal halide perovskite quantum dots (QDs) hold significant promise across various applications due to their exceptional optoelectronic properties. The intense research interest in metal halide perovskite nanostructures is driven by their outstanding optical characteristics, including narrow emission spectra, high photoluminescence quantum yield (PLQY), and tunable emission wavelengths covering the visible region. Moreover, their cost-effective solution synthesis process enables large-scale production for potential commercial applications. However, the thermal instability of inorganic halide perovskites poses challenges in practical applications, particularly in optoelectronic devices such as solar cells and light-emitting diodes (LEDs). To address this issue, we explore a fundamental approach by incorporating them with the SBA-15 series, named after the University of California, Santa Barbara, with the abbreviation derived from Santa Barbara amorphous. SBA-15 is a mesoporous silica characterized by a fine and controllable pore diameter arrangement. In comparison to older mesoporous silica, SBA-15 features larger pores and thicker walls, resulting in superior thermal, mechanical stability, and chemical resistance properties. This strategic integration aims to enhance the overall stability of inorganic halide perovskites, offering a potential solution to advance their practical applications in diverse optoelectronic devices.

Method: The main synthesis methods, of perovskite quantum dot including the hot-injection method, and the synthesized $CsPbBr_3$ (CPB) perovskite QDs were incorporated with SBA-15, SBA-15 NH_2, SBA-15 SO_3H by slightly modified hot injection method. SBA-15 was synthesized by hydrothermal treatment, SBA-15 NH_2 and SBA-15 SO_3H were synthesized post grafting method. All the synthesized material was characterized by XRD, FTIR and XPS. The absorption and PL spectra of CPB, CPB/SBA-15, CPB/SBA-15 NH_2 and CPB/SBA-15 SO_3H QDs were recorded.

Results: We examined the absorption and photoluminescence spectra of freshly synthesized $CsPbBr_3$ quantum dots (CPB) and those impregnated with SBA-15, NH_2-functionalized SBA-15, and SO_3H-functionalized SBA-15. Both functionalized and bare SBA-15-impregnated CPBs exhibited consistent absorption trends, indicating mesoporous silica support did not induce color changes. Photoluminescence spectra showed no further shifts, confirming the support's non-interference with CPB's optical properties. Structural analyses (TEM, SEM with EDX, PXRD, XPS) verified CPB, and DLS indicated an average size of 19 nm. Impregnation feasibility into thermally stable SBA-15 was supported by CPB size and SBA-15 pore diameter. SBA-15 incorporation enhanced CPB stability, interestingly, SO_3H-functionalized SBA-15 demonstrated superior stability, suggesting potential interactions between the SO_3H group and CPB capping ligands.

Conclusions: In conclusion, the integration of mesoporous silica SBA-15 markedly boosts the stability of CPB perovskite nanomaterials. Particularly, the enhanced performance of SO_3H-functionalized SBA-15 suggests interactions with CPB capping ligands, revealed through analytical techniques. This research sets a foundation for leveraging silica-based mesoporous materials to enhance the stability of various perovskite quantum dots.

Keywords: Perovskite quantum dots, Mesoporous SBA-15, Thermal stability.

03-20

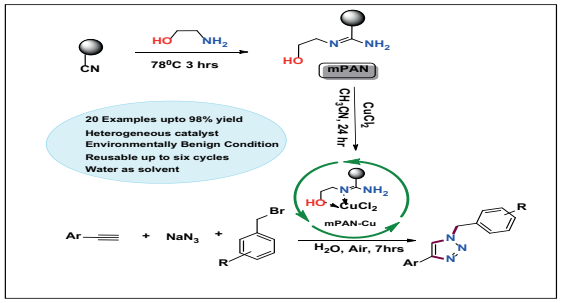
MONOETHANOLAMINE FUNCTIONALIZED POLYACRYLONITRILE SUPPORTED COPPER CATALYST FOR CLICK REACTION IN WATER

Arya Suku [a], Malini Sivan[a], Saithalavi Anas [a]*

[a] *School of Chemical Sciences, Mahatma Gandhi University,Kottayam, Kerala,India-686560*

E-mail: anas@mgu.ac.in

Click reaction; The Nobel Prize winning chemistry in 2022 has emerged as a powerful synthetic tool to functional molecule from modular building blocks under ambient conditions.[1] Classical Click reaction involves the cycloaddition reaction of organic azide with alkyne to generate regioselective product in presence of copper catalyst.[2] Despite tremendous advances in homogenous click reaction, heterogeneous analogues have been developed to overcome the limitations of homogenous catalysis.[2] So the researchers are much interested in designing various supported systems to heterogenize the homogenous condition.[3] Recently our group reported a number of modified PAN supported heterogeneous catalytic system for various organic reactions.[4]



In this work; we have developed a novel monoethanolamine functionalized polyacrylonitrile supported copper catalyst (**m-PAN-Cu**) and investigated the catalytic efficiency of the resulting complex **m-PAN-Cu** through one pot three component reaction of alkyl halide, sodium azide and alkyne in presence of 20 mol% mPAN-Cu in water resulted 1,4-disubstituted 1,2,3-triazole with excellent yields. After detailed optimization reactions, this approach is found to be general over a number of substrates. The catalyst could be reused and recycled up to six cycles without much appreciable loss in catalytic activity. This is the first report on monoethanolamine modified PAN supported copper catalyst towards greener and efficient click reaction.

03-21

PHOSPHINE LIGAND EFFECTS ON MECHANISM OF GOLD(I)-CATALYZED REACTION OF ALKYNE WITH ALKENE: A DFT STUDY

Ramakrishnan Thushara[a,b] and Cherumuttathu H. Suresh[a,b*]

[a]*Chemical Sciences and Technology Division, CSIR- National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram, Kerala, 695019, India*
[b]*Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 201002*
E-mail: sureshch@gmail.com

Background: Catalysis employing gold has emerged as a pivotal research domain with great impact. The use of gold as a catalyst is desirable when a completely new chemical transformation and high reactivity is possible than a less expensive catalyst. Ligands plays a major role in tuning the environment of gold catalysts. An inclusive mechanism for the formation of cyclobutene by gold (I) catalyzed reaction of alkynes with alkenes through ligand effects is proposed on the basis of density functional theory calculations.

Method: The optimization of all the molecules are carried out at the TPSSTPSS/def2TZVP/GD3 level of thoery using Gaussian16 package. Frequency calculations was done using the same level of theory as that of optimization. Molecular electrostatic potential (MESP) was also analyzed and studied.

Results: We are getting a good correlation between E_{act} and the $\Delta_1 Vc$ of the complex in which $\Delta_1 Vc$ can be interpreted as a measure of the electron deficiency of the acetylene triple bond due to the coordination of this ligand with the cationic metal center.

Conclusion: Our theoretical analysis confirms that the electron deficient ligands/electron accepting ligands attached to gold can accelerate the reaction than electron rich ligands/electron donating ligands. The computational studies focusing on the influence of ligands on each stages in the gold catalytic cycle propose new catalytic design strategies for the development of more effective gold catalysis and provides clear guidelines for identifying factors that facilitate the homogeneous gold catalysis.

Keywords: Catalysis, Phosphine ligands, Optimization, MESP, Catalytic cycle

03-22

C-H ACTIVATION OF STYRENE WITH BENZENE USING REUSABLE POLYMER SUPPORTED PALLADIUM CATALYST

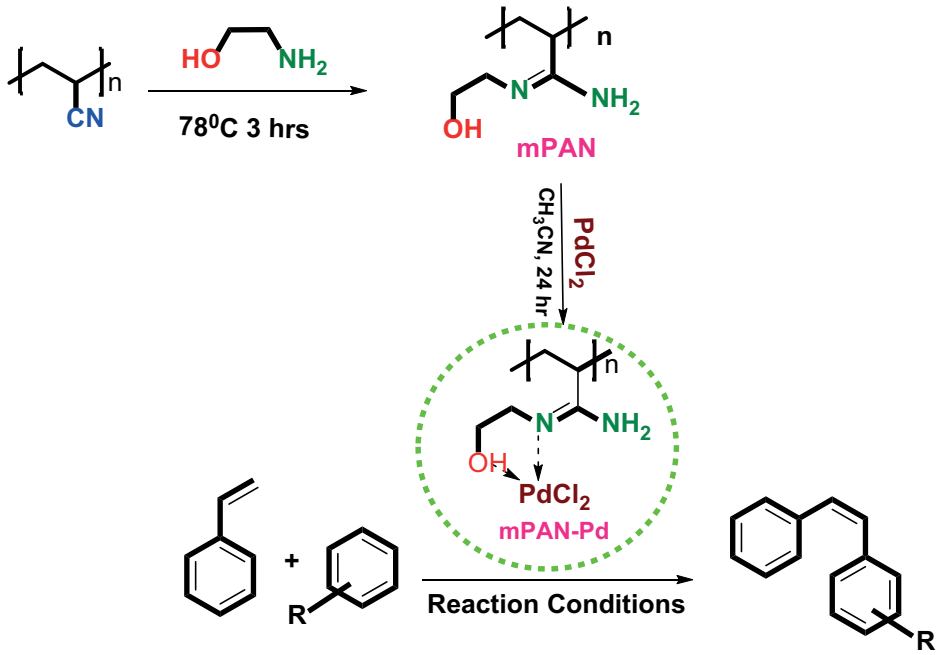
Malini Sivan[a], Arya Suku[a], Saithalavi Anas [a]*

[a] *School of Chemical Sciences, Mahatma Gandhi University,Kottayam, Kerala,India-686560*
E-mail: anas@mgu.ac.in

The direct functionalization of non-activated C-H bonds in organic processes is a desired class of transformations that optimize atom and step-economy and simplify chemical synthesis[1]. In organic chemistry, carbon–hydrogen bond functionalization, sometimes referred to as C−H functionalization, is the process of cleaving a carbon–hydrogen bond and replacing it with a C–X bond (X frequently being carbon, oxygen, or nitrogen). the expression frequently denotes the involvement of a transition metal in the C-H cleavage process. For C-H activation, a wide range of reagents and catalysts have been created, allowing less expensive organic substrate to be transformed into more valuable and versatile products[2,3]. To solve the limitations of homogeneous catalysis, there is currently a great deal of interest in the development of heterogeneous catalyst, notably in organic synthesis[4]. Using transition metal supported by heterogeneous polymers, our group created a novel catalytic system for a variety of organic processes[5].

The current study focuses on creating a new heterogeneous polymer-supported Pd catalyst for the benzene-to-styrene CH activation process[6]. Palladium chloride was immobilized on polyacrylonitrile (PAN) that had been altered with ethanolamine to generate the catalyst[7]. It was also investigated how well the catalyst worked with C-H activation activities. Numerous spectroscopic methods, including FTIR and 1HNMR, were used to confirm the reported product. The reusability of the catalyst, substrate scope studies, and optimization studies were also assessed.

GRAPHICAL ABSTRACT



03-23

A STUDY OF THE DIFFERENT INTERACTIONS EXISTING AMONG IMINE COVALENT ORGANIC FRAMEWORK AND PHENOL USING DFT

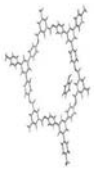
Jisha Mary Thomas[1,2] and Renjith Thomas[1,2*]

[1]*Department of Chemistry, St Berchmans College (Autonomous), Mahatma Gandhi University, Changanassery, Kerala 686101, India*

[2]*Centre for Theoretical and Computational Chemistry, Department of Chemistry, St Berchmans College (Autonomous), Mahatma Gandhi University, Changanassery, Kerala 686101, India*

Phenol and its derivatives are moderately soluble in water and it is found in the wastewaters of many different industries, including the oil and gas, paint, phenolic resin, paper, pulp, and pharmaceutical sectors. The presence of excess phenol concentration in water bodies is toxic to both living beings as well as the environment. Although several treatment options are available, yet a new treatment system has to be engineered which has high selectivity, environmentally benign and is cost effective.1 Hence, we propose the use of different imine based covalent organic framework (COF) for the water treatment and selective interaction with phenol and its derivatives.2,3 In this study, the effect of non-covalent interaction in the imine COF-phenol systems is evaluated particularly the hydrogen bonding interaction using density functional theory in the gas phase. From the optimization results and the binding energy calculated thereafter, it is concluded that interaction in the employed system occurs between the O-H groups on phenol and nitrogen atom in the imine group. These

interactions were concluded to be those of the weak hydrogen bonds by carrying out the reduced gradient approach and atoms in molecule (AIM) analysis, which are basically electron density based topological analyses. The charge localization between the donor-acceptor moieties were analyzed using the natural bond order (NBO) analysis. Using the local energy decomposition (LED) analysis, the binding energy between the imine COF and phenol was partitioned into different energy terms centered on domain-based local pair natural orbital coupled cluster method. Thus, the electronic environment of the different imine COF-phenol systems is evaluated in order to evaluate the factors leading to better selectivity of phenol and their derivatives in wastewater.



03-24

EXPLORING NON-COVALENT BONDING IN METHYL ACETATE COMPLEXES WITH CHLOROFORM AND HEXAFLUOROISOPROPANOL

Sneha Anna Sunny[1, 2] * and Renjith Thomas[1, 2]

[1]*Department of Chemistry, St Berchmans College (Autonomous), Mahatma Gandhi University, Changanssery, Kerala, India*

[2]*Centre for Theoretical and Computational Chemistry, St Berchmans College (Autonomous), Mahatma Gandhi University, Changanssery, Kerala, India*

* snehaannasunny@gmail.com

In this study, we examine the non-covalent interactions in two molecular complexes: Methyl Acetate-Chloroform (MA-CF) and Methyl Acetate-Hexafluoroisopropanol (MA-HFIP). We optimized the structures of both the individual molecules (monomers) and their combined forms (dimers) using the M062X/cc-pVDZ method. We calculated the binding energies of these complexes to understand their stability. Our analysis of the non-covalent interactions, using tools like RDG (Reduced Density Gradient) and QTAIM (Quantum Theory of Atoms in Molecules), shows distinct interaction patterns in the two complexes. Charge distribution within these complexes was examined using FMO (Frontier Molecular Orbital) and NBO (Natural Bond Orbital) analyses. Additionally, we employed the DLPNO-CCSD(T) method for an in-depth energy decomposition of the complexes. Our results indicate that both complexes exhibit significant non-covalent interactions, with the MA-HFIP complex showing stronger interactions compared to the MA-CF complex. Notably, hydrogen bonding plays a crucial role in the MA-HFIP complex, as evidenced by its higher hydrogen bond energy (EHB = -11.30 kcal/mol) compared to that in the MA-CF complex (EHB = -4.40 kcal/mol). The primary contributor to these hydrogen bonds is the oxygen atom in the Methyl Acetate molecule, which interacts with both solvents. The MA-CF complex demonstrates notable van der Waals interactions, as suggested by its RDG plot. The energy decomposition analysis reveals that the overall binding energies of both complexes are attractive, suggesting stable interactions.

This theoretical study highlights the distinct non-covalent interactions in MA-CF and MA-HFIP complexes, particularly emphasizing the stronger interactions and significant hydrogen bonding in the MA-HFIP system.

03-25

THE POSSIBILITY OF TUNING THE CHEMICAL ENHANCEMENT MECHANISM IN SEMICONDUCTOR BASED TERNARY RGO/AG^0/ZNO SERS PLATFORM

Fadeela Chundekatt Ummer[a], Nandakumar Kalarikkal [a, b, c]

a- International and Inter University Centre for Nanoscience and Technology, Mahatma Gandhi University, Kottayam, Kerala, India-686560
b-School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam, Kerala, India, 686560
c-University Centre for Ultrafast Studies, Mahatma Gandhi University, Kottayam, Kerala, India, 686560
Email Id: nkkalarikkal@mgu.ac.in

Background: The two mechanisms contributing to SERS enhancement is electromagnetic mechanism and chemical enhancement mechanism. The electromagnetic mechanism is due to the interaction of incident light with localized surface plasmons. The contribution from electromagnetic enhancement is high compared to chemical enhancement and hence conventional SERS is based on plasmonic metal nanoparticles such as gold and silver. However, we must probe the possibility of increasing the contribution from chemical enhancement as it is due to charge transfer between analyte and substrate as it leads to the development of an economical SERS detection platform for various point of care of detection techniques for sensing of various disease markers and chemicals. This work tries to understand the the signal enhancement possibility to increase the Raman signals by the incorporation of Zinc oxide semiconductor which a very cheap semiconductor.

Method: This work involves the development of a ternary hybrid SERS substrate by incorporating GO, Ag and ZnO. Three ternary hybrids were prepared by keeping same concentration of silver in all of them and increasing the concentration of Zinc oxide. The substrate is then used for SERS studies of Raman reporter molecules such as Rhodamine-6G and 4-mercapto benzoic acid

Results: The results shows that the incorporation Zinc oxide considerably increased the SERS intensity of the analyte molecules. The analysis shows that this is due to the Charge transfer or chemical enhancement contribution from zinc oxide. However, an optimum concentration of analyte is required to harness the chemical enhancement contribution as it depends on the analyte probed.

Conclusions: This work reveals the charge transfer contribution from zinc oxide component towards the SERS intensity. The two analytes show different trends on the three different ternary substrates. This is due to the characteristic chemical nature of the analyte. The findings are important for the development of semiconductor-based substrate for SERS based detection techniques.

Keywords: SERS substrates. reduced graphene oxide. charge transfer enhancement. chemical sensors

03-26

BF3·OET2/H_2O_2 MEDIATED SYNTHESIS OF B- AMINO CHROMENONES AND THIOCHROMENONE ANALOGUES: THE SEARCH FOR NEW ANTIMICROBIALS

Ajay Krishna M S[a,b] and Sasidhar B S*[a,b]

[a]*Organic Chemistry Section, Chemical Sciences and Technology Division, Council of Scientific and Industrial Research (CSIR)-National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram-695019*
[b]*Academy of Scientific and Innovative Research (AcSIR), New Delhi-110001, India*
E mail: ajaykrishnamurali@gmail.com

Background: Homoisoflavonoids like polyphenolic compounds that are found naturally have a broad range of biological functions. The significance of polyphenolic flavonoids has grown due to their potent antioxidant activity and its potential to prevent diseases including cancer, Alzheimer's, Parkinson's, and cardiovascular conditions. The development of synthesis techniques for chromenone and thiochromenone derivatives has garnered significant attention owing to its significance in drug discovery research.

Method: This work explores the novel methodology for the construction of β-Amino chromenone and thiochromenone by utilizing easily accessible starting materials and transition metal free conditions. Also involves investigation of antimicrobial properties of various substituted derivatives.

Results: Various substituted β-Amino chromenone and thiochromenone were synthesized by BF3·OEt2/H_2O_2 mediated condition at room temperature. Derivatives includes electron withdrawing, electron releasing, halogens, and aliphatic chains. Later the derivatives were screened against various Gram positive, Gram negative and fungi.

Conclusion: This is efficient method for the synthesis of substituted β-Amino chromenone and thiochromenone. Some of the derivatives showed moderate to good antimicrobial activity.

Keywords: Homoisoflavonoids, amino chromenes and thiochromenes, antimicrobial agents

03-27

DFT STUDIES ON THE MECHANISM OF CO_2 CAPTURE AND CONVERSION BY NITROGEN-RICH MOLECULES AND MATERIALS

Puthiya Valappil Arathi Krishnan[a,b] and Cherumuttathu H. Suresh[a,b*]

[a]*Chemical Sciences and Technology Division, CSIR- National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram, Kerala, 695019, India*
[b]*Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 201002*
E-mail: sureshch@gmail.com

Background: Luo et al. have developed a new method for CO_2 capture by pyridine-containing anion-functionalized ionic liquids through multiple-site cooperative interactions.

Method: The structure and energetics of the interaction of hydroxy pyridine (**py**), dihydroxy

naphthyridines (**nt**), and trihydroxy pyridonaphthyridines (**pn**), along with their respective anions, with multiple CO_2 molecules have been studied at the M06-2X/6-311++G(d,p) level of density functional theory.

Results: The results showed that neutral systems captured CO_2 and converted it into corresponding carboxylic acids. Specifically, **py** captured one CO_2 molecule, **nt** captured two, and **pn** systems captured three CO_2 molecules, and converting them to mono, di, and tricarboxylic acids, respectively. All the reactions were exergonic in nature.

Conclusions: The analysis of molecular electrostatic potential (MESP) proved to be a valuable tool for assessing the electron-rich sites where CO_2 binds. In the anionic studies, the anions of **py**, dianions of **nt**, and trianions of **pn** systems were employed. Interestingly, the mono and dianions exhibited a similar trend to their neutral counterparts in the capture and conversion of CO_2, but with a shift in the binding site from N to O in the ionic form. However, a distinct behavior was observed in **pn** systems, which tended to adsorb a greater number of CO_2 molecules. Notably, a strong covalent bond formed between the O-C bond during this process. The energetics data of the anion-CO_2 noncovalent complexes revealed that the E_{ad} values of the anions gradually increased with an increasing number of CO_2 molecules. Furthermore, in the presence of a cation, the anions effectively adsorbed the CO_2 molecules, emphasizing the significance of ionic interactions.

Keywords: CO_2, Capture, Conversion, Pyridine, Naphthyridine, Pyridonaphthyridine, DFT

03-28

AROYLHYDRAZONE BASED CU(II) COMPLEXES: SYNTHESIS, SPECTRAL CHARACTERIZATION AND CATALYTIC ACTIVITIES

Lahinakillathu Nishana, Ayyamperumal Sakthivel*, M. R. Prathapachandra Kurup

*Inorganic Materials & Heterogeneous Catalysis Laboratory, Department of Chemistry, School of Physical Sciences, Central University of Kerala, Kasaragod, 671320, India. *sakthiveldu@gmail.com /sakthivelcuk@cukerala.ac.in.*

Background: Aroylhydrazones are an important class of materials making significant contribution in the field of co-ordination chemistry, for example as biologically active molecules, sensors, catalysts, corrosion inhibitors, etc.[1-3] A particular focus is on aroylhydrazone-based metal complexes with O and N donor atoms, which function efficiently as homogeneous catalysts, especially in oxidation reactions. Cinnamyl alcohol, a renewable feedstock for platform chemicals, is used as a model reaction to determine catalyst efficiency to obtain cinnamaldehyde. The study introduces bio-inspired copper metal-bearing tridentate NNO donor aroylhydrazones and further studies emphasize on the use of environmentally friendly and cost-effective copper-containing organometallic complexes for catalytic alcohol oxidation under mild reaction conditions.[3]

Methods: The aroylhydrazone ligands, di-2-pyridyl ketone-4-methoxybenzhydrazone and 2-acetylpyrazine-4-methoxybenzhydrazone were prepared by the condensation of respective carbonyl compounds with the aroyl benzhydrazide. The copper(II) complexes were then synthesized by refluxing the ligand solution with different copper(II) salts. The synthesized compounds are characterized by several spectral methods such as FT-IR, UV-Visible, MS and ^{1}H NMR as well as analytical techniques like CHN, thermal analysis etc. The molecular structures of aroylhydrazones

and one of the copper complexes were resolved using single-crystal X-ray diffraction (XRD) studies. Further the copper(II) complexes were explored for oxidation of cinnamyl alcohol using tert-butyl hydroperoxide (TBHP) as an oxidant. The catalytic reaction progress was monitored using gas chromatography.

Results: A series of copper(II) complexes [Cu(DKMB)Cl] (**1**), [Cu(DKMB)NO_3] (**2**), [Cu(APMBH)Cl_2] (**3**) and [Cu(APMB)NO_3(H_2O)] (**4**) (where DKMBH = di-2-pyridyl ketone-4-methoxybenzhydrazone and APMBH = 2-acetylpyrazine-4-methoxybenzhydrazone) were prepared and systematically characterized. The occurrence of the amido form of the aroylhydrazone in the solid state was confirmed by IR spectroscopy and single-crystal XRD studies. The mass spectral studies and elemental analysis showed the intended composition was formed. The single-crystal X-ray diffraction technique was used to elucidate the structures of aroylhydrazones and copper complex **4**. The copper(II) complexes were then explored for the catalytic oxidation of cinnamyl alcohol using tert-butyl hydroperoxide (TBHP) as an oxidant. Among the complexes, copper(II) complex **1** exhibited superior catalytic activity, achieving a maximum cinnamyl alcohol conversion of 79% with 74% cinnamaldehyde selectivity in acetonitrile as a solvent at 70 °C for 4 hours using TBHP (70% water) as an oxidant.

Conclusion: Bio-inspired copper metal bearing tridentate NNO donor aroylhydrazones were synthesized and structurally characterized. Further we have reported the liquid-phase cinnamyl alcohol oxidation with tert-butylhydroperoxide over synthesized copper(II) complexes in acetonitrile solvent under mild reaction conditions. The reaction followed first-order kinetics with an activation energy of 11.74 kJ mol^{-1}, which is comparable to previously reported values. Our approach primarily centers on a simple way of preparing aroylhydrazone complexes and explores their use as catalysts for the chemoselective oxidation of cinnamyl alcohol.

Keywords: Aroylhydrazones, Alcohol oxidation, Copper(II) complexes, Homogenous catalysis, single crystal XRD.

03-29

IN-SILICO ANALYSIS ON THE SCAVENGING MECHANISM AND TOXICOLOGICAL PROFILE OF NYMPHAEOL C, A FLAVANONE IN MACARANGA TANARIUS

G.S. Gopika Krishnan, P.C. Sumayya, K. Muraleedharan*

Department of Chemistry, University of Calicut, Malappuram 673635, India
**kmuralika@gmail.com; Tel.: +91 494 2407413; Fax: +91 494 2400269*

Abstract: The quantum chemical calculations of Nymphaeol C ($C_{30}H_{36}O_6$) have been carried out using the density functional theory method, M06-2X in the 6-311+G (d, p) basis set. The HOMO, LUMO, molecular electrostatic potential, and physicochemical descriptors of the optimized structure have been evaluated at the same level of theory. Further, this study was designed to evaluate and compare the radical scavenging activity of Nymphaeol C in different solvent media using three potential working mechanisms. The results showed that Nymphaeol C can act as a good antioxidant molecule and it can be better understood by high-ELF localization domain population analysis, atoms in molecules analysis, non-covalent interaction analysis, Fukui analysis, and aromaticity indices evaluated by using the Multiwfn software package. Bond energy is an important concept

to evaluate the potency of chemical bonds. The active antioxidant site in the title compound can be predicted more accurately. The molecule displays good drug-like characteristics, as expected by the examination of absorption, distribution, metabolism, excretion, and toxicity.

Keywords: Nymphaeol C; Density functional theory; DOS; NCI; Antioxidative activity; HELP

03-30

EBHP: AN EFFICIENT OXIDIZING AGENT FOR DIASTEREOSELECTIVE SYNTHESIS OF SPIRO-EPOXY OXINDOLES

Mohan Banyangala,[a,b] Praveen K. Valmiki,[a,b] Sunil Varughese,[a,b] and Sasidhar B. Somappa[a,b,*]

[a] Organic Chemistry Section, Chemical Sciences and Technology Division, CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram-695019, Kerala, India.
[b] Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201 002, India

Background: Spiro-epoxyoxindoles are privileged scaffolds, found in many pharmacologically active synthetic and natural products which exhibit significant biological activities. Even though, the peroxides are the front-line oxidizing agents, with prolonged reaction time, poor diastereoselectivity and use of additives like phase transfer catalyst, the photosensitizer are the drawbacks for industrial application.

Method: In this work we have utilized oxindole chalcones to prepare spiroepoxy oxindoles by using EBHP as oxidising agent. Generality of protocol examined by exploring variety of electron-deficient, electron-rich arylideneindolin-2-ones, heteroarylideneindolin-2-ones and alkylideneindolin-2-ones. All products formed confirmed through ^{1}H NMR, ^{13}C NMR and HRMS data.

Result: A simple and efficient process for transforming oxindole chalcones to the corresponding epoxides by using EBHP at room temperature in excellent yields was developed. 10 molar aqueous solution of NaOH (3 equiv.) was added drop wise to the stirring mixture of oxindole chalcone and EBHP (2 equiv.) in hexane at room temperature afforded the product in a short reaction time.

Conclusion: The protocol proceeds well with a variety of electron-deficient, electron-rich arylideneindolin-2-ones, heteroarylideneindolin-2-ones and alkylideneindolin-2-ones. This procedure enables access of diastereoselective *trans*-spiro-epoxy oxindoles in a very short reaction time.

Keywords: Ethylbenzene hydroperoxide, Diastereoselective synthesis, Spiro-epoxy oxindoles, Metal-free synthesis, Heterocycles.

03-31

ELECTROCHEMICAL BEHAVIOUR OF PROPYL GALLATE AT A MERCAPTOACETIC ACID SELF ASSEMBLED GOLD ELECTRODE

Fathima Muhammed and Leena R.

Department of Applied Chemistry, Cochin University of Science and Technology, Kochi 682022, India

Background: Electrochemical technique is simple and hence it is one of the widely used platforms for the determination of various compounds due to its short response time, simplicity in operation, and possibility of miniaturisation. Determination of the antioxidant Propyl gallate (PG) is important because excess use of these products can result in potential health problems.

Method: Novel SAM based voltammetric sensor has been fabricated via cyclic voltammetry and concentration study was conducted using SWV measurements. Mechanistic aspects were derived using LSV.

Results: Different experimental parameters were optimized. Under the optimized experimental conditions, determination of PG on SAM based GE is possible in a wide linear range with low limit of detection. Selectivity studies were done with co-existing as well as structurally similar species.

Conclusion: A SAM based voltammetric sensor for the determination of antioxidant propyl gallate (PG) has been developed. The credibility and mechanistic aspects behind the processes have been investigated also.

Keywords: Electrochemical sensor, anti-oxidant, self-assembled monolayer, gold electrode

03-32

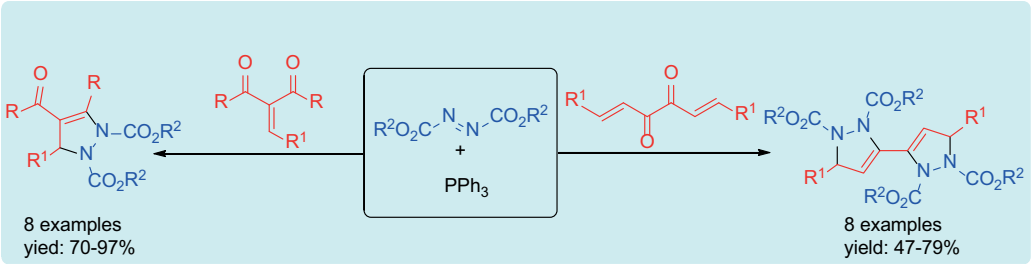
FACILE ENTRY INTO BISPYRAZOLINES AND HIGHLY FUNCTIONALIZED PYRAZOLINES: TUNING THE HUISGEN ZWITTERION.

Department of Chemistry, CMS College Kottayam, Kottayam-686001, India

Background: Carbon-nitrogen bond construction is pivotal to the synthesis of a wide variety of natural and unnatural heterocyclic compounds. In this context, the advent of phosphine-azodicarboxylate zwitterions assumes importance. The zwitterion of this type is popularly known as Huisgen zwitterion. In view with the interesting reactivity patterns towards a wide variety of carbonyl compounds, it was decided to engage cinnamils and 2-alkenyl-1,3-diones with the Huisgen zwitterions.

Method: Cinnamil (1,6-diphenylhexa-1,5-diene-3,4- dione) was treated with ditert- butyl azodicaboxylate (DTAD) and triphenylphosphine in dry toluene at 110 °C for 30 min. The reaction mixture on column chromatography afforded the product, bispyrazoline derivatives. Further the reaction was optimized.

Results: Various cinnamils with electron withdrawing or electron donating substitutions at the 4th position of the phenyl ring, were subjected to react with the DTAD-triphenyl phosphine zwitterion. This synthesis yielded good results across a range of cinnamils and azodicarboxylates. Inspired by the interesting result obtained from the reaction of cinnamil, we have studied the reactivity of 2-alkenyl-1,3-diones with Huisgen zwitterion. The reaction was tested with a series of substituted 2-alkenyl-1,3-diones and dialkyl azodicarboxylates, which afforded highly functionalized pyrazoline derivatives in good to excellent yields. The structure of all the synthesized compounds were established based on spectral data and the final confirmation was obtained by single crystal X-ray analysis.



Conclusions: A series of bipyrazoline derivatives were synthesized by the reaction of Huisgen zwitterions with cinnamils. The reaction with 2-alkenyl-1,3-diones yielded highly functionalised pyrazoline derivatives. It is noteworthy that a wide range of biological activities are attributed to pyrazoline and bipyrazoline derivatives.

Keywords: Zwitterion, Huisgen zwitterion, Cinnamil, Phosphine mediated reaction, Phosphine azdicarboxylate zwitterion, azoesters.

03-33

SYNTHESIS OF CATIONIC POLYACRYLAMIDE BY INVERSE EMULSION POLYMERIZATION AND ITS APPLICATIONS IN FLOCCULATION OF KAOLIN MINERAL

Devika K. S., Suresha P. R., Arun Torris and Manohar V. Badiger

Polymer Science and Engineering Division, CSIR-National Chemical Laboratory, Dr. Homi Bhabha Road, Pune-411008, Maharashtra

Background: Flocculants or clarifying agents are a class of chemicals which cause colloidal destabilization. These flocculants find applications in various industries such as water treatment, mineral recovery, protein recovery form fish meal industry waste water, sugar cane juice clarification and paper manufacturing etc. By addition of flocculants, the finely dispersed particles are aggregated to form large flocs which can be separated easily. The driving force for flocculation arises from bridging and charge neutralization of dispersed particles. Industrial toxic wastes need to be treated with flocculants before leaving them to natural water bodies, such as rivers and streams. Therefore, there is a big demand for the design and synthesis of efficient polymeric flocculants for the above mentioned applications.

Objective and Method: In our laboratory, we have given major focus on synthesizing and characterizing cationic flocculants based on copolymers of acrylamide (AM) and 3-(acrylamido) propyltrimehtylammonium chloride (APTMAC) by inverse emulsion polymerization for mineral separation namely, Kaolin which is used in wide variety of applications.

Results: The obtained polymers were characterized in terms of their chemical composition by IR and NMR spectroscopy. The charge on the copolymer was measured by zeta potential measurements. The flocculation efficiency was investigated by using kaolin suspension with time. The efficiency of flocculation depended largely on the charge and the molecular weight of polymer.

Conclusions: Higher molecular weight and higher charge on the copolymer contributes favourably for efficient flocculation.

Keywords: Flocculation, cationic polyacrylamide, kaolin, inverse emulsion polymerization

03-34

STABILIZATION OF FAUJASITE TYPE SAPO-37 ZEOLITIC MATERIALS BY POST-SYNTHETIC INCORPORATION OF VARIOUS HETERO-ELEMENTS

K Shabana, N P Nimisha, Soumya B. Narendranath **and A. Sakthivel***

Inorganic Materials & Heterogeneous Catalysis Laboratory,
Department of Chemistry, School of Physical Sciences,
Central University of Kerala, Sabarmati Building, Tejaswini Hills, Periya P.O. Kasaragod, 671320 Kerala,
India Email: sakthiveldu@gmail.com / sakthivelcuk@cukerala.ac.in

Background: Zeolites are highly crystalline microporous materials known as potential catalysts and found application in many sustainable processes such as reforming, cracking, isomerization in petrochemical industrials as well as biomass conversion, CO_2 utilization and water purification. In particular, large pore zeolites, viz., ultra-stable rare earth containing Faujasite type Zeolite-Y has been extensively used for the fluidized catalytic cracking processes in petrochemical industries for the production of gasoline. Analogues to Zeolite-Y, the silico-aluminophosphate based materials having moderate acidity, viz., SAPO-37 has similar pore architecture, however, their application is limited due to their poor thermal, hydrothermal and mechanical stability. The calcination of as-prepared materials results in change of structural morphology and or formation of amorphous phase. Thus, it will be interesting to stabilize moderately acidic SAPO-37 materials by the incorporation of hetero-elements (such as Ti, Zr, Al, etc.) by post-synthetic approach..

Method: This work explores the effect of various hetero-elements incorporation by post-synthetic approach on the stability of SAPO-37 framework. Attempts, were made by introduction of several hetero-elements by post-synthetic methods, followed by various treatment such as steaming, alcoholic extraction and two stage calcination for the stabilization of framework of SAPO-37. All the samples were systematically, characterized by Fourier Transform Infra-red spectroscopy, powder X-ray diffraction and thermogravimetric analysis.

Results: From FTIR analysis it is clear that after 500 °C calcination, tetraethylorthosilicate(TEOS) treated sample showed peaks at 533 and 562 cm^{-1} which are characteristics of secondary building units of Faujasite type SAPO-37 building unit. The powder-XRD pattern also support retaining of structure after calcination. The alcoholic extraction is helpful to remove templates partially with retaining the structure.

Conclusion: In this work, attempts were made to stabilize the SAPO-37 structure by post-synthetic approach. The use of TEOS as teathering agent help on stabilize the SAPO-37 framework by the condensation of short-range order framework sites. Further work is in progress to reproduce synthesis and stabilization.

Keywords: SAPO-37, stabilization, hetero-elements, TEOS treatment, Faujasite , tethering.

03-35

SYNTHETIC ROUTES TO NITROGEN-CONTAINING HETEROCYCLES AND THEIR CHARACTERIZATION: BRIDGING PHARMACOLOGICAL AND OPTOELECTRONIC APPLICATIONS VIA COUPLING REACTIONS

C M Athira, Karickal Raman Haridas

School Of Chemical Sciences,Swami Anandatheertha Campus ,Kannur University,Payyannur,Kerala
haridaskr@Kannuruniv.ac.in

Background: Nitrogen-containing heterocycles stand at the forefront of organic chemistry, serving as pivotal molecular architectures with widespread implications in pharmaceutical and biological realms.Recent scientific reports underscore the critical significance of advancing synthetic methodologies for the preparation of nitrogen-containing heterocycles, acknowledging their substantial potential in biological activity and in opto electronic devices.

Method: Coupling reactions have become one of the most attractive and atom economical method for the synthesis of heterocycles.The organic scaffolds were synthesised and the chemical structures of the prepared compound were confirmed by various analytical and spectroscopical techniques and electrochemical studies.

Results: The synthesized products were stable at room temperature. The solubility data were satisfying for further studies.The elemental analysis data obtained are in good agreement with the calculated values and suitable for various pharmaceutical and opto electronic applications.

Conclusion: The synthesised compound is characterized and structures are confirmed.From the obtained data we found that our compound satisfies the requirements for a biologically active precursor material in drug development.

Key words: Nitrogen containing heterocycles,coupling reaction,spectroscopic techniques,opto electronic devices,pharmaceutical application

03-36

FACILE SYNTHESIS OF PYRROLE DERIVATIVES VIA PAAL-KNORR REACTION USING TUNGSTOPHOSHOPRIC ACID INCORPORATED SBA-15-SO_3H AS GREEN CATALYST

Arun R[a] and Suja Haridas[a,b]

[a]*Department of Applied Chemistry, Cochin University of Science and Technology, Kochi, Kerala, India.*
[b]*Inter University Centre for Nanomaterials and Devices*

Background The chemistry of pyrroles has indeed been a subject of significant interest in the field of organic chemistry. Pyrrole is a five-membered aromatic ring containing one nitrogen atom, and it is a key structural motif in various natural products, pharmaceuticals, and functional materials. The unique electronic properties of pyrroles make them valuable building blocks in organic synthesis. Researchers have been actively engaged in developing new synthetic methods for the construction of pyrrole derivatives. The diversity of pyrrole derivatives arises from their varied biological activities

and potential applications in materials science. As the vital roles of pyrroles become increasingly apparent, a growing number of eco-friendly synthetic methods for producing pyrroles are continually emerging.

Method: In this study, SBA-15-SO_3H (SSA) was synthesized through a one-pot method. Subsequently, TPA was introduced into SSA using the wet impregnation method. The synthesized catalyst was characterized by various techniques. Following that, we investigated the catalytic activity of TPA-incorporated SBA-15-SO_3H in the Paal-Knorr synthesis of pyrrole derivatives.

Results: The catalytic systems were tested for their applicability to Paal Knorr reaction and the reaction parameters were optimized. The broad substrate scope of the synthetic protocol was validated. Heterogenization of TPA over SSA facilitated the work-up procedure and enabled easy catalyst recovery ensuring recyclability for over five successive runs. The substrate scope study was also carried out using the optimized reaction conditions.

Conclusions: In summary, we have introduced a mild and efficient procedure for synthesizing pyrrole derivatives *via* Paal-Knorr synthesis utilizing a bifunctional composite catalyst TPA incorporated SBA-15-SO_3H. Key characteristics of this novel method include shorter reaction times, a simple experimental process, easy product isolation, extensive applicability, yields ranging from good to excellent, mild reaction conditions, and the use of green solvent and inexpensive catalyst. The satisfactory recovery and reuse of the catalyst highlight the cost-efficiency and environmentally friendly aspects of our synthetic approach.

Keywords: Heterogeneous catalysis, Paal-Knorr synthesis, SBA-15-SO_3H, tungstophosphoric acid

03-37

AIE, TADF AND MECHANOFLUOROCHROMIC PROPERTIES OF PHENOTHIAZINE-NICOTINONITRILE DERIVATIVES

Pavithra V. Prabhu and Joshy Joseph*

Chemical Sciences and Technology Division, CSIR-National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram, 695019, Kerala, India
Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 201002, India
**Corresponding author* – joshy@niist.res.in

Background: Metal-free small organic compounds with ordered pi-conjugated twisted skeletons are capable of engendering brilliant multifunctional materials. This work mainly focuses on two novel multi-functional materials involving donor–π–acceptor based single molecular platform with synchronised photophysical behaviour such as Aggregation Induced Emission (AIE), Mechanofluorochromism (MFC) and Thermally Activated Delayed Fluorescence (TADF).

Method: We report two classic, organic donor–π–acceptor type molecules, *NTPOM* and *NTPCF,* which is composed of phenothiazine as electron donor and nicotinonitrile as electron acceptor, equipped with methoxy- and trifluoromethyl- groups, respectively. The molecules were synthesized by the Buchwald-Hartwig amination reactions of respective starting materials and characterized using NMR and ESI-MS techniques. The photophysical investigations including the UV-visible absorption, fluorescence and phosphorescence were carried out. The thermal properties of these emitters were investigated by thermogravimetric analysis (TGA) and differential scanning

calorimetry (DSC) under nitrogen atmosphere. The solution state electrochemical properties of the molecule were investigated by cyclic voltammetry (CV). Time-resolved spectroscopy measurements were also carried out. Wide-angle X-ray diffraction (WAXD) was conducted to primarily understand the structural property. Morphology of the compounds were studied through Scanning Electron Microscope (SEM). Theoretical calculations of the same are performed by means of Gaussian 09 software.

Results: Two new simple and easily prepared phenothiazine based nicotinonitrile derivatives, *NTPOM* and *NTPCF* were synthesized, which showed AIE behaviour, remarkable and reversible

MFC and TADF properties. The fluorescence analyses were performed in DMSO with different fractions of water to study the AIE behaviour of the molecules. Both the molecules were non emissive up to 20% of water fraction. Along with the formation of aggregates by addition of water from 30% to 50% as the solution turns cloudy, the PL intensity gradually increases and the emission is bright blue. However, the PL intensity decreases when the water content reaches to 60% and shifts to orange emission, probably due to increase in the aggregate size or decrease in the crystallinity of particles. In the case of *NTPOM* and *NTPCF,* the emission maxima were red shifted from 475 to 585 nm and 460 to 595 nm respectively, after grinding. The spectroscopic properties and luminescence colour change of both the molecules in the solid state were reversible when in contact with the solvent vapors or heating. The results of WAXD, DSC and SEM revealed that the MFC mechanism was the transformation between ordered crystalline and amorphous states upon external stimuli. Time-resolved spectroscopy measurements of both the molecules in dilute toluene solution under nitrogen atmosphere demonstrates a prompt and delayed component which ensures the TADF nature.

Conclusion: The presented results demonstrate that these nicotinonitrile-phenothiazine derivatives, with promising chemical, photophysical and electrochromic properties have the potential for multifunctional applications.

Keywords: TADF, Mechanofluorochromism, AIE, Phenothiazine, Nicotinonitrile

03-38

SONOPHOTOCATALYTIC REMOVAL OF BACTERIAL POLLUTANT FROM WATER USING ZNO AS CATALYST

Divya Nair[1, *], Gayathri P. V[2], Girish Gopinath[1]

[1] *Department of Climate Variability and Aquatic Ecosystems, Kerala University of Fisheries and Ocean Studies, Puduveypu Campus, Kochi 682508. India.*

[2] *Department of Chemistry, St. Albert's College, Ernakulum, Kochi, Kerala 682018*

**** Corresponding author:*** divyanair1970@gmail.com

Background: Antibiotic Resistance Bacteria (ARB) and its effect on living organisms has become a serious global health challenge. Wastewater from hospitals, aquafarms, poultry farms, cattle farms, sewage treatment plants, pharmaceutical industries, etc. is the major source of the release of antibiotics into the environment that has led to the spread of ARB. Advanced oxidation processes (AOPs) are considered to be the most effective method for the removal of both chemical and bacterial pollutants by the formation of hydroxyl radicals.

Method: This study presents the results of an experimental investigation on the Sonophotocatalytic degradation of ARB removal in water using Ultrasound (US) and natural sunlight (SL) combination (US-SL) as the source of energy and semiconductor oxide as a catalyst. Investigations of the effect of various operational parameters such as pH, H_2O_2 concentration, Persulfate concentration was determined.

Results: Zinc oxide (ZnO) was found to be the most effective semiconductor oxide catalyst among the different catalysts screened. The study was carried out under natural pH. The re-emergence of ARB was also investigated and it was not observed in the presence of ZnO.

Conclusions: The results clearly proved that the possibility of using inexpensive natural, non-renewable solar energy combined with ultrasound for the purification of ARB contaminated water than single US and SL along with ZnO, thereby enabling the reuse of scarce water resources.

KEYWORDS: Antibiotic Resistance Bacteria (ARB); Catalyst; Re-emergence

03-39

DEGRADATION OF TOLCAPONE BY OZONATION PROCESS

Prasanthi Tejomurtula, Anbazhagi Muthukumar, Muthukumar Muthuchamy

Department of Environmental Science,
Central University of Kerala, Periye, Kasaragod

Tolcapone (TCP), (3,4-Dihydroxy-5-nitrophenyl)(4-methylphenyl)methanone, is a medication used to treat Parkinson›s disease. It is an emerging contaminant that poses considerable risk in aquatic environments worldwide. Ozonation is an efficient technique for breaking down various benzophenone compounds, and it will be used in this work to break down tolcapone. Utilising chemical oxygen demand (COD), the effectiveness of the degrading process was verified. When tolcapone with a starting pH of 7.42 and COD value of 200 was treated with ozonation for 60 minutes at a flow rate of 0.4 lit./min, the process's efficiency was 40%; however, when the pH was raised to 10, its efficiency climbed to 64. The degradation efficiency is 94.6% when the pH is raised to 10 using sodium hydroxide, from an initial TOC value of 0.88. demonstrating that decomposition efficiency is influenced by pH.

Keywords: Tolcapone; NSAID; Ozonation; Degradation, COD, TOC.

04- EARTH AND PLANETARY SCIENCES

ORAL PRESENTATION

04-01

EXPLORING THE SPATIOTEMPORAL VARIATIONS, DRIVERS AND CONSEQUENCES OF UNUSUAL RAINFALL PATTERNS DURING 2023 IN KERALA, INDIA

Aiswarya Kunnath Poovakka[1*], Sinan Nizar[1], P. J. Jainet[2] and K. P. Sudheer[3]

[1]KSCSTE- Institute for Climate Change Studies (ICCS), Kottayam
[2]KSCSTE- Centre for Water Resources Development & Management (CWRDM), Kozhikode
[3]Kerala State Council for Science, Technology and Environment, Thiruvananthapuram

Background: In the year 2023, the South West Monsoon (SWM) season and North East Monsoon (NEM) in Kerala displayed significant variations in terms of its onset, active spells, and the quantity of rainfall received. A comprehensive understanding of the intricacies of Kerala's 2023 rainfall is therefore crucial for informed decision-making and preparedness in future. This study examines the possible alterations in the long-term trend of monsoon rainfall in Kerala, and explore their implications. The study also seeks to comprehend the spatiotemporal variations of SWM and NEM in 2023, including the underlying causes and implications

Method: To understand the long-term changes in rainfall pattern and spatiotemporal variations of the rainfall in 2023, gridded rainfall data at a resolution of 0.25 X 0.25 degree were collected from Indian Meteorological Department (IMD) for the period 1920-2023. In this study, Oceanic Niño Index (ONI) and Dipole Mode Index (DMI) data from National Oceanic and Atmospheric Administration (NOAA) were collected to understand the variation in rainfall with respect to El Niño-Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD).

Results: Based on the trend analysis of annual rainfall in the state, it is observed that the amount of annual precipitation has exhibited relative stability over the years. However, a noteworthy shift is apparent in the decreasing number of rainy days coupled with an increase in rainfall intensity. This trend is further exemplified in the 2023 rainfall data, where the count of rainy days during the SWM season was significantly lower compared to previous periods.

Conclusions: The heightened intensity of rainfall poses an increased risk of flash floods, while prolonged dry spells between active monsoon periods contribute to a drought-like scenario within the monsoon season itself. To adapt to the changing rainfall patterns in Kerala, it is essential to invest in climate-resilient agricultural practices, robust water management infrastructure, and effective disaster response mechanisms.

04-02

INFLUENCE OF ATMOSPHERIC BOUNDARY LAYER HEIGHT VARIATIONS ON TRACE POLLUTANTS OVER KANNUR, KERALA

Keerthi Lakshmi KA[1*], Nishanth T[1*] and Satheesh Kumar MK[2]

[1]*Department of Physics, Sree Krishna College Guruvayur, Kerala*
[2]*Department of Atomic and Molecular Physics, Manipal Academy of Higher Education, Karnataka, India*

Atmospheric Boundary Layer (ABL) is the lowest part of the troposphere, where significant transfer of heat, momentum, and mass between the surface of the earth and atmosphere occurs. Considerably large ABL heights are usually observed in summer and lower heights are observed in monsoon seasons due to wet surface conditions. Depending on the convection resulting from the intensity of the incoming solar radiation, the ABL height varies from ten meters to two kilometers. The height of the nocturnal ABL is usually low until early morning. As a result, the air in the surface layer resists mixing with the air in the upper layers. During this time, the dispersion of ambient air pollutants decreases, and consequently these pollutants get accumulated below the ABL and exhibit a high concentration of pollutants from night to early morning hours. The present work investigate the influence of Atmospheric Boundary Layer height variations on trace air pollutants over Kannur, Kerala a coastal site in south India. The average diurnal variation of Boundary Layer Height (BLH) in different seasons over Kannur were accessed from the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA-Interim dataset, which has a spatial resolution of 0.125^{o}. Seasonal average maximum and minimum BLH were observed in summer and monsoon seasons respectively. Owing to the convection activated by solar radiation, BLH increases until mid-afternoon and afterward, it starts becoming shallow due to the absence of solar radiation. This dynamical variation of BLH variations have strong influence on pollutant concentration due to vertical mixing.

04-03

EXPLORING THE DRIVERS OF THE RECORD ANOMALOUS OCEAN SURFACE WARMING IN THE ARABIAN SEA, AUTUMN 2023

Jikku Joy[1*], C. C. Bajish[1], Sinan Nizar[1] and K. P. Sudheer[1,2,3]

[1] *KSCSTE – Institute for Climate Change Studies, Kottayam, Kerala, India*
[2] *Department of Civil Engineering, Indian Institute of Technology Madras, Chennai*
[3] *Kerala State Council for Science Technology and Environment, Thiruvananthapuram*

Background: The Arabian Sea (AS) has been undergoing a nearly consistent warming trend, resulting in warmer winters and a reduction in decadal monsoon rainfall. This warming trend is also implicated in the intensification of monsoon extremes over the northwestern Indian subcontinent. Moreover, the SST in the AS reached a record high, exceeding 1°C with respect to the climatological mean, during the Autumn months (Sep - Nov) of 2023. Given the pivotal role of SST in determining and predicting air–sea interactions in the region, understanding the potential drivers of this warming is imperative. This study aims to document the plausible oceanic and atmospheric features responsible for the anomalous SST increase in the Arabian Sea.

Method: This research utilizes data on ocean-atmospheric variables, including sea surface temperature

(SST), ocean heat content (OHC), and salinity from ORAS5, alongside atmospheric parameters like Mean Sea Level Pressure (MSLP), wind components, Surface Air Temperature (SAT), and various radiation and heat flux measures from ERA5 (1980–2023), to investigate convective activity in the Arabian Sea. It also examines SST anomalies from ERSSTv5 to identify El Niño and La Niña events, employing a threshold-based approach for classification. The study calculates the net heat flux (NHF) and seasonal climatologies (1981-2010) to analyze anomalies. The focus is on summer and fall seasons, offering insights into the complex ocean-atmosphere interactions in this region.

Results: The Arabian Sea exhibits a unique four-stage annual SST cycle, driven by the southwest monsoon and coastal upwelling. Autumn 2023 witnessed unprecedented warming, with SST anomalies exceeding 1.1°C, coinciding with a robust El Niño event. Autumn 2023 experienced significant SST and SAT warming, linked to reduced wind speeds and positive net heat flux, highlighting complex ocean-atmosphere interactions. The unusual warming is not just a surface phenomenon but is significantly influenced by subsurface ocean processes. This suggests that the anomalous warming in the AS during the autumn of 2023 is a result of both local oceanic conditions and larger-scale climatic events like El Niño.

Conclusions: The findings emphasize the need for a deeper and more better understanding of ocean-atmosphere interactions in the Arabian Sea, particularly in the context of global climate change. Future research focusing on a detailed heat budget analysis of the ocean mixed layer is essential to unravel the intricate mechanisms driving such anomalous warming events, aiding in better prediction and management of climate-related impacts in the region.

Keywords: *Sea Surface Temperature, Indian Ocean, Climate Change, Marine Heat, Oceanography*

04-04

TREND OF SEA SURFACE TEMPERATURE OVER ARABIAN SEA USING LONG TERM REANALYSIS DATA

Anila Alex[1*] and Sreekutty Radhakrishnan[2]

[1] *Centre for Water Resources Development and Management, Kerala*
[2] *Kerala Institute of Local Administration, Kerala,*

Background: Sea surface temperature is a crucial oceanic characteristic that can help us better understand the upper thermal structure, cyclone genesis, marine heat waves, as well as improve the predictive capability of monsoon in tropical oceans.This parameter is found to be increasing in many regions as a result of changes in climate.

Methods: Trends in sea surface temperature over Arabian Sea basin (0-25◦N/50◦E-75◦E) in the month of January to December from 1979 to 2021 was computed. Significance and magnitude of the trend was analysed using Mann Kendall test and Sen slope estimator.

Results: The Monthly average time series shows an upward trend of sea surface temperature over the Arabian Sea from 1979-2021. A significant trend in SST is observed in all months except February, June and July.SST was found to be highest during 2015 and 2020.

Conclusion: It is clearly showed an upward trend in sea surface temperature from 1979 to 2021, with a relatively higher sea surface temperature trend being observed in the Arabian Sea

with temperatures rising at the rate of 0.011K per year.The variations show the effect of various atmospheric oscillations as well as the effect of climate change.

04-05

ASSESSMENT OF GROUNDWATER QUALITY OF KERALA BY ENTROPY-WEIGHTED WATER QUALITY INDEX MODELLING

Mohammed Maharoof P[1*], C. D. Aju[2], Achu A. L.[3] and Raicy M. C.[4]

[1] *Gems Arts and Science College, Ramapuram Town, 679321 Kerala*
[2] *Indian Institute of Tropical Meteorology, Ministry of Earth Sciences, Pune, India*
[3] *Department of Climate Variability and Aquatic Ecosystems, University of Fisheries and Ocean Studies (KUFOS), Kochi*
[4] *Centre for Water Resources Development & Management, Kunnamangalam,*

Background: Water is an essential natural resource and an absolute necessity for the sustenance of life. As groundwater is the primary source for drinking in many parts of the world, periodic monitoring of groundwater quality is necessary. The present study is conducted to understand the spatio-temporal variations in physico-chemical parameters of groundwater resources in Kerala state, India.

Method: The hydrogeochemical data for 324 groundwater samples for the year 2018 were collected from CGWB to calculate the Entropy Weighted Water Quality Index (EWQI). Spatial maps were prepared using Arc Gis software.

Results: Most of the samples are alkaline nature and the major groundwater facies were found as Na^+-Cl^- and Ca^{2+}- Mg^{2+}-Cl^-. The higher concentrations of Cl^- and NO_3^- in groundwater is attributed to anthropogenic influences, such as industrial effluents and agricultural fertilizers, while that of SO_4^{2-}, and Mg^{2+} is due to geological influences. The hydrochemistry varied along the groundwater flow pathways. Based on the numerical entropy-weighted water quality index (EWQI) model, 12.04 % of the samples had medium water quality, and 0.62 % had poor water quality. High EWQI values were observed for mixed Ca^{2+}-Mg^{2+}-Cl^- and Na^+-Cl^- water types of water.

Conclusions: GIS-based spatial variation maps of water quality parameters and EWQI specify that central eastern, central western, and central regions have poor water quality. This research holds significance because of its socio-economic advantages, particularly in the design of effective water treatment and management strategies.

Keywords: *Entropy-weighted Water Quality Index (EWQI) model, Hydrochemistry, water quality, Kerala*

04-06

BRIDGING MODELS AND REALITY: AN APPROACH TO QUANTIFYSUBMARINE GROUNDWATER DISCHARGE FLUX THROUGH FIELD SURVEYS AND NUMERICAL MODELING

Jeenu Mathai[1*], K Sreelash[1], Nidhin K[1], Ajit Kumar Behera[2], Upendra B[1], Reji Srinivas[1]

[1]National Centre for Earth Science Studies, Thiruvananthapuram
[2]National Institute of Hydrology, Roorkee

Background: This study integrates field surveys and numerical modeling to quantify Submarine Groundwater Discharge (SGD) in the Kadinamkulam coastal catchment, Trivandrum. Initial SGD zones were identified in a comprehensive Kerala West Coast Expedition, confirming their existence through porewater chemistry analysis during February 2023.

Method: A 3D numerical model, employing FEFLOW, was developed using diverse hydrogeological datasets. Inputs included Digital Elevation Model, geology, Land Use Land Cover map, and IMD rainfall data. Precise aquifer characterization, boundary condition assignments, and non-homogeneous recharge considerations were incorporated. Calibration and validation used monitored groundwater levels data from observation wells.

Results: The study revealed a hydraulic gradient favoring freshwater discharge, estimating an SGD flux of 53.4 litres/day/m of shoreline per 30 m depth. Annual freshwater discharge totaled 233,965 m^3/year. The model showcased SGD sites based on porewater chemistry, emphasizing the significance of numerical model in SGD flux quantification.

Conclusions: The study employs a robust methodology, combining field surveys and numerical modeling with a focus on FEFLOW, showcasing its effectiveness in handling aquifer complexity and diverse datasets for accurate model development. Calibration using observed data strengthens the methodology, allowing numerical modeling to be an efficient tool for predicting complex subsurface processes and facilitating exploration of future scenarios in coastal catchments. Future considerations include the impact of groundwater draft and aquifer characterization using resistivity surveys.

Keywords: *Submarine Groundwater Discharge, FEFLOW, Numerical Modeling, Coastal Aquifers, Groundwater Flux.*

4-07

RESPONSE OF MONSOON LOW-LEVEL JET DURING WET AND DRY RAINFALL EPISODES OVER SOUTHERN TIP OF INDIA

Resmi E. A.[1*], B. Preethi[2], R. S. Ajayamohan[3], Pallav Ray[4], C. K. Unnikrishnan[1], S. Nita[1], R. K. Sumesh[1] and J. Dharmadas[1]

[1]National Centre for Earth Science Studies (NCESS), Thiruvananthapuram, India, [2]Indian Institute of Tropical Meteorology (IITM), Pune, India, [3]Department of Meteorology, Institute of Applied Technology, Abu Dhabi, UAE, [4]Meteorology, Florida Institute of Technology, Melbourne, FL, USA

Background: The large spatial and temporal variability of wet and dry spells of the Indian Summer

Monsoon poses great challenge in understanding and predicting monsoonal rainfall. This challenge is further exacerbated over smaller regions, such as the southern tip of India, which receives the first spell of ISM rainfall.Also, the future projections indicate that active spells will be strengthening over northern India and weakening over the peninsular India, which may facilitate intense break spells over the southern tip of peninsular India.

Method: We use in-situ observations (rain gauges, automatic weather stations or AWS and radiosonde) as well as gridded reanalysisfor the summer monsoon season from Thiruvananthapuram region for the period 1981-2020. A wet and dry spell is defined when the standardized anomaly of daily rainfall for three or more consecutive days is> 0.5 and < - 0.5 respectively.

Results: The present study showed the characterization of wet and dry spells using station data over Thiruvananthapuram reveals that a summer monsoon season witnesses 1-2 wet spells consisting of 3-4 days duration, which contributes about 30% of seasonal rainfall. For the onset of wet spells over the southern tip of India, southerly winds from the Arabian Sea and associated strengthening of LLJ initiate a cyclonic gyre at 5°N before 2 days and this acts as the precursor for the wet spells. On the other hand, weakening of LLJ is seen prior to 2 days over the equatorial Indian Ocean located to the south and southwest of the southern tip before the onset of dry spells and easterly wind anomalies strengthened from d-1 to d+6 days, and these features are in coherence with rainfall gives a clear indication as precursors for both the spells over the region. Results showing the modulation of regional- and local-scale conditions by the large-scale circulation indicate that consistent and long-term observations may enhance our capacity to understand these precursor signals and thereby enhance our predictive skill during wet and dry spells of the Indian summer monsoon at specific locations.

04-08

DETECTION OF SIGNIFICANT INCREASE IN ANTHROPOGENIC INFLUENCE OVER IDUKKI DISTRICT, KERALA

Subin Jose, Kochurani Lalu*, Aqueena Tresia Cherian and Sijo Joseph

Research and Postgraduate Department of Physics
Newman College, Thodupuzha, Kerala
**Corresponding author: 99kochuranilalu@gmail.com*

The recent observations and modelling studies have unequivocally depicted that our Earth's climate is changing. South Asia is considered as one of the hotspot regions most profoundly impacted by these changes. In the present study, we made an attempt to quantify the climate changes over Idukki district of Kerala. The significance of this study region is that it is a part of Western Ghat, which is considered as the gateway of south west monsoon and also one of the biodiversity hotspots.Inorder to quantify the changes in surface temperature we have used long term (1980-2020) satellite, in-situ and reanalysis data. Computed Boltzmann entropy values (60,000 to 12,00,000) from satellite retrieved Digital Elevation Model (DEM) data have revealed that there has been a significant increase in spatial heterogeneity of the landscape in recent years. Changes in Land Use and Land Cover (LULC) during the study period estimated using machine learning algorithms (Random Forest and Gradient Tree Boost) from Landsat data have revealed that there has been an increase (decrease) in urban/ buildup (forest) points by 12- 16% (2-8%) during the year 2020 in comparison with the year 2000.

Changes in LULC significantly modifies the surface energy balance, which in turn modulates the surface temperature affecting the micro-climate of the region. Long term land surface temperature (LST, K) over the study region is analyzed and a statistically significant increasing trend of ~ 0.01 K/decade in LST is observed. A positive Observation Minus Reanalysis (OMR) trend over the study region also suggests that increase in temperature over the study region is mostly due to changes in LULC or urbanization.

Keywords: *Boltzmann Entropy, LULC, LST*

4-09

GEOGRAPHICAL INFORMATION SYSTEM AND MULTI-INFLUENCING FACTOR TECHNIQUES FOR THE ASSESSMENT OF GROUNDWATER POTENTIAL ZONES OF TROPICAL WATERSHEDS: A CASE STUDY

Imthiaz Ahammed*, Jayapal G and T K Prasad

Department of Geography, Kannur University, Kerala, India

Background: The groundwater of a region is predisposed much by terrain factors along with climatic factors. Being a subsurface phenomenon groundwater cannot be observed directly, it had to be done indirectly based on the analysis of data of observable features collected through field observation and various geophysical techniques. Groundwater occurrence is a phenomenon that is heavily dependent on multiple parameters viz., Geomorphology, geology, land use, slope, soil texture, drainage density, lineament density, relief, and vegetation.

Method: The present study intends to examine the need and prospect of assessing the groundwater potential of a tropical watershed on Geographical Information System (GIS) platform using the Multi-Influencing Factor (MIF) technique. A multi-influencing factor approach is used, where weights were assigned to each factor based on their level of influence and finally conducted weighted overlay platform to generate groundwater potential zones of the Perumba watershed, in the Kannur District of Kerala, India. Various parameters of groundwater have been analyzed from a geomorphological standpoint and potential zones were identified and categorized.

Conclusion: The study signifies the application of MIF and GIS techniques in hydrological studies, as they qualify for comprehensive assessment and spatial analysis of various factors that affect the dynamics of groundwater. The results were verified through a field survey.

Key Words:*Groundwater potential, Tropical watershed, Geographical information system, multi-influencing factor, Weighted overlay*

04-10

LATE QUATERNARY PALEOCLIMATIC VARIABILITY IN A SEDIMENT CORE FROM BAY OF BENGAL: A MULTIPROXY STUDY

Nayana V Haridas[a,b*], Upasana S. Banerji [c], D. Padmalal [a], Maya .K [a], John Kurian P [d], and Ravi Bhushan [e]

[a] *National Centre for Earth Science Studies, Thiruvananthapuram, Kerala, India*
[b] *Department of Marine Geology and Geophysics, Cochin University of Science and Technology, Kochi, Kerala*
[c] *Ministry of Earth Science, New Delhi, India*
[d] *National Centre for Polar and Ocean Research, Goa*
[e] *Physical Research Laboratory, Ahmedabad, Gujarat, India*

Background: Bay of Bengal (BoB) is highly susceptible to monsoonal influences and receives huge volumes of sediment from the Himalayan and peninsular rivers during Indian Summer Monsoon (ISM) and North East Monsoon (NEM). This makes the BoB a unique basin to understand the Indian Monsoon variability and its teleconnections. Furthermore, the cores retrieved from sedimentary archives of the BoB could unfold the sources and pathways of particulate matter reaching the basin over the years. Considering all these, a study has been undertaken to investigate the paleoclimatic records in a sediment core retrieved from the BoB.

Method: A 2.90m marine sediment core (GC-01) retrieved at a water depth of ~1576m from the continental margin of Krishna river confluence of western BoB was studied based on multiproxy approach and chronologically supported by AMS radiocarbon ages

Results: Textural analysis displays unimodal distribution and shows silty clay as the major sediment type. Enriched $d^{13}C$ along with higher TOC/TN suggests the dominance of C4 plants of terrestrial origin during 45–15 ka. The presence of charcoal was predominant from 45 ka–15 ka suggestive of fire-borne particulates reaching the core site through the hinterland rivers. The geochemical proxies along with textural variation demonstrated an enhanced rate of coarser particles deposition during 25-14 ka. This period is also marked by increased calcareous productivity due to the lack of freshwater stratification. The period 12–4 ka demonstrated poor calcareous productivity due to the persistence of fresh water stratification over BoB caused by strengthened ISM. Dominance of mangrove pollens in the palynological assemblage reiterates this view. The last 4 ka is marked by enhanced calcareous productivity possibly due to ISM reduction and poor freshwater stratification. The provenance of sediments revealed that the Deccan basaltic and the Archean crystalline rocks in the hinterlands contributed significantly to the sediment build-up at the core site.

Conclusion: Sediment deposition took place under a calm and low-energy depositional environment. Organic carbon source is prominently of terrestrial origin. ISM reduction and poor freshwater stratification over BoB resulted in enhanced calcareous productivity during 25-14 ka and the last 4 ka. The sediments in the core are prominently derived from the Deccan basaltic and the Archean crystalline rocks in the hinterlands.

Keywords: *Sediment, Bay of Bengal, Paleoclimate, Monsoon, Productivity*

04-11

GEOMORPHIC EVOLUTION OF THE SEISMICALLY ACTIVE EASTERN PART OF KACHCHH MAINLAND FAULT IN WESTERN INDIA

Akash Padmalal*, D. M. Maurya and L. S. Chamyal

Department of Geology, The M. S. University of Baroda, Vadodara, Gujarat
Email: akash.padmalal47@gmail.com

Background: The Kachchh Rift Basin (KRB) is a seismically active E-W trending inverted rift graben located at the western continental margin of the Indian plate. The Kachchh Mainland Fault (KMF) is the largest fault passing through the center of the KRB that has triggered many earthquakes during historical time. The present study focuses on detailed geomorphic investigation of the eastern half of the KMF zone to understand its geomorphic evolution during the Late Cenozoic.

Methodology: The study is based on the analysis of satellite data and extensive field investigations supplemented by detailed topographic and drainage analysis and interpretations based on standard procedures.

Results: The imposing north-facing scarp also known as the Kachchh Mainland Fault Scarp (KFMS) dominates the geomorphic setup of the KMF zone. The present study shows that the KMFS formed in older Mesozoic formations in the western part shows higher degradation while in eastern part, it is formed in younger Mesozoic formations and is relatively less degraded. The KMFS shows the highest elevation in the western part which progressively decreases towards the east. The exposed Quaternary colluvio-fluvial sediments in the fault zone are characterized by a pronounced lateral variation in thickness, the highest thickness and coarse nature in the western part and a progressive decrease in both parameters towards the east is observed. Detailed analysis of the drainages in the KMF zone shows a progressively younger topography towards the east.

Conclusions: Geomorphic characteristics, tectonic setting and laterally variable nature of the Quaternary sediments indicate multiple phases of tectonic reactivation of KMF during the Late Cenozoic. A general trend of decrease in scarp height, topographic relief, fluvial dissection, younger geomorphic stages and fining up of sedimentary facies is observed towards the east in the KMF zone. The present study shows that lateral and vertical growth of the KMF during the Late Cenozoic period.

Keywords: *Kachchh Rift Basin (KRB), Kachchh Mainland Fault (KMF), Kachchh Mainland Fault Scarp (KMFS), Morphometric Analysis, Western India.*

04-12

URANIUM OCCURRENCE IN GROUNDWATER ALONG A SHEAR ZONE IN THE SOUTHERN GRANULITE TERRAIN OF PENINSULAR INDIA

Bindu J Viju[1*], Mini Chandran[1], G Sreenath[1], Shaji E[2]

1. Central Ground Water Board, Kerala Region, Ministry of Jal Shakti, Department of Water Resources, RD & GR, Thiruvananthapuram, India
2. Professor and Head of Department, Department of Geology, University of Kerala

About 60% of the rural population in southern India gets their water from basement aquifers, which cover a sizable area of the region. There have been multiple instances of uranium contamination in basement aquifers; in some places, the contamination levels are higher than the WHO drinking water guideline values of 30 µg/L, which could pose a health risk to people. The major ions and uranium contents of groundwater samples obtained from several locations along the Dharmapuri shear zones of Krishnagiri district were analyzed. The bulk of the region's geology is composed of Amphibolite/ Pyroxene Granulite, Basic Rocks, Granitic Gneiss, Granitic/Acidic Rocks, and Migmatitic Complex. According to data from the lithologs of the wells explored by CGWB, the possible fracture zones that supply water in this geological terrain are located at depths lower than 200 m bgl (below ground level). The primary source of water for the 19 lqakh people living in the study area's domestic and agricultural needs is bore wells. The research area has 750 to 900 mm of annual rainfall on average, and groundwater levels are between 4.5 to 31.0 m bgl. The analytical results of groundwater samples revealed an average pre-monsoon uranium content of 78.68 µg/L and post-monsoon concentration of 72.11 µg/L, with a range of 0.34 to 485.19 µg/L Out of 40 well samples collected in pre monsoon, 22 wells (55%) exceed the WHO permissible limit of 30 µg/, the highest value being 485.19 µg/L. The Uranium concentrations in deep bore well samples is considerably higher than in dug well and shallow bore well samples. To comprehend the mechanism controlling uranium dissolution and transport in this region's groundwater, connections between U and major ions were examined. Correlation study done on data shows that Uranium has weak correlation coefficients positively with EC, Total Hardness, Chloride, Sodium, Potassium and Sulphate which indicate that the source is probably geo genic and negatively with Iron and Nitrate .The negative correlation with Iron is significant in the sense that it indicates the presence of an oxidising environment for the Uranium to remain in solution since Iron is mobilised only in a reducing environment. The negative correlation with Nitrate probably points to the lack of an agricultural source for Uranium enrichment in the waters.The results suggest that a detailed examination of the groundwater quality in the vicinity of the shear zone is required. The results also take into account the possible health concerns that the local population may face from prolonged, untreated use of uranium-contaminated groundwater. The study also highlights the necessity of conducting further research on the geologically comparable areas in Kerala's Palakkad and Wayanad districts in order to evaluate the uranium contamination of ground water.

Key words: *Uranium, Migmatites, Fractures, shear zones, Correlation, Groundwater contamination*

04-13

ASSESSMENT OF GROUNDWATER POTENTIAL OF A TROPICAL RIVER BASIN, NORTH KERALA USING INTEGRATED GEOSPATIAL-GEOPHYSICAL APPROACH

A Aswin[a], CD Aju[b], M Maharoof P[a], AL Achu[c], MC Raicy [d*] and Rajesh Reghunath[c]

[a]PG Department of Applied Geology, GEMS Arts and Science College, Malappuram, Kerala
[b]Indian Institute of tropical Meteorology, Pune, Maharashtra
[c]Department of Climate Variability and Aquatic Ecosystems, Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi, Kerala
[d]Centre for Water Resources Development and Management (CWRDM), Calicut, Kerala, India*
Department of Geology, Karyavattom Campus, University of Kerala

Introduction: Groundwater, a critical global natural resource, is stored in subsurface geological formations within the Earth's crust. Effective exploration and utilization of groundwater, especially in hard rock terrains, necessitate a profound understanding of geology. This study employs a combination of GIS, Analytical Hierarchy Process (AHP), remote sensing, and geophysical techniques, including resistivity surveying, to delineate groundwater potential zones in the Kadalundi River Basin, Kerala, India.

Methodology: Geoenvironmental data, including curvature, Topographic Position Index (TPI), Topographic Wetness Indicator (TWI), soil information, rainfall patterns, slope, drainage density (Dd), land use/land cover (lu/lc), lineament density, groundwater level fluctuations, geomorphology, and geological characteristics, were incorporated. The Multi-Criteria Decision Analysis (MCDA) approach, integrating various GIS tools and the Analytic Hierarchy Process (AHP) technique, was employed for GWPZ delineation. The AHP method facilitated the allocation of weights to each geo-environmental variable, influencing the creation of slope stability and potential recharge maps. The accuracy of the GWPZ delineation was assessed by analyzing the bivariate relationship between the groundwater potential index and resistivity values of the formation.

Results: Groundwater potential zones in the Kadalundi River Basin were delineated using various geoenvironmental variables, resulting in five categories: very poor, poor, moderate, high, and very high comprising approximately 20%, 19.7%, 19.8%, 20.3%, and 20.2% of the basin, respectively. The eastern and central regions exhibited poor groundwater potential due to factors like steep slopes, clayey soils, and the presence of the peninsular gneissic complex. Moderate potential areas were dispersed randomly across the study region, while good and very good potential zones were concentrated in the central-eastern and western parts, characterized by sand, silt, and laterite, along with favorable slope and density conditions. The validation of these zones using resistivity data from the field, particularly Vertical Electrical Sounding (VES) curves, highlighted the correlation between geological formations and groundwater potential.

Conclusion: This study emphasizes the distinct interplay of geological compositions in shaping groundwater potentials across the Kadalundi River basin.

Key words: *Groundwater potential, Kadalundi, Resistivity, AHP*

04-14

SPATIAL AND TEMPORAL HYDRO-GEOCHEMISTRY IN THE MUNNAR CZO, SOUTHERN WESTERN GHATS, INDIA: EXPLORING CHEMOSTATIC BEHAVIOUR ACROSS WATER SOURCES

Sreelesh, R[1,2*]., Manab, Kumar, Dutta[1]., Sreelash, K[1]. and Maya, K[1].

[1] *National Centre for Earth Science Studies (NCESS), Thiruvananthapuram, India*
[2] *School of Marine Sciences, Cochin University of Science and Technology, Kochi, India*

Background: This investigation explores the hydrogeochemical intricacies of the Munnar Critical Zone Observatory (CZO), a part of the CZO Network *TERRAIN* in the Southern-Western Ghats region, India. Focusing on seasonal and lithological factors influencing chemical weathering, CO_2 consumption, and concentration-discharge relations in CZO aquatic sources (Intermittent streams, River, and Groundwater (GW)).

Method: Water samples (125 ml) for hydrogeochemical analysis were collected in prewashed HDPE bottles. Analyses included temperature, pH, and EC measured in the field with a portable analyser. Major anions were determined through titrimetric methods and ion chromatography, while major cations were analysed using ion chromatography. SiO_4^{2-} was measured via a continuous flow analyzer. Instruments were routinely calibrated, and charge balance ensured data quality. pCO_2 was calculated using Total Alkalinity, pH, Temperature, and dissociation constants.

Results: The study identifies the prevalence of Na^+, Ca^{2+}, and HCO_3^- ions, indicating robust silicate and carbonate weathering dynamics. Utilizing a forward, revealed that surface water's higher susceptibility to atmospheric inputs (average of 39.75%) compared to GW (20%). Silicate weathering emerges as the primary solute-generating mechanism with an average contribution of 38.65% in the CZO. Despite approximately 35% of solute contributions from carbonate weathering in PRM for intermittent streams and GW, anthropogenic sources contribute 10%, 18%, and 23% to river, intermittent streams, and GW, highlighting plantation influence in Munnar. The estimated annual discharge-weighted silicate weathering rate (SWR) for intermittent streams is 5.67 t $km^{-2}y^{-1}$, while rivers average 6.23 t $km^{-2}y^{-1}$, indicating higher silicate weathering rates in rivers. The Chemostatic behaviour in intermittent streams exists throughout seasons, while river water displays seasonal fluctuations due to high runoff and lithological characteristics.

Conclusion: This study provides insights into chemical weathering processes, and certain carbon dynamics, emphasizes the impacts of hydrological variability on solute generation and transport, and underscores the necessity for informed environmental management strategies in the region.

Keywords: *Critical Zone Observatory, Hydro-geochemistry, Chemostatic Behaviour, Forward Model.*

04-15

GRANULITE-FACIES METAMORPHISM IN MAFIC ROCKS FROM ATTAPPADI VALLEY, PALAKKAD DISTRICT, KERALA

K.V. Kavyanjali* and Y. Anilkumar

Department of Geology, University of Kerala, Kariavattom, Thiruvananthapuram
**Email: kavyanjali@keralauniversity.ac.in*

Background: Attappadi, the area under investigation is a broad valley, inclined in a NE-SW direction with a broad synformal structure. Garnet-bearing metagabbro, Garnet-bearing gabbroic anorthosite, and two pyroxene granulite exposed in the Attappadi Valley are considered for the present study. According to the mineralogical analysis, the rocks fall under the mafic rock group. The study aims to evaluate the indication of granulite facies minerals and high-grade metamorphism.

Method: Thin-section samples were prepared for the optical studies. Textural relationships are identified under transmitted light polarised microscope. The textural equilibrium among garnet, clinopyroxene, orthopyroxene, plagioclase, and quartz are identified. Textural studies permit the determination of the granulite facies mineral assemblages.

Results: These rocks have experienced metamorphic events, as evidenced by the occurrence of new phases such as garnet, plagioclase, hornblende, and quartz. The equilibrium assemblages of Garnet-clinopyroxene, Garnet-orthopyroxene, and Clinopyroxene-orthopyroxene are supportive evidence for granulite facies metamorphism.

Conclusions: According to their petrological, and textural relationships, three rock types were distinguished. The mineral assemblages and their co-existence from the textural studies demonstrate the regional metamorphic condition. It has been proven that the presence of garnet, clinopyroxene, and orthopyroxene and their mutual textural relationships in the mafic rocks lead to the granulite facies metamorphism in Attappadi Valley.

Keywords: *Mafic, Granulite facies, Metamorphism, Attappadi*

04-16

HYDROGEOCHEMICAL CHARACTERIZATION OF THE GROUNDWATER RESOURCES OF KARIANGODE RIVER BASIN, SOUTHERN INDIA

B K Arya[1]* K V Sarath[2], E Shaji[2], K Sandeep[1]

[1]Department of Geology, Central University of Kerala, Tejaswini Hills, Periye, Kasaragod, Kerala
[2]University of Kerala, Kariavattom campus, Thiruvananthapuram, Kerala

Background: Groundwater is the primary source of water for human development in the Kariangoderiver basin (KRB), and therefore characterizing groundwater quality is essential for sustainable development of groundwater resources in the region. The present study is carried out to understand the hydrogeochemistry of the groundwater resources and the major hydrogeochemical processes controlling the concentration of major ions in groundwater in the KRB, South India.

Method: Literature survey followed by field investigations and collection of water and rock

samples were carried out. The hydrochemical analyses were conducted in the Hydrochemistry lab, Department of Geology at University of Kerala. Chemical parameters of groundwater such as pH, EC, TDS, total alkalinity, total hardness, Fe, major cations and major anions were determined and was compared against BIS and WHO standards. GIS software was used in constructing spatial variation maps, while graphical representations included Hill Piper diagrams, Durov plots, Schoeller diagrams,1:1 scatter plot, Wilcox plot and USSL diagram. The petrographical and geochemical methods were used to understand the geological composition of insitu rocks and their influence on groundwater quality.

Results: Comparison with the WHO permissible and desirable limits, TDS, potassium, magnesium, carbonate, chloride, and sulphate levels are generally below the desirable limits. The predominant hydrogeochemical facies of the region is Ca^{2+} - Mg^{2+} - HCO_3^-. The order of major cations is Na^+> Ca^{2+}> Mg^{2+}> K^+, while the anions follow HCO_3^-> Cl^-> SO_4^{2-}> CO_3^{2-}.High iron contamination, particularly in locations like Pothamkandam, Vellarikund, and Konnakkad, was attributed to the dissolution of iron-bearing minerals such as pyroxenes and biotite, along with interactions between aquifers and rock formations in borewells. Evaluation of 1:1 scatter plot of different water parameters indicates dissolution of amphibole, pyroxene and plagioclase sources. Overall, the presence of silicate weathering is evident in the aquifer rocks.

Conclusions: The region faces challenges such as groundwater scarcity, contamination, and the impact of anthropogenic activities on aquifers. The continued monitoring and management of the water resources in the region is needed to ensure sustainable and safe water access.

Keywords: Iron contamination, Kariangode river basin, Hydrogeochemistry, Groundwater

04-17

HYDROCHEMICAL CHARACTERISTICS OF GROUNDWATER FROM THE WEATHERED AND FRACTURED ZONES OF PRE CAMBRIAN CRYSTALLINE AQUIFER OF IRUVANHIPPUZHA WATERSHED, KERALA

Manjula P*, Jnanachandra VJ, Neema M Shaji,Vimala T. and Resmi T R

Centre for Water Resources Development and Management, Kunnamangalam, Kozhikode
** Corresponding Author e mail: mp@cwrdm.org*

Background: The state of Kerala is highly dependent on groundwater for its requirements. Pre Cambrian Crystalline rocks comprising of gneiss, granites and charnockite cover most part of the state. The study aims to compare the hydrochemical characteristics and quality of groundwater representing the weathered zone and deeper fractured zones of the Pre Cambrian crystalline aquifers of Iruvanhhippuzha watershed, Chaliyar River basin, Kerala.

Method: The open well samples representing the weathered zone and bore well samples representing the deep fractured zones of Precambrian crystalline aquifer were collected during the pre monsoon season (May 2023)and the physico chemical parameters were determined.

Results: Groundwater from the deeper fractured zone showed a higher value of Total dissolved solids compared to groundwater from the weathered zone. Na^+ and Cl^- were the dominant cation and anion in the wells from weathered crystallines whereas $Ca^{2+}$and HCO_3^- dominated in majority of the wells representing deeper fractured zone. The water quality of the wells representing both zones

belonged to the 'Excellent' category as per the Weighted Arithmetic Water quality index

Conclusions: The groundwater representing the weathered crystalline zone and deep fractured zone showed distinct major ion chemistry. The major ion chemistry of the open wells was dominated by alkalies and strong acids (Na- Cl type) whereas the bore wells were dominated by alkaline earths and weak acids (Ca-HCO_3 type)The water quality of the wells representing both weathered and fractured crystalline zone belonged to the 'Excellent' category

Key words: Hydrochemical characteristics, Pre Cambrian crystalline aquifer, Iruvanhippuzha watershed, Weighed Arithmetic Water Quality Index as per the Weighted Arithmetic Water quality index

04-18

DEPOSITIONAL CONDITIONS OF BANDED IRON FORMATIONS IN ATTAPPADI VALLEY, DECIPHERED FROM ITS SILICATE MINERAL ASSEMBLAGES

R. Radhika*, Y. Anilkumar, A.P. Pradeepkumar

Department of Geology, University of Kerala, Thiruvananthapuram
**Email:* radhikar@keralauniversity.ac.in

Background: Banded Iron Formations (BIFs) are recognized as good paleo proxies in deciphering the conditions that prevailed in the early earth as well as in understanding the evolution and tectonic history of the region that hosts the BIFs based on its mineral assemblages. The present study includes the BIFs within the Neoarchean (2.5 Ga) rock suites ofthe Attappady Valley of Palakhat district, Kerala.

Method: The samples of BIFs are collected from the Attappadi Valley during the time of field investigation. Polished thin sections are prepared for enhanced microscopic analysis in order to determine the mineralogical and textural variations of BIF samples. Leica 2700 P reflected and transmitted light polarizing microscope is used for petrographic interpretations.

Results: Silicate facies of BIF are dominant compared to oxide facies in some locations of Attappadi. The presence of grunerite, pyroxene and garnet in samples indicate medium to high-grade metamorphic overprint on BIFs. The breakdown of garnet and the growth of amphibole and biotite indicates retrograde metamorphism after the later stage of prograde metamorphism. These observed mineral assemblage in BIFs is not of primary origin. The precursor BIF sedimentswas a sea water precipitate of iron silcate gel. These were dominantly greenalite and minnesotaite. When the metamorphic grade increases, amphiboles, i.e., grunerite, pyroxene and olivine become the end-products of minnesotaite alteration.

Conclusion: The BIF precursor sediments in the early ocean is an iron rich precipitate similar to greenalite like composition, later post depositional processes lead to the formation of diversified silicates in BIFs. This diversification is also a result of source of sediments, proximity to continents and volcanic sources associated rocks and sea level changes etc. that hosted BIF deposition.

Keywords: Banded Iron Formations (BIFs), Early earth, Petrography, Metamorphism, Greenalite, Minnesotaite

04-19

DO AEROSOLS ABOVE THE BOUNDARY LAYER AFFECT WARM CLOUD MICROPHYSICS?

Sijo Joseph* and Subin Jose

Post Graduate Department of Physics, Newman College, Thodupuzha
**sijojoseph@newmancollege.ac.in*

The effect of aerosols on clouds is recognised as one of the largest uncertainties in determining climate change. Therefore, reduction of these uncertainties is key in understanding present climate and predicting future climate. Multispectral analysis of satellite images are used to analyze the impact of aerosol loading on microphysical processes in warm clouds. We utilized observations from the Suomi National Polar-orbiting Partnership (Suomi-NPP) and Cloud-Aerosol Lidar Infrared Pathfinder Satellite Observations (CALIPSO) from 2013 to 2018 over the South Asian region. Cloud Top Temperature (T, K) versus Cloud drop effective Radius (r_e µm) curves are used to identify these microphysical processes. Observations showed a substantial transformation in microphysical zones in different aerosol loaded cases (high aerosol loaded case and low aerosol loaded case). Satellite retrieval analysis for low aerosol loading cases shows a rapid increase in Cloud Drop Effective Radius with height indicates the dominance of coalescence growth. On further analysis, we can see coalescence growth as a dominant process in cases of aerosol loading under the boundary layer (~3km). Analysis revealed that r_e increases slowly for cases of high aerosol loading with the presence of an aerosol layer above the boundary layer. In these cases, the precipitation threshold (14 µm) is barely attained, and cloud-top height increases more swiftly, indicating that more liquid is lifted to the cloud-top region, indicating more cloud lifetime. Thus we found that cloud microstructure and the precipitation forming process are sensitive to the aerosol loading.

POSTER PRESENTATION

04-20

COMPREHENDING THE LONG-TERM HYDROLOGICAL RESPONSE OF THE RIVER BASINS IN KERALA

R. Gowri[1*], P. J. Jainet[2], Jose George[1], Sinan Nizar[1], C. C. Bajish[1] and K. P. Sudheer[1,3,4]

[1]KSCSTE - Institute for Climate Change Studies, Kottayam, 686004, India
[2]KSCSTE - Centre for Water Resources Development and Management, Kozhikode,673571, India
[3]Department of Civil Engineering, Indian Institute of Technology Madras, Chennai, 600036, India
[4]Kerala State Council for Science Technology and Environment, Thiruvananthapuram, 695004, India

Background: The global water crisis has aggravated due to the combined effects of natural and human-induced climate change, exacerbated by a growing human population. Therefore, ensuring water security is essential, especially considering its profound impact on the mental, physical, nutritional, and socio-economic well-being of individuals. Long-term water budget assessment provides insightful inferences about the water availability in a catchment and helps develop a sustainable policy framework in response to these evolving water stress conditions.

Method: The Variable Infiltration Capacity (VIC) model is employed over the river basins of Kerala (including the transboundary river basins extending to Karnataka and Tamil Nadu) for the period 1951-2022 at 0.25^0 grid resolution to simulate the long-term water balance components. Statistical trends of hydroclimatic variables are evaluated at annual and seasonal scales using the non-parametric Mann-Kendall (MK) test and Sen's slope estimation at a 5% significance level. The change points in trends are evaluated using the Sequential MK test.

Results: Significantly increasing trends are observed in the annual rainfall and runoff values at several locations, especially along the Western Ghats. However, declining trends in water availability are manifested in the northern river basins. In most grids, evapotranspiration is found to have consistently increasing trends, whereas all the other water balance components show mixed trends across the study region. On an annual scale, the predominant component in the water balance partitioning is baseflow, followed by actual evapotranspiration and surface runoff. Additionally, several change points are detected for all the annual water balance components, signifying the uneven distribution of the water resources within the river basins.

Conclusions: The annual and seasonal water balance studies signify pronounced seasonal variations in water availability within the river basins of Kerala. The observed variations in trend patterns reveal an inherent non-linear behaviour in the considered hydrological processes. Moving forward, a comprehensive basin-wise analysis, considering the inter-relationships among various hydro-climatological factors, must be conducted to critically assess the distribution of water resources within the State. The findings of this study can serve as a fundamental basis for developing sustainable strategies for improved water resources management.

Keywords: Water Availability, VIC Model, Water Balance, Trend Analysis, Kerala Rivers

04-21

CHARACTERIZATION OF BOUNDARY LAYER HEIGHT OVER A HIGH-ALTITUDE SITE IN WESTERN GHATS USING A CEILOMETER AND MICROWAVE RADIOMETER

A. R. Aswini*, E. A. Resmi and R. K. Sumesh

National Centre for Earth Science Studies (NCESS), Thiruvananthapuram, India

Background: Measurements on the diurnal evolution of the atmospheric boundary layer over high altitude complex terrains are essential to understand the vertical transfer of momentum, energyand the mixing of pollutants in the lower troposphere.There are only limited studies available on the boundary layer evolution from complex terrains specifically the Western Ghats.The investigation of local boundary layer evolution and associated mixing helps to understand the role of regional pollution on air qualityover the pristine Western Ghats region.

Method: In this study, aerosol backscatter and temperature profile data obtained from a ceilometer (CHM 15k Nimbus) and a microwave radiometer (RPG-HATPRO) respectively, at the High-Altitude Cloud Physics Observatory (HACPO: 10° 9' 19.94" N, 77° 1' 6.65" E, 1820 m above MSL) site at Rajamallay near Munnar in Idukki district of Kerala., are used to study the structure of boundary layer height for the period 2021-2023.

Results: The diurnal variability of boundary layer height (BLH) from ceilometer and microwave radiometer (MWR) for the period 2021-23 on a monthly basis were evaluated, which showed distinct patterns. The MWR-derived BLH showed well-defined growth and decay during 09:00-18:00 IST. For BLH evaluated from ceilometer, the diurnal variability was less evident with a tendency to increase towards late evening hours. BLH derived from parcel method of MWR observations peaks at ∼12:30–1:30 IST, whereas the BLH derived from aerosol layers peaks at ∼18–20 IST. Monthly mean patterns revealed peak values in ceilometer BLH during March and April, while MWR BLH peaked during October and November. Ceilometer-derived BLH was found to be always higher than MWR BLH, with MWR data showing a maximum BLH extending to ∼1000 m, while, ceilometer derived BLH goes up to ~ 1700 m.

Conclusion: The observations helped to understand the differences between the thermodynamic boundary layer (given by MWR) and the material boundary layer (given by ceilometer), its structure, diurnal and seasonal evolution over the Western Ghats region. The ceilometer could detect full diurnal cycle of the BLH variations, whereas BLH height estimated from MWR through parcel method is accurate in the convectively unstable atmosphere. However, during periods of advection and transport of aerosols, which largely affects mountain regions, ceilometer data of BLH may be affected. Over mountain region such as the Western Ghats, the influence from aerosols transported from valley regions also influence the ceilometer backscatter profiles.

Keywords: Boundary layer height, Western Ghats, ceilometer, microwave radiometer

04-22

COMPARATIVE STUDY OF CLIMATOLOGICAL DIURNAL TEMPERATURE RANGE OVER THE FOUR MAJOR AIRPORT LOCATIONS IN KERALA

Madhu Vazhathottathil

Department of Atmospheric Sciences, School of Marine Sciences, CUSAT, Kochi-16

Background: All-India mean annual temperature is quiet varying. The significant warming trend is shown for the past few years. There is a substantial acceleration of warming during last decades. The major turn-around in the diurnal asymmetry of temperature over the Indian region is contributed by the features of surface minimum and maximum temperature. This study focused on the Diurnal Temperature Range (DTR) variability over the Four Major Airport Locations in Kerala (Trivandrum, Kochi, Karipur and Kannur) for the Period 1991-2020.

Data and Methods: The Daily Surface Air temperature (Maximum & Minimum) from the India Meteorological Department Website for the period 1991 to 2020 was used to compute the Diurnal Temperature Range (DTR) over the four Airport locations in Kerala. Climatology and anomalies of surface temperature are also computed for the time series analysis.

Results: The DTR value is an indicator of weather and climate over region and DTR can give information regarding the weather over a location. It is found that the annual average of DTR are low for the Trivandrum and Kochi Airport locations (8.6^{o}C) expects cloudy weather with precipitation compared to the high DTR over Karipur and Kannur stations (9.3^{o} C). The DTR indicate the durations of sunshine or solar radiation over a region.

Conclusions: Since the DTR is an indicator for the weather over a location, the pre-knowledge

about monthly climatology of DTR help us to understand the seasonal weather pattern such as cloudy, rainy, or sunny day over a location such as airports or public place. The knowledge of DTR values attribute to the Safety and Health benefit of the passenger.

Keywords: Diurnal Temperature Range (DTR), Surface air temperature, Global warming

04-23

SPACE-BASED LANDSLIDE SUSCEPTIBILITY ASSESSMENT OF WAYANAD, NORTHERNKERALA: A STATISTICAL APPROACH

Athul B.*[1], Mubashira[2] and SumithSatheendran S.[1]

[1]Amrita-Natural Resource Monitoring Laboratory (Amrita-NRML), Earth Observation Group,DepartmentofChemistry,AmritaVishwaVidyapeetham,Amritapuri Campus,Kerala
[2]Department of Statistics, Kannur University, Kerala

A landslide can be described as the movement of a substantial volume of rock, debris, or earth down a slope. Landslides represent the abrupt and often unforeseen downward motion of saturated over burden, carrying a diverse assortment of materials ranging from fine soil particles to large boulders, causing destruction and sweeping away everything in its path. In the realm of landslide susceptibility analysis, remote sensing and Geographic Information System (GIS)play pivotal roles by furnishing invaluable data and tools for monitoring, mapping, and evaluating areas prone to landslides. The objective of this study is to generate a landslide susceptibility map for the Wayanad region using the frequency ratio method. Additionally, it aims to establish the correlation between these land slides and the various factors that trigger them. The current investigation focuses on the Wayanad district in Kerala, an area characterized by its hilly terrain situated in the Western Ghats region of Kerala, India, which has a history off requent land slide incidents. In this study, 12 causative factors (including Slope, Rainfall, Elevation, Land Use and Land Cover (LULC), Soil type, Aspect, Stream density, Proximity to Streams and Roads, Curvature, Geology, and Land slide Inventory) were employed to construct the landslide susceptibility map based on the Frequency Ratio method. According to the Frequency Ratio analysis, the factors with the highest weights for landslide susceptibility mapping in Wayanad are slope (12.193), followed by Curvature (9.780), and Aspect (9.069). The landslide susceptibility map of Wayanad district is categorized into four risk classes: Very High, High, Moderate, and Low. The majority of the area falls into the high landslide risk zone (33.73%), with a portion designated as a very high-risk area (15.60%), followed by moderate risk (32.5%) and low risk (18.16%) of testudinate.

Keywords: Landslide, Geographic Information System, Frequency Ratio, WesternGhats

04-24

RISING TEMPERATURES IN KERALA: EXAMINING HEATWAVES AND HUMAN COMFORT OVER THE DECADES

Sruthin Vijay [1*], C.C Bajish[1], Sinan Nizar[1] and K. P. Sudheer[1,2,3]

[1]KSCSTE – Institute for Climate Change Studies, Kottayam
[2] Department of Civil Engineering, Indian Institute of Technology Madras, Chennai 600 036, India. [3] Kerala State Council for Science Technology and Environment, Thiruvananthapuram

Background: According to the 2013 report from the Intergovernmental Panel on Climate Change (IPCC), a rise in the global average temperature is expected to result in an escalation of Heat Waves (HW). HW have measurable impact on air quality, human health (dehydration, cramping, heat exhaustion, and/or heat stroke) and the environment. The Heat Index (HI) is utilized as a metric to assess human comfort or discomfort, mirroring the effects of HW on human health and welfare. Notably, there is a notable gap in comprehensive research regarding the incidence and characteristics of HW in Kerala.

Method: ClimPACTv2 (R-based) software is utilized to identify the decadal changes of HW aspects (number (HWN), duration (HWD), frequency (HWF), amplitude (HWA), and magnitude (HWM)) over Kerala during the period (March- July) from 1971–2020 along with HI analysis following Steadman's approach.

Results: The decadal summation and anomalies of the 5 HW aspects showed gradual increase in each aspect across (1971-1980, 1981-1990, 1991-2000, 2001-2010, 2011-2020) periods based on ClimPACTv2 HW criteria, indicating the growing impact of climate change in the region. Spatial analysis further identified areas in Kerala more prone to heat stress. Additionally, the study calculates the Heat Index (HI) for Kerala, using a constant relative humidity of 70% and assessing both extreme (based on maximum monthly Tmax) and moderate (based on monthly Tmean) temperature conditions from 1951 to 2020. The HI, which reflects human discomfort due to heat, shows that February to May is particularly critical, falling into the 'Danger'category in extreme scenarios and 'Extreme Caution' in moderate conditions. This trend, especially notable in the last decade (2011-2020), highlights Kerala's increasing vulnerability to heat-related issues, posing risks to human and animal well-being

Conclusions: These converging insights from this study on the HW and HI across Kerala are crucial for informing targeted mitigation and adaptation strategies to address the challenges posed by rising temperature and HWs in the context of ongoing climate change.

Keyword: Heatwaves, Heat Index, Heat Stress, HW Aspects, ClimPACT.

04-25

EFFECT OF CROPMANAGEMENT PRACTICES ON WATERBALANCE COMPONENTS IN AN AGRICULTURAL CATCHMENT

Jose George[1*], Sinan Nizar[1], R. Gowri[1], Aiswarya B. Babu[1], C. C. Bajish[1] and K. P. Sudheer[1,2,3]

[1]KSCSTE – Institute for Climate Change Studies, Kottayam, Kerala 686 004, India, [2]Department of Civil Engineering, Indian Institute of Technology Madras, Chennai 600 036, India,[3]Kerala State Council for Science Technology and Environment, Thiruvananthapuram 695 004, India.

Background: The water balance of a catchment and its response to anthropogenic forcing is complex and underscores the need for modelling studies apart from historical observations. Crop management practices can have significant impact on the water balance components in a region. From this perspective, understanding the hydrology of Bharathapuzha river basin (BRB)with specific consideration to its crop management practices is of paramount importance sit flows through areas with intense paddy farming. Moreover, the catchment area has suffered from extreme flooding and dry events in the recent warming climate, with parts of the catchment under severe water stressed condition.

Method: The water balance components of BRB was estimated by employing the SWAT model with different levels of management operations to study the impact of water management on the water balance components.

Results: The water balance components of the model setups with and without crop management practices, show statistically significant differences between them. The model configuration with irrigation operations results in 6% decrease in the catchment water yield. This can be attributed to the allocation of water for irrigation, causing a reduction in the amount of water flowing into the river channel.

Keywords: Water Balance, Hydrological Modelling, Crop Management, Irrigation Scheduling

4-26

TOTAL DISSOLVED SOLID PREDICTION USING HYBRID MACHINE LEARNING MODELS – A CASE STUDY

Nikitha P. Bhaskar [1,2]*, Arunkumar K. S[1] and Arun P. R.[2]

[1] Department of P G Studies & Research in Geology M E S Ponnani College, University of Calicut, Ponnani, Kerala, India

[2] Hydrology and Climatology Research Group, Centre for Water Resources Development and Management, Kunnamangalam, Kerala, India

Background: The assessment and prediction of water quality parameters, like Total Dissolved Solids (TDS), are essential for comprehending the health of ecosystems and promoting sustainable management of water resources. Precise determination of TDS is critical in the Chaliyar River Basin, an area of great ecological and economical significance. The study's ultimate goal is to help choose the best modeling strategies for accurate and dependable TDS prediction in the Chaliyar River Basin.

Methods: During the pre-monsoon season in the Chaliyar River Basin, 82 water samples were collected. Physical and chemical laboratory measurements were conducted to assess various parameters, including alkalinity, Cl, Ca, Na, K, Mg, NO_3, NO_2, PO_4, and Fe. The primary focus of this study was the prediction of TDSutilizing chemical parameters. This prediction was achieved using the Random Forest and M5 Tree models implemented within the Weka software.

Results: The random forest model exhibits strong predictive performance, as indicated by a high correlation coefficient of 0.9999, minimal mean absolute error at 0.3842, and low root mean squared error of 0.6091. In contrast, the M5 tree model shows slightly lower predictive accuracy with a correlation coefficient of 0.9799, higher mean absolute error at 4.528, and elevated root mean squared error at 7.2238.

Conclusion: The Random Forest model performs better for TDS prediction in the Chaliyar River Basin compared to the M5 Tree model. The Random Forest model's ability to capture complex relationships between various influencing factors might contribute to its superior performance in this context. The Random Forest method stands out as one of the most effective machine-learning approaches for classification tasks.

Keywords: Chaliyar River Basin, Machine learning, Random Forest model, M5 Model Tree

4-27

AN IMPROVED TECHNIQUE TO INCREASE THE BARE SOIL MAPPING ACCURACY IN WETLANDS AND URBAN AREAS

P. S. Smitha[1*], K. Maya[1], K. P. Sudheer[2], K. Sreelash[1] and D. Padmalal[1]

[1]National Centre for Earth Science Studies, Akkulam, Thiruvananthapuram- 695011
[2]Indian Institute of Technology Madras, Chennai- 600 036

Background: Bare soil plays a vital role in the regional ecosystem as it acts as an indicator of urban expansion along with other developmental activities. The unprecedented changes in land cover over the past few decades have been a threat to the health and long term sustainability of the ecosystem. Hence the accurate assessment of bare soil in urban, rural and wetland areas with high prevalent human activities can provide useful insights on the environmental and ecological impact of urbanization. Recently remote sensing has been widely used in the mapping and management of land resources. However, analysis of remote sensed data is not straightforward due to the similarity and overlapping of various land cover types. The major difficulty faced in the identification of bare soil is in its differentiation from built up surface, whose reflectance values are often very close to that of bare soil. The main focus of this study is to formulate an index that can delineate bare soil from other land cover types in both urban and wetland areas.

Method: In this context an advanced multispectral bare soil index for wetlands (AMBSI) has been proposed using green, red, near infrared and shortwave infrared bands of Sentinel 2 MSI image. The new index was tested for accuracy and robustness in highly populated Thiruvananthapuram airport region and Vembanad wetland ecosystem. The validation of AMBSI was performed in Girna dam site in Maharashtra and Saputara lake area of Gujarat. The proposed index was compared with the most widely used bare soil indices namely bare soil index (BSI) and dry bare soil index (DBSI). The accuracy assessment of AMBSI was performed using producer accuracy, user accuracy, overall

accuracy and F1 score. The contrast of bare soil area of AMBSI with other land cover features was determined with respect to other indices. The robustness of threshold was assessed over a broad range of threshold values.

Results: A high F1 score of 0.96 was obtained for AMBSI. The results also showed that the proposed bare soil index exhibited an increase in contrast value of 40% and 20% with vegetation and water background respectively compared to BSI and DBSI. The proposed index also depicted robustness in threshold stability compared to other indices. The consistency of performance of the index for Landsat and MODIS was also determined and the performance of AMBSI was found to be consistent for other sensors also.

Conclusion: The proposed bare soil index can effectively separate bare soil from water, vegetation and built up area which is highly dominant in the study area. Moreover, this index can be used for monitoring the rate and extent of urban expansion in a small state like Kerala.

Keywords: Bare soil index, Remote sensing, Sentinel, F1score, built up areas

04-28

ANALYSIS ON THE EFFECT OF THE PRE-SEISMIC ACTIVITY ON IONOSPHERE-THERMOSPHERE DYNAMICS FOR THE M 8.8 EARTHQUAKE IN CHILE

Aswathy R.P* and Parvathy S.

Department of Physics, University of Kerala, Thiruvananthapuram
e-mail: aswathyrp872@gmail.com

Earthquake, natural, unexpected, and sudden phenomena, causes massive harm to human life, material properties, the eco system environment, and regional structural alterations. Hence, developing earthquake prediction techniques at both short and long-timescales is critical for reducing massive losses. In the present study, an attempt has been made to analyze thermospheric and ionospheric perturbations caused by the major earthquake having magnitude 8.8, which occurred on 27th February 2010 in Chile (36.122° S, 72.898°W),using TIMED and C/NOFS satellite observations. Thermospheric neutral density rises two weeks before the earthquake (increment ~ $3.0 \times 10^{11} cm^{-3}$), before which the trend was declining. In the two weeks preceding the earthquake catastrophe, however, an6 Kdecrement in neutral kinetic temperature in the thermosphere is detected. The response of ionospheric parameters is quite different. The ion density decreases sharply one week prior to the event (decrement is $3.5 \times 10^{4} cm^{-3}$) and increases in the 4 to 1 pre-earthquake week (increment is $2.08 \times 10^{5} cm^{-3}$). The zonal electric field shows a sharp increment one week prior (2mV/m(decrement). It shows increment in trend 3 to 1 weeks prior to the occurrence of earthquake. In accordance with that, sharp changes in plasma velocity components and plasma temperatures are also observed in the specified time bin. This could be due the wave-induced variabilities in the ionosphere-thermosphere system. Analysis of the zonal and meridional wind in two distinctly separated altitudes in thermosphere reveals the upward amplitude enhancement trend which is indicative of the presence of atmospheric waves in conjunction with the earthquake event.

04-29

IMPACTS OF MODERNIZATION OF THANEERMUKKAM BARRAGE IN THE SOUTHERN PLAINS AND COASTAL AQUIFERS

C.P Priju*, Angel P. Thomas, Deepa Baby, Aiswarya P. G., Angel Hanna John and Ajeesh N. Pillai

KSCSTE-Centre for Water Resources Development and Management, Kozhikode

Background: The Thanneermukkam bund is planned with the objectives of preventing ingress of salinity into Kuttanad during the summer and for retaining freshwater flows into the wetland from the rivers. MS Swaminathan Research Foundation undertook a comprehensive study in the region and suggested remedial measures to mitigate the agrarian distress faced by the region (*Kuttanad package)* and one of the key recommendations is to alleviate salinity problems in the region was the modernization of Thanneermukkam bund. The study is to understand the impacts of modernization of Thaneermukkam bund on - Coastal aquifers, Spatial and Temporal salinity spreading pattern in the Vembanad wetlands upstream of the barrage, Salinity intrusion magnitude into rivers and changes in water quality parameters of surface water bodies, Water quality of open wells in the floodplains of rivers draining into the wetland and groundwater level changes in the floodplains of five rivers draining into the backwater system.

Method: Wells were selected for groundwater sampling (in-situ and lab measurements) and seasonal piezometric measurements in appropriate intervals. Seasonal water levels and in-situ measurements of water quality from each observation well was carried out. The following in-situ parameters were determined viz., temperature, pH, Eh, electrical conductivity, salinity, total dissolved solids and turbidity using a handheld multi-parameter probe. The selected samples were analysed further to determine other chemical constituents.

Results: The TDS in March 2019 in the samples ranges from 48 mg/l to 3022 mg/l with an average value 1535 mg/l. In February 2021, the value ranges from 31mg/l to 1769mg/l with an average of 900mg/l. Salinity values in March 2019 varied from 0.04ppm to 2.20 ppm with an average 1.12 ppm. In the year February 2021, the value ranges from 0.0009 ppm to 2.36 ppm with an average value 1.18 ppm. The major ions concentration in the study area shows that Na-Ca-Cl-HCO_3 type dominated and the major ions are Na^+, Ca^{2+} and Cl^-.

Conclusions: Based on the study it can be concluded that after the modernisation of the bund showed gradual reduction of EC, salinity & TDS compared before the modernisation of the bund indicating it has significant influence on the groundwater quality of the aquifers upstream region.

Keywords: Coastal Aquifers, Thanneermukkam bund, Groundwater Quality, Kuttanad Region, Vembanad Backwaters

4-30

ASSESSMENT OF SHORELINE CHANGEALONG THE COASTAL LANDSCAPEOF KASARAGOD DISTRICT, KERALA

Sushama S.* and Dr. Jayapal G.

Department of Geography, Kannur University

Background: Coasts are dynamic systems, undergoing changes in form and processes spatially and temporally with respect to marine conditions and geomorphic features. It is one of the nation's greatest environmental and economic assets. Shoreline is one of the major indicators to understand the nature of coastal processes and sea level variations. It helps to assess the intensity of coastal hazards.

Method: The satellite images of Google earth explorer from 1991 to 2011 have been used for shoreline change detection using digital shoreline Assessment system (DSAS). The study used Net Shoreline Movement (NSM), End Point Rate (EPR), Linear regression rate (LRR) statistical methods for measuring the shoreline dynamics.

Results: The analysis of NSM and EPR indicates that the study area suffered substantial changes during the selected years. The multidated data indicated the growth and movement of erosion and accretion of coastline.

Conclusion: This study is helpful in identifying and quantifying the erosion and accretion rate and shoreline rate of the Kasaragod coast.

Keywords: Shoreline changes, Erosion, Accretion, DSAS

04-31

CALC-ALKALINE LAMPROPHYRE INTRUSIVES FROM SALEM BLOCK, SOUTHERN GRANULITE TERRANE, INDIA

M. R. Nandu*, Y. Anilkumar and A. P. Pradeepkumar

Department of Geology, University of Kerala, Kariavattom, Thiruvananthapuram, Kerala.

Background: Lamprophyres are defined as mantle-derived mafic-ultramafic volatile-rich alkaline igneous rocks characterized by porphyritic- panidiomorphic texture with phenocrysts of hydrous mafic silicates such as amphibole and mica with feldspars, where recognizable, are always restricted to the groundmass. Although these rocks are volumetrically insignificant (<1%), they have profound implications for understanding enrichment and depletion processes in the sub-continental lithospheric mantle (SCLM), and large-scale geodynamic processes. Lamprophyres are known to be diamondiferous and some are also associated with the mesothermal gold-copper deposits and hence of economic significance. It can be seen that lamprophyres are widespread in the Indian Shield and are found right from the Archaean to the Eocene. The lamprophyre bodies described in this study are reported from the Salem block of southern granulite terrane. One is from the Omalur Igneous Complex and Another from the Chalk Hill complex.

Method: carried out multiple phases of fieldwork to locate the lamprophyres and the associated rock

types. Further to this, individual representative exposures across certain locations were selected to document the full range of mineralogical, textural and structural variations. Representative samples were collected from the field. The Petrographic and ore-microscopic investigations were carried out by using a high-end reflected and transmitted polarising microscope (Leica DM 2700P), available at the Department of Geology, University of Kerala.

Results: All the studied samples display porphyritic-panidiomorphic texture with hydrous mafic phase as phenocryst and feldspar confined essentially to the groundmass. Amphibole phenocrysts are euhedral in shape and display glomeroporphyritic texture. Combined megascopic and petrographical studies reveal that lamprophyres are to be free from visible crustal xenoliths. Albitization of feldspars and the presence of secondary amphiboles has been noticed in the samples under study. This is consistent with the alteration (dueteric) – prone nature of the lamprophyres recorded worldwide owing to their highly volatile contents.

Conclusions: Based on the mineralogy, all three lamprophyre bodies are classified as Calc Alkaline variety of lamprophyres. According to the International Union of Geological Sciences (IUGS) classification, Calc-alkaline lamprophyres are essentially associated with convergent settings. So, the lamprophyre intrusives from various parts of Salem block possibly indicate an active subduction zone in the Precambrian time, which is ultimately related to the assembly-evolution-disruption of supercontinents through time. So, further studies of this lamprophyre should bring new insights into the tectonic evolution of SGT.

Keywords: Lamprophyres, Calc-alkaline lamprophyres, Salem block, SGT, Convergence settings

05–FISHERIES AND VETERINARY SCIENCES

ORAL PRESENTATION

05-01

ENVIRONMENT FRIENDLY EXTRACTION AND PURIFICATION OF ANTICOAGULANT POLYPHENOLS FROM MARINE MACROALGAE OF SARGASSACEAE FAMILY

Ans Mariya George[1,2], Kajal Chakraborty[1], Leena Devadas Marypushpam[1], Shubhajit Dhara[1]

[1]Marine Biotechnology Fish Nutrition and Health Division, ICAR-Central Marine Fisheries Research Institute, Ernakulam North P.O, P.B. No. 1603, Kochi, 682018, India. [2]Faculty of Marine Sciences, Lakeside Campus, Cochin University of Science and Technology, Kochi, Kerala
Corresponding author: ansmariyageorge16@gmail.com

Background: Marine macroalgae are pivotal components of the oceanic ecosystem, due to their diverse therapeutic applications. Recent studies underscore the pharmaceutical promise held by marine macroalgae, with a specific focus on their antioxidant and anticoagulant activities. Among the bioactive compounds, polyphenols emerge as notable anticoagulants, exerting their effects through the inhibition of key enzymes in the coagulation cascade, including thrombin and Factor Xa. Additionally, polyphenols modulate platelet function, contributing to a reduction in the formation of blood clots. This research sheds light on the therapeutic potential of marine macroalgae, particularly their role in preventing coagulation-related disorders.

Method: Polyphenolic extracts from seven marine macroalgae (*Turbinaria ornata, Turbinaria conoides, Turbinaria decurrans, Sargassum ilicifolium, Sargassum tenerrimum, Sargassum wightii*, and *Sargassum plagiophylum)* were obtained using acetone: water: acetic acid and ethanol: water: acetic acid (70:29.7:0.3, v/v/v). Based on the antioxidative activities among these, *Sargassum plagiophylum* were selected for resin purification and used for *invitro* anticoagulant studies (aPPT and PT assays) using human umbilical vein endothelial cells (HUVECs). *In vitro* platelet aggregation study was conducted by aggregometry and SEM imaging.

Result: In this study, a comparative analysis of total phenolic contents (ranging from 78.04 to 143.56 mg GAE/mL), total phloroglucinol contents (6.71 to 19.77 mg PGE/g), and antioxidant activities ($IC_{50} < 0.6$) revealed varying levels among different species of marine macroalgae. Particularly noteworthy was the robust activity exhibited by *Sargassum plagiophyllum*, prompting a more detailed investigation through resin purification and NMR fingerprinting techniques. Further examination demonstrated that the tested polyphenols displayed potent in vitro anticoagulant activity in a dose-dependent manner. The activated partial thromboplastin time (aPTT) clotting time was measured at 114.78 seconds, while the prothrombin time (PT) clotting time was recorded at 86.015 seconds. Polyphenols extracted from *S. plagiophyllum* not only decreased the expressions of Factor Xa (FXa) but also exhibited a reduction in platelet aggregation. Additionally, alterations in platelet morphology and a time-dependent reduction in fibrin polymerization were observed.

Conclusion: The findings of this study underscore the potential of brown seaweeds as reservoirs of antioxidant and anticoagulant polyphenolic compounds, and could open promising avenues for developing interventions to mitigate disorders related to oxidative stress and thrombosis.

Keywords: Seaweeds, Polyphenols, anticoagulants, Resin, Phlorotannins.

05-02

CHARACTERISATION AND COMPARATIVE ANALYSIS OF THE MILK TRANSCRIPTOME IN HIGH AND LOW MILK PRODUCING CROSSBRED CATTLE OF KERALA USING RNA SEQUENCING

Haritha B. Pillai*, Naicy Thomas, T.V. Aravindakshan, Elizabeth Kurian

Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, Mannuthy-680651, Kerala Veterinary and Animal Sciences University, Pookode, Wayanad

Background: Globally, milk and milk products are considered as a staple food for human beings. It may be deciphered that dairy industry is one of the most important contributors to the livestock sector. Transcriptome profiling and comparison in high and low milk producing crossbred cattle, would unravel the biological differences in the pathways and functions related to differences in milk production.

Method: High throughput RNA sequencing (RNA-seq) was used to generate the milk transcriptome of three high and low milk producing crossbred cattle and to investigate the variation of gene expression in the transcriptome profile associated to the milk production traits.

Results: A total of 48 genes were differentially expressed significantly between high and low milk producing crossbred cattle ($p \leq 0.05$), of which43 genes were upregulated and5 genes were downregulated in high milk producing crossbred cattle compared to low milk producing crossbred cattle. According to KEGG pathway analysis, AMP-activated protein kinase signalling had the highest level of enrichment among upregulated genes in comparison between high and low milk-producing crossbred cows. Riboflavin metabolism and neurotrophin signalling had the highest level of enrichment among upregulated and downregulated genes, respectively, in high milk producing crossbred cows compared to Vechur cows. According to GO analysis in comparison between high and low milk-producing crossbred cows, detection of chemical stimulus, brush border membrane and phosphatidylserine binding had highest enrichment in biological process, cellular component and molecular function categories. The enrichment analysis also revealed that specific metabolic and immunological pathways are related to cattle milk yield traits.The result was validated using ten selected DEGs by qPCR, and the expression patterns were consistent with the deep sequencing results obtained by RNA-Seq.

Conclusion: Therefore, this work provided a comprehensive understanding of the transcriptome of bovine milk in crossbred cattle from Kerala in association with milk production. These findings provide significant resources for biological research on crossbred cattle of Kerala, as well as prospective recommendations for understanding the relationship between milk production and immune function.

Keywords: Differentially expressed genes, milk yield, RNA-seq, transcriptome.

05-03

MICROBIAL TECHNOLOGY FOR ENHANCED HEALTHY SCAMPI SEED PRODUCTION AS PART OF ONE-HEALTH APPROACH TO BOOST REGIONAL AQUATIC FOOD PRODUCTION IN SUPPORT OF KERALA RURAL ECONOMY

K. P. Vinusree and I. S. Bright Singh

National Centre for Aquatic Animal Health, Cochin University of Science and Technology, Cochin 682016, Kerala, India

Background: *Macrobrachium rosenbergii*, the giant freshwater prawn, has been widely cultivated in Kerala both commercially as well as in homestead ponds for domestic use. However, the past two decades witnessed decline in the popularity of the species for commercial culture thanks to the introduction of *P. vannamei* having a comparatively shorter culture period and higher demand in the international market. This situation was augmented by the lack of quality broodstock and seed at the right time and even round the year as well. Considering seed availability at affordable price as the single factor, two impediments were found paving the way for failures at hatchery level even though the hatchery technology for seed production has been well developed. They were white tail diseases and vibriosis, besides decline in the larval population during the 30-day larval period due to various unknown reasons. This suggests the requirement of a preventive health care strategy to be implemented at seed production stage to improve the larval survival with an input of healthy seed. This work was undertaken with an objective to develop a microbial technology to be implemented at the seed production stage to produce quality scampi seed.

Method: As the first step, profiling of immune and immune-related genes in *Macrobrachium rosenbergii* was investigated to unravel the basic and non-specific immune structure of the animal during 11 larval stages and post larvae using selected genes under the category. Having found that all the stages were equally immunocompetent to all genes, post larvae were selected for further experimentation. The objective was to develop a microbial technology based on gut probiotics and immunostimulants indigenously developed at this Centre. To accomplish this target, three different treatment plans with triplicates and three control groups were set up. In test-1, post larvae were fed with preparation of marine yeast isolate *Candida* sp. MCCF 101 (MY-1) enriched *Artemia nauplii*, in test 2 they were fed with a preparation of two bacterial strains such as *Bacillus cereus* MCCB 101 and *Arthrobacter nicotiana* MCCB 104 (Enterotrophotic) enriched *Artemia nauplii*, and in test – 3, post larvae were fed with MY-1 and Enterotrophotic enriched *Artemia nauplii* and the onesin control tanks were fed with placebo *Artemia nauplii*. After 15 days of treatment the post larvae were challenged with the pathogenic *Vibrio alginolyticus* MCCB 112 and the survival was analysed. A field experiment was then carried out in a commercial hatchery having MY-1 and Enterotrophotic administered bioencapsulated in *Artemia*, and having Placebo *Artemia* as the control. The survival in both the systems was assessed at the time of harvesting.

Results: Among the three combinations of probiotics and immunostimulants the post larvae fed with MY-1 and Enterotrophotic performed best in terms of survival, resistance to pathogen invasion and immune status**.** On field level validation approx. 10% more survival of larvae could be achieved on the above combination. Moreover, the larvae in the test were found visibly more healthy and active demonstrating the positive impact of the treatment.

Conclusions: The microbial technology developed here for enhanced production of healthy seed

includes feeding the larvae from Mysis 1 to PL20 with bioencapsulated MY-1 and Enterotrophotic on continuous basis. This technology can easily be integrated in to the existing hatchery practice by simply adding the preparation to the *Artemia nauplii* (Instar II) hatching tank and incubating for two hours prior to feeding.

Keywords: *Macrobrachium rosenbergii*, immunity, probiotics, survival, growth.

05-04

UNRAVELLING THE GENETIC AND CHEMICAL BASIS OF THE ANTIBACTERIAL EFFICACY OF A HETEROTROPHIC *BACILLUS VELEZENSIS* (MTCC13304) ISOLATED FROM MARINE MACROALGA

Sreelakshmi Aravind Kuppadakath[1], Kajal Chakraborty[1*], Chesvin Varghese[1], Nisha Alex[1], Anjana A. G.[1], Silpa K. P.[1]

Marine Biotechnology Fish Nutrition and Health Division, Central Marine Fisheries Research Institute, Ernakulam North P.O., P.B. No. 1603, Cochin-682018, Kerala, India
Corresponding author: sreelakshmiaravindk@gmail.com

Background: Marine microbes that coexist with marine macroalgae have been receiving greater attention in recent years due to their capability to biosynthesize several newer metabolites possessing potent anti-microbial properties. *Bacillus* species with maritime ancestry develop an extensive range of secondary metabolites with distinct structural features. In the current work, the heterotrophic bacterium, *Bacillus velezensis* MTCC13304, isolated from the marine macroalga *Sargassum wightii* was screened for its antimicrobial activity and the genetic and chemical basis of the activity was decoded.

Methods: The isolate of *Bacillus velezensis* (MTCC13304) from *Sargassum wightii* was confirmed by 16srRNA sequencing. The disc diffusion method was used to assess the antibacterial activity of the extract soluble in ethyl acetate. Using the Illumina HiSeq X10 technology, whole-genome sequencing was carried out to detect the molecular basis of the antibacterial activity of *Bacillus velezensis*. Additionally, the polyketide synthase functional gene was amplified to demonstrate the presence of polyketides suggestive of antibacterial properties. The bacterium was subjected to extensive extraction and chromatographic purification to yield a macrocyclic lactone of polyketide origin, which has been characterized by detailed spectroscopic experiments.

Results: The heterotrophic bacteria *Bacillus velezensis* associated with marine algae *Sargassum wightii*, have demonstrated a promising inhibitory potential against a variety of pathogenic microorganisms. The whole genome of *B. velezensis* was sequenced using Illumina HiSeq X10 next-generation sequencing, which showed the greatest genome size among *Bacillus* members that are currently available. Using AntiSMASH genome mining, comparative genome analysis revealed 17 biosynthetic gene clusters (BGCs) in *B. velezensis*. These clusters aid in the production of secondary metabolites, such as plipastatin, fengycin, bacillibactin, and surfactin, which are produced by non-ribosomal peptide synthases (*NRPSs*). Moreover, the genes encoding polyketide synthase (*PKS*) were identified for producing difficidin, bacillaene, macrolactin, andbutirosin A/B. By amplifying the polyketide synthase gene, the presence of a polyketide-promoting antibacterial action was confirmed. Spectroscopic characterization revealed a 24-membered substituted macrocyclic lactone of polyketide origin.

Conclusion: The study demonstrated that marine macroalgal symbiont *Bacillus velezensis* MTCC13304has significant antibacterial activity, and is constituted by potential biosynthetic gene clusters leading to the biosynthesis of24-membered polyketide-derived macrocyclic lactone with potential antibacterial activity against nosocomial pathogens. This study is of particular significance to develop a novel antibiotic lead for use against pathogenic bacteria including multidrug-resistant pathogens.

Keywords: Marine macroalga; *Bacillus velezensis* MTCC13304; novel antibiotic lead; 24-membered polyketide-derived macrocyclic lactone; genome mining; antibacterial activity.

05-05

QUALITY ASSESSMENT AND SHELF-LIFE DETERMINATION OF UNDERUTILIZED FISH *GRAMMOPLITES SUPPOSITUS* (TROSCHEL, 1840) DURING REFRIGERATED STORAGE

Haritha Haridas[1], Ginson Joseph*[1], Remya Kumari K. R.[2]

[1]School of Industrial Fisheries, Cochin University of Science and Technology, Cochin-682016, [2]National Institute of Fisheries Post Harvest Technology and Training, Foreshore Road, Cochin-682 016, Corresponding author: ginsonjoseph@cusat.ac.in

Background: *Grammoplites suppositus,* commonly known as spotfin flathead, remains underutilized owing to its physical traits, masking its significant nutritional potential. Despite its prevalence in bycatches, it has not gained significant attention, contributing to its limited utilization. These factors underscored the need to conduct an in-depth analysis of its shelf-life to encourage broader acceptance of the species and integration into commercial use.

Method: The whole fish (WF) and dressed fish (DF) samples of spotfin flathead were stored in refrigerated condition (2-4º C). The quality indices of both groups were measured through physiochemical (pH, TMA-N, TVB-N, FFA, PV, TBA, colour, texture), microbiological (Total Plate Count, Psychrotrophic bacterial count) and sensory analysis, at a set interval of two days until the sample underwent spoilage.

Results: Gutting the fish before iced storage extended its shelf life by 2-3 days compared to storing the whole fish in ice. Significant differences were observed in the quality indices of WF and DF samples ($p<0.05$) throughout the storage period. Analysis of total plate count, TVBN, and sensory evaluation showed a high correlation during the refrigerated storage period. The WF samples had a shelf-life of 8-10 days, and DF samples extended their shelf-life for up to 10-12 days during refrigerated storage. However, the lipid oxidation products were prominent in the DF samples.

Conclusions: The study highlighted the impact of the processing method on the storage life and quality of spotfin flathead during iced storage. The observed shelf-life of the species opens opportunities for the optimum utilization of this species leveraging its commercial potential.

Keywords: *Grammoplites*, flathead, refrigerated storage, shelf-life, quality assessment.

05-06

EVALUATION OF DUCKWEED (*LEMNA MINOR*) AS A PLANT PROTEIN SOURCE IN THE DIET OF ROHU (*LABEO ROHITA*) FINGERLINGS

Suja Nagampoozhi, Riswana N. and Arathi S.

St. Aloysius College, Edathua, Alappuzha
**Corresponding author: nsuja_r@yahoo.co.uk*

Background: The study was carried out to evaluate dried duckweed, *Lemna minor*, as a dietary protein source for fingerlings of rohu (*Labeo rohita*).

Method: Four different experimental diets were prepared with similar energy to protein ratios were fed to the fingerlings of rohu with an average initial weight of 14.0 g for 60 days. A diet containing 15%, 30% and 45% duckweed respectively was substituted for the commercial 32% protein control-group diet.

Results: The results revealed that there was no significant difference between the growth performance of fish that were fed with diets containing up to 45% duckweed and fish that were fed with the control diet ($P>0.05$), except for the group of fish on the 15% duckweed diet. Also, no significant difference was observed among treatments with respect to feed utilization ($P>0.05$). While carcass lipid content increased, protein content of the fish fed with a diet of 15% duckweed increased compared to other groups ($P<0.05$).

Conclusion: The results showed that a diet consisting of up to 15% duckweed content could be used as a partial replacement for fish meal in the diet of rohu fingerlings.

Keywords: Aqua feed, Fish meal, Spirulina, Physical properties, Proximate composition.

05-07

MODULATION OF CYP1B1 BY PLANT EXTRACTS AND PHYTOCHEMICALS AS POTENTIAL CANDIDATES FOR ANTICANCER THERAPY

Sujith S[1], Dhanusha G[2], Bimitha Benny[3], Sandesh Krishna[3] and Roshni Sivaraman[3]

[1]Assistant Professor, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences, Pookode, [2]MVSc Graduate, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences Mannuthy, [3]MSc Graduates, Department of Veterinary Biochemistry, College of Veterinary and Animal Sciences Mannuthy

Background: Cytochrome P450 1B1 (CYP1B1) is a heme-thiolate monooxygenase involved in NADPH-dependent phase I metabolism of a variety of xenobiotics.CYP1B1 is involved in the metabolism of a wide variety of xenobiotics, such as ethoxyresorufin, theophylline and caffeine, and shows some overlapping metabolic activities with CYP1A1 and CYP1A2. Unlike most CYPs, CYP1B1 expression is not detected in human liver, but CYP1B1 is expressed in many extra-hepatic tissues, including lung, colon, eye and kidney. CYP1B1 shows activity toward activation of environmental carcinogens via the hydroxylation of procacinogens, including 27 polycyclic aromatic hydrocarbons and their derivatives, 17 heterocyclic and aryl amine and aminoazo dyes, 3 mycotoxins, 2 nitroaromatic hydrocarbons. Hence down regulation of this gene can be of immense

use in therapy of cancer.

Method: Extracts of *Boerrhavia diffusa, Asparagus racemosus, Tamarindus indica, Mallotus phillipensis* and *Narringenin* were diluted serially from 640 to 5 µg/mL and then assayed for cytotoxicity by MTT assay on MCF-7 cells. The IC50 was calculated by Graph padprism and the cells were exposed to Half, IC50 and double IC50 concentrations of the compounds for 96 hours. The cells were then collected by trypsinisation, RNA isolated, cDNA synthesied and subjected to RT-PCR using custom synthesised primers and the fold changes calculated, keeping *GAPDH* as control gene.

Results: There was a dose dependent inhibition of proliferation of cells in all the treatments and IC50 were found to be 267, 170, 190, 16, 395 µg/mL for *B. diffusa, A. racemosus, M. Phillipensis, T. indica* and Narringenin respectively. It is evident that the extracts of *A. racemosus, B. diffusa* and Narringenin produced a reduction in the expression of CYP1B1 whereas *T. indica* and *M. phillipensis* caused an increase in the expression of the gene. *T. indica* caused a dose dependent increase in the gene expression where as *M. phillipensis* caused a dose dependent decrease in gene expression.

Conclusions: From the study, it could be concluded that the phytochemicals under study can reduce the expression of CYP1B1 and can be used as anticancer drugs acting by a novel pathway.

Keywords: CYP1B1, *B. diffusa, A. racemosus, M. Phillipensis, T. indica,* Narringenin.

05-08

ANTI-INFLAMMATORY POTENTIAL OF NOVEL SULFATED GLYCOSAMINOGLYCAN FROM *PERNA VIRIDIS*: AN *IN VIVO* STUDY

Ashwin A. Pai[1,2], Archana R[3], Shubhajit Dhara[1,2], Anoopraj R[4], Bibu John Karayil[3 and] Kajal Chakraborty[1,*]

[1]Marine Biotechnology, Fish Nutrition and Health Division, Central Marine Fisheries Research Institute, Ernakulam North, P.B. No. 1603, Cochin 682018, Kerala State, India, [2]Department of Chemistry, Mangalore University, Mangalagangothri- 574199, Karnataka State, India, [3]Department of Veterinary Pharmacology & Toxicology, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala State, India, [4]Department of Veterinary Pathology, College of Veterinary and Animal Sciences, Mannuthy 680651, Kerala Veterinary and Animal Sciences University

**Corresponding author: ashwinashokpai@gmail.com*

Background: The growing demand for therapeutics obtained from natural sources has prompted the exploration of promising immunomodulatory agents.

Method: Previously undescribed (1→3)/(1→4)-linked sulfated glycosaminoglycan polysaccharide was isolated from Asian green mussel *Perna viridis*, with potent anti-inflammatory activity. Polysaccharides obtained from *Perna viridis* was chromatographically fractionated by using diethyl amino ethyl cellulose. Depending upon the higher carbohydrate content, column fraction PVP-2 was selected for further study and subjected to comprehensive spectroscopic characterization. Monosaccharide composition of PVP-2 was determined by High performance liquid chromatography (HPLC). Partially methylated alditol acetates (PMAA) of PVP-2 were prepared by a series of derivatization reactions and the glyosidic linkage pattern was evaluated by gas chromatography coupled with mass spectrometry (GC-MS) data. PVP-2 was assessed for the ability to reduce the

activity of pro-inflammatory enzymes, specifically 5-lipoxygenase (5-LOX) and cyclooxygenase-1,2 (COX-1,2). *In-vitro* studies of PVP-2 on lipopolysaccharide (LPS)-induced RAW 264.7 macrophage cell line involved quantitative estimation of suppression of nitric oxide (NO) secretion. Furthermore, the anti-inflammatory activity of studied sulfated glycosaminoglycan polysaccharide (PVP-2) was evaluated by two *in vivo* animal models (carrageenan and formalin induced paw edema), where dose-dependent inhibition of paw edema was quantified with different time interval.

Results: The polysaccharide obtained from *P. viridis* (PVP-2), when subjected to monosaccharide compositional analysis and spectroscopic characterization, revealed predominant recurring units identified as β-(1→3,4)-GlcNS*p* (unit A) and α-(1→4)-GlcA*p* (unit B). PVP-2 displayed potent anti-inflammatory effect by attenuating cyclooxygenases (COX-1, 2) and 5-lipoxygenase (5-LOX) (IC_{50} < 2 mg mL^{-1}) enzymes with a higher selectivity index ($IC_{50\ COX\text{-}1}/IC_{50\ COX\text{-}2}$ ~1.7) towards COX-2. In a concentration-dependent manner ranging from 1 to 10 µg/mL, PVP-2 exhibited the ability to suppress the secretion of NO in lipopolysaccharide (LPS)-induced RAW 264.7 cells. At a concentration of 3 µg/mL, PVP-2 efficiently restored NO levels to homeostasis by mitigating excessive production. The *in vivo* investigation of PVP-2 at a dosage of 22 mg/kg body weight demonstrated a substantial and time-dependent reduction in carrageenan-stimulated paw edema, with an 82% inhibition observed at the 5th hour. Notably, this reduction was comparable to the efficacy of the standard indomethacin treatment, which achieved an 87% inhibition of paw edema. Administering PVP-2 at a dosage of 110 mg/kg body weight led to a significant inhibition of formalin-induced paw edema, persisting for up to 10 days. By the end of the 10th day, the group treated with PVP-2 displayed a paw thickness reduction ratio four times higher than that observed in the formalin-induced group.

Conclusion: The polysaccharide isolated from *P. viridis* possesses anti-inflammatory potential, and could be utilized as a naturally derived source to mitigate inflammation related disorders.

Keywords: Sulfated polysaccharide, *P. viridis*, Anti-inflammtory property.

05-09

TOXICITY OF HEXACONAZOLE IN AQUATIC CRUSTACEANS - AN *INSILICO* AND *INVIVO* APPROACH

Nimisha M. A. [1], Sherin Thomas[1], Gouri Krishna C.[1], Archana Raj[2], Angel Benny[2], Suresh N. Nair[2] and Nisha A. R[3]

[1]MSc scholar (Applied Toxicology), Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy. [2]Research Assistant, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy. [2]Associate Professor, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy. [3]Associate Professor and Head, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy-680651

Background: Hexaconazole, a systemic imidazole fungicide, is employed for the management of various seed-borne and soil-borne diseases caused by fungi, notably Ascomycetes and Basidiomycetes. In this study, we conducted both *in silico* and *in vivo* evaluations to assess the acute toxicity of Hexaconazole using the model organism *Artemia salina*.

Method: *In silico* assessment of toxicity: A docking study was performed using Autodock V4.2 after

setting appropriate grid and docking parameters, downloading the receptor proteins from Alpha Fold protein Structure database and predicting the acute LC50 in *Artemia salina*. *In vivo* assessment of toxicity: Concentrations of hexaconazole at 6 µg/ml, 3 µg/ml, 1.5 µg/ml, 0.5 µg/ml, 0.03 µg/ml, 0.003 µg/ml, 0.0003 µg/ml were prepared by serial dilution using the salt water. The experiment was conducted under uniform conditions as the stock culture was kept in the lab. The experimental group consisted of five replicates with each replicate containing ten *A. salina* were treated with various concentrations of hexaconazole at 48 hours after exposure the number of live mobile and dead brine shrimps was recorded.

Results: *In the in silico toxicity assessment of brine shrimp, the binding energies (Kcal/mol) of the brine shrimp receptor proteins kinase and histone deacetylase with the ligand hexaconazole were determined as -7.21 and -6.67, respectively. This indicates that the protein kinase receptor exhibits a higher affinity for hexaconazole compared to histone deacetylase. In the in vivo toxicity evaluation of brine shrimp, it was observed that the LC 50 value of Hexaconazole against Artemia was found to be 1.761 µg/ml.*

Conclusions: *The results indicate the substantial ecotoxic potential of hexaconazole. The comparison between in silico and in vivo approaches reveals a consistent demonstration of toxicity, establishing the harmful effects of hexaconazole for aquatic arthropods and computationally through in silico analysis.*

Key words: *Brine shrimp, in vivo toxicity, Hexaconazole, ecotoxicity, in silico toxicity, Docking.*

05-10

EVALUATING CYTOTOXICITY AND MODULATION OF OESTROGEN RECEPTORS IN MCF-7 CELLS BY *B. DIFFUSA*

Nisaath Begum[1], Sujith S.[2], Krishnanjana V. J.[3], Sunkara Prathyusha[4] and Nisha A. R.[5]

[1]PhDScholar, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences Mannuthy, [2]Assistant Professor, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences, Pookode, [3]MVSc Scholar, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences Mannuthy, [4]PhD Scholar, Department of Veterinary Parasitology, College of Veterinary and Animal Sciences Mannuthy, [5]Associate Professor and Head, Department of Veterinary Physiology, College of Veterinaryand Animal Sciences Mannuthy, Thrissur-680651

Background: Oestrogen is an important hormone which exerts its effects through the nuclear receptor oestrogen receptor alpha (ERα) and oestrogen receptor beta (ERβ) and the G protein–coupled receptor family (GPER), respectively. G-protein coupled oestrogen receptor is expressed ubiquitously and is known for regulation of endocrine, immune, neuronal and cardiovascular functions. The cell growth regulatory effects of GPER aids in therapeutic interventions in cancer biology. *Boerhavia diffusa (B. diffusa)* in ayurveda classified as "rasayana" herb, posseses antidiabetic, immunomodulatory, anticonvulsant, hepatoprotective, antibacterial, antiproliferative and anti-oestrogenic activities. The present study aims to evaluate the modulation of GPER-mediated pathways, particularly emphasizing its potential modulation in the landscape of cancer therapeutics. Thus, targeting this receptor presents a promising frontier in developing effective treatment regimens against various cancers and challenges concerning reproductive health.

Method: Methanolic extract and fractions of *B. diffusa,* were diluted serially from 160 to 10 µg/mL and then assayed for cytotoxicity by MTT assay on MCF-7 cells. The IC50 was calculated by Graph padprism and the cells were exposed to Half, IC50 and double IC50 concentrations of the extracts for 96 hours. The cells were then collected by trypsinisation, RNA isolated, cDNA synthesized and subjected to RT-PCR using custom synthesised primers and the fold changes calculated, keeping *GAPDH* as control gene.

Results: Methanolic, n-hexane, dichloromethane, n-butanol and water fractions of *B. diffusa* exhibited dose dependent decrease in cell viability as indicated by the increase in cytotoxicity from 10 to 160 µg/mL, with n-hexane exhibiting the lowest IC50 value (49.77 µg/mL) and dichloromethane showing the highest (90.11 µg/mL). *B. diffusa* showed varying effects on oestrogen receptors ERα, ERβ and GPER. Methanolic and hexane fraction predominantly showed a dose dependent reduction in the expression of all three receptors. Butanol and water fractions, exhibited considerable increase in all receptor expressions, particularly GPER.

Conclusions: From the study it could be seen that methanolic and hexane fractions of *B. diffusa* produced a reduction in the expression of ERα, ERβ and GPER. Whereas, Butanol and water fractions caused an increased expression of the genes. The observed differential effects of the methanolic extract and its fractions on gene expression, suggest a promising avenue for targeted gene modulation, indicating therapeutic interventions in mitigating cancer and reproductive health challenges.

Key words: *B. diffusa,* GPER, ER-α, ER-β, Tamoxifen.

05-11

IDENTIFICATION OF DIFFERENTIALLY EXPRESSED GENES AND CHARACTERIZATION OF PATHWAYS IN CROSSBRED AND VECHUR CATTLE IN KERALA

Jemima Jasmine A.*, F. A. Lali, L. A. Bindya, Muhasin Asaf, A. J. Roshin, D. K. Deepak Mathew

Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences University, Wayanad, Pookode-673576

Background: Transcriptomic analysis is a standard procedure to understand various biological processes and to monitor the molecular consequences that occur in different experimental conditions. Whole blood transcriptome profiling and identification of differentially expressed genes (DEGs)in crossbred and Vechur cattle in Kerala would provide knowledge on the genes that are associated with biological pathways that ultimately aids in the survival of the animal.

Method: Whole blood transcriptome profiles of three crossbred and Vechur cattle were generated using high throughput RNA sequencing (RNA-seq) platform in order to investigate the variation of gene expression

Results: A total of 394 genes were differentially expressed significantly in crossbred and the native breed of cattle ($p \leq 0.05$), of which 146 transcripts were upregulated and 248 were downregulated during the study. Gene ontology (GO) analysis demonstrated that the DEGs were enriched in specific biological processes with regard to inflammatory response, positive regulation of angiogenesis, cell

migration, cell differentiation, innate immune response, protein homodimerization activity and calcium ion binding. The Kyoto encyclopedia of genes and genomes (KEGG) pathway analysis with 394 DEGs revealed that the most statistically significant metabolic pathways were related to cytokine-cytokine receptor interaction pathway, pathways in cancer, axon guidance and complement and coagulation cascades.

Conclusion: The data generated in the study can be used to identify molecular markers which can be incorporated in the future breeding programs to increase the production status and to combat the challenging climatic conditions

Keywords: Differentially expressed genes, Vechur, RNA-seq, whole blood.

05-12

SPECIFIC AUDIENCE TARGETED SOCIAL MEDIA CAMPAIGNING AS A RAPID AND EFFECTIVE EXOTIC SPECIES INVASION MANAGEMENT STRATEGY: A CASE STUDY OF SUCCESSFUL REDUCTION IN THE POPULATION OF *PTERYGOPLICHTHYS PARDALIS* FROM RIVER BHARATHAPUZHA

Greeshma Pradeep and F. G. Benno Pereira

Department of Zoology, University of Kerala, Thiruvananthapuram

Background: Exotic Species invasion is one of the major reasons of global biodiversity loss, yet information on the management and eradication the invaded species is insufficient.

Methods: A conceptual framework proposed on the basis of the management of the exotic species *Pterygoplichthys pardalis* in River Bharathapuzha, provides a globally applicable model for a rapid and effective strategy for managing invasive exotic species.

Results: The research process included an evaluation of the sudden appearance of exotic species in the river after the 2018 Kerala flood. Management of rapidly growing population of *Pterygoplichthys pardalis* during the COVID-19 pandemic was implemented with the help of social media groups involving fishermen, anglers and citizens living near the river, and yielded positive results. The policy agenda highlights an urgent need for regulation of introduction pathways, prioritization of the worst invasive species, shifting from species- to biota-centric approaches, looking beyond political borders, forging interdisciplinary collaboration, launching a national network, and generating public awareness.

Conclusions: Adopting a social media – integrated framework for early management of invasive species into the fisheries policies in India, and in other developing countries, can serve as a rapid exotic population management strategy which is a crucial step in reducing biological invasions.

Keywords: Exotic species, social media, *Pterygoplichthys pardalis*, Bharathapuzha.

05-13

SUSTAINABLE RECIRCULATING AQUACULTURE SYSTEM (RAS) FARMING IN KERALA: ADDRESSING KEY CHALLENGES

Anagha Raju and Benno Pereira F. G

Department of Zoology, University of Kerala, Kariavottom, Thiruvananthapuram-695581, Kerala, India

Background: Recirculating aquaculture systems (RAS) are an emerging innovative approach to sustainable fish farming. In Kerala, the RAS industry faces various challenges impacting farmers' livelihoods and environmental sustainability. This study delves into RAS farmers' current practices and challenges and seeks sustainable and efficient solutions.

Method: A comprehensive survey involving 40 RAS farmers from different regions of Kerala was conducted. Data were collected utilizing visual documentation and structured questionnaires.

Results: Findings reveal persistent challenges in RAS farming, underscoring the need for targeted interventions. Key issues include High operational costs of RAS and feed prices, concerns about seed quality, difficulties in water management, the impact of temperature variations, and Tilapia marketing issues, which emerged as central to the findings.

Conclusion: The study advocates the need for region-specific strategies to enhance the resilience of RAS farming. Addressing these challenges through government support, developing cost-effective RAS systems, formulating budget-friendly fish feeds, market development, initiating farmer training, and researching optimized RAS technologies can unlock Kerala's RAS potential, contributing to food security, economic development, and environmental sustainability.

Keywords: Recirculating aquaculture system, Kerala, Sustainability, Feed, Water quality.

05-14

CONSUMER PERCEPTION AND FRESH FISH MARKETING AT FISH MARKETS OF THIRUVANANTHAPURAM DISTRICT, SOUTH KERALA

Chinnu S. Raj* and S. Sabu

School of Industrial Fisheries, Cochin University of Science and Technology, Foreshore Road, Pallimukku, Ernakulam, Kerala, 682016.
**Corresponding author: chinnu19@cusat.ac.in*

Background: Kerala is considered one of the leading marine fish-consuming states in the country. Seafood is famous for its perishability, and if not handled and preserved properly leads to spoilage. In Kerala, a major share of fish landed is marketed for domestic consumption, particularly in the fresh form. In this study, an attempt was made to understand the present status of fish handling, and traditional marketing techniques at the fresh fish markets of Thiruvananthapuram district and also the consumer perception towards fish quality and the decision-making process during fresh fish purchase.

Method: Proportional Random Sampling, with a semi-structured questionnaire method, was employed. A consumer perception survey was conducted in 13 fish markets of Thiruvananthapuram

district with 390 respondents.

Results: 59% of consumers prefer to buy fish coated with sand, and 37% believe fish selling in sand bed or fish coated with sand is a hygienic handling practice and can keep the fish in fresh condition. 27.2% of consumers responded that they are forced to buy sand-coated fish as they do not have any other option.41% of consumers in the study opined that they dislike purchasing iced fish. 64% of consumers in the markets opined that the fish is coated with sand to cover/hide the spoilage of fish.

Conclusion: There exists a knowledge gap among consumers and fish handlers on fish contamination and incorrect fish handling techniques in the Trivandrum fish markets. Lack of usage is quality ice will affect the storage life of fresh fish. The findings of this investigation will pave the way for more focused research on the hazards associated with sand-coated fresh fish marketing in the Trivandrum markets and the need for appropriate monitoring and regulatory mechanisms to supply safe and healthy fish to the fish-eating population in the region.

Keywords: Seafood, Hygienic Handling, Contamination, Hazards, Seafood safety.

05-15

TECHNOLOGY MAPPING OF MACHINES USED IN THE SEAFOOD INDUSTRY: AN EMPIRICAL EXAMINATION OF SEAFOOD UNITS IN KERALA IN THE CONTEXT OF INDUSTRY 4.0

Abhirami Subash and Hareesh N Ramanathan

School of Industrial Fisheries, Cochin University of Science and Technology, Kochi 682016, India

Background: Technological improvements have brought about considerable modifications in the seafood business, which is an essential part of the global food supply chain. The seafood industry, a crucial part of the global food supply chain, is experiencing significant changes due to technological advancements across the world. The fourth industrial revolution, or Industry 4.0, is integrating smart technologies like robotics, automation, big data, robotics, and artificial intelligence (AI) to promote innovation and streamline processes. Seafood products are widely consumed and valued globally, but their perishability has led to the development of various processing, preservation, and analytical approaches. Kerala, a state rich in marine resources, has the potential to become a successful seafood industry by implementing the concepts of Industry 4.0.

Method: The study aims to map the level of technology in the machinery used in the seafood industry in Kerala. The survey method was carried out in Kerala, where samples were taken from two districts, Ernakulam and Alappuzha, which are considered as the hubs of seafood companies. Primary data was collected through the survey and analyzed with sophisticated statistical tools to understand the technological level of the machines.

Result: The study was able to map the level of technology in seafood processing machines in seafood industries.

Conclusion: The seafood sector in Kerala was assessed in terms of the advancements in the technology of the machinery used there. This study concludes the importance of understanding the level of technology in the seafood industry, which can enhance the production capacity per company by utilizing the resources efficiently.

Keywords: Industry 4.0, seafood industry, machineries, technology adoption.

05-16

DIFFERENTIAL GENE EXPRESSION OF *TRACHINOTUS BLOCHII* BYRNA-SEQ

Lali F. A.[1], Sandhya Sukumaran[2], V. G. Vysakh[2], T. V. Aravindakshan[1] and A. Gopalakrishnan[2]

[1]Kerala Veterinary and Animal Sciences University, Pookode, Wayanad- 673576, Kerala, [2]Indian Council for Agricultural Research - Central Marine Fisheries Research Institute, Cochi-682018, Kerala

Background: *Trachinotus blochii* is a promising candidate species for coastal mariculture in India, owing to its fast growth, good meat quality, survivability in varying salinity and high market demand. However, the species faces several challenges in the aquaculture industry including the sporadic occurrence in wild, limitations of year-round spawning and seed production and differential growth pattern as per the changing environmental parameters. The genetic and genomic information could help to address these challenges, but such information is scarce forsnubnose pompano.

Methods: In this study, we developed a de novo transcriptome assembly of T. blochiifrom liver and muscle tissues of larval and adult stages employing short read paired end sequencing. The assembled transcripts were annotated and differential expression analysis was done between larval and adult stages and between liver and muscle tissues of T. blochii.

Results: We generated a total of 121,812,576 RNA-Seq read pairs using Illumina HiSeqX10 platform. The cleaned reads were assembled into 254,244 contigs (N50 = 2299 bp) and generated a total of 209,261 genes and successfully annotated 54,245 transcripts. Functional annotation using sequence similarity search against database KEGG identified gene ontology terms such as biological processes (3432), cellular components (742) and molecular function (2021). Differentially expressed transcripts were found to be 3442 ($p \leq 0.05$) between larval and adult stages among which 1471transcripts were up-regulated (logFC>1) and 1971transcripts were down-regulated (logFC< -1). The comparison between liver and muscle tissues revealed that 6558 transcripts were differentially expressed and 3028 transcripts were up-regulated (logFC>1) and 3530 were down-regulated (logFC< -1).

Conclusion: The results provide transcriptome resources for Trachinotus blochii that are the key information to develop genomic tools to combat the challenges in the aquaculture industry of the species.

Key words: *Trachinotus blochii*, De novo transcriptome assembly, gene annotation, DEGs, aquaculture in India.

05-17

IDENTIFICATION OF GENETIC VARIANTS BY WHOLE GENOME SEQUENCING IN VECHUR AND KASARGODE CATTLE OF KERALA

T. X. Seena[1], Elizabeth Kurian[1], Lali F. A.[5], P. M. Rojan[1], T. V. Aravindakshan[2], Aziz Zarina[3] and George Sherin K.[4]

[1]Assistant Professor, [2]Senior Professor and Head, Department of Animal Genetics and Breeding, [3] Assistant Professor, Department of Veterinary Physiology, [4]Associate Professor, Department of Animal Nutrition, College of Veterinary and Animal Sciences, Mannuthy, Kerala,[5]Assistant Professor, Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, Pookode, Kerala, Kerala Veterinary and Animal Sciences, University, Pookode, Wayanad, Kerala, PIN. 680651

Background: The Vechur and Kasargode cattle are unique animal genetic resources of Kerala, which are known for their disease resistance and adaptability. An understanding of the genetic variability among the different groups of cattle would help in improving the traits of interest and prioritising the conservation goals for these native cattle. The whole genome sequencing (WGS) is a novel tool for identifying the genetic variants, an attempt was made to identify the genetic variants in Vechur and Kasargode cattle using WGS data.

Method: The WGS of pooled DNA samples from 15 Vechur and Kasargode cattle were conducted separately, subjected to quality control and aligned to the reference *Bos taurus* genome assembly ARS-UCID2.0. The mapped reads were subjected to variant calling and variant annotation using Freebayes and snpeff programmes, respectively.

Results: The genetic variant analysis identified an effective genome length of 2,76,70,83,036 in Vechur and 2,76,75,07,651 in Kasargode cattle groups. A total of 1,99,34,247 variants were observed in Vechur cattle at a rate of 1 in every 138 bases; whereas a total of 1,96,72,089 variants at a rate of 1 in every 140 bases in Kasargode cattle. Intergenic and intronic variants were high in Vechur compared to Kasargode cattle. The highly variable, low, moderate and modifier regions were found to be high in Vechur, compared to Kasargode cattle. The number of Single Nucleotide Polymorphisms, Multiple Nucleotide Polymorphisms, insertions, deletions and mixed variants noticed was 1,66,49,750, 10,49,708, 8,97,041, 9,80,868 and 3,56,880 in Vechur cattle and, 1,64,44,817, 10,49,280, 8,73,845, 9,53,777 and 3,50,370 in Kasargode cattle, respectively. The number of missense, nonsense and silent mutations, and the ratio between missense to silent mutations were higher in Vechur (0.6939) than in Kasargode (0.6894) cattle. Similarly, the ratio between transitions to transversions was found to be high in Vechur (2.3217) when compared to Kasargode cattle (2.3206).

Conclusions: Results of the study provided a comprehensive knowledge of the genetic variation existing between Vechur and Kasargode cattle groups, which will be useful for successful breeding and effective management of existing germ plasm of native cattle in Kerala.

Keywords: Genetic variants, WGS, Vechur, SNP, native cattle of Kerala.

POSTER PRESENTATION

05-18

DEVELOPMENT AND FORMULATION OF AN OXYTETRACYCLINE INCORPORATED VEGETABLE OIL ORGANOGEL AND ITS CHARACTERIZATION

Suresh N Nair[1] Angel Benny[2], Thaware Rahul Hansraj[3], Gijo Ittoop[4] and Sanis Juliet[5]

[1]Associate Professor, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy and P.I. KSCSTE-SRS project on the Development of organogel for antibiotics administration in aquaculture. [2]Project Fellow, KSCSTE-SRS project on the Development of organogel for antibiotics administration in aquaculture, [3]MFSc scholar, Department of Aquatic Animal Health Management, Kerala University of Fisheries and Ocean Studies Panangad, Kochi. [4]Assistant Professor, Department of Aquatic Animal Health Management, Kerala University of Fisheries and Ocean Studies Panangad, Kochi. [5]Associate Professor and Head, Department of Veterinary Pharmacology and Toxicology, Kerala Veterinary and Animal Science University Pookode

Background: Antimicrobial agents, such as oxytetracycline, hold significant therapeutic value in various domains, necessitating innovative delivery systems for enhanced efficacy. This study introduces the development of an oxytetracycline-incorporated vegetable oil organogel, a potential candidate for controlled drug delivery.

Method: The research encompasses the meticulous formulation and characterization of this novel organogel, employing beeswax as the gelator. The minimum quantity of gelator required for gelation was determined using the inversion method with varying concentrations of beeswax. Furthermore, the organogel was enriched with oxytetracycline, and its molecular interactions were probed using Fourier-transform infrared spectroscopy (FTIR).

Results: The ATR-FTIR analysis confirmed successful oxytetracycline incorporation, evidenced by synchronized absorption peaks in the spectra of pure oxytetracycline and oxytetracycline-incorporated organogel, absent in the spectrum of pure oil.

Conclusion: This research presents a versatile platform for oxytetracycline delivery, with potential applications in healthcare and agriculture.

Keywords: Oxytetracycline, Organogel, Controlled Drug Delivery, Gelation, Fourier-transform Infrared Spectroscopy, Beeswax, Inversion Method.

05-19

ANTIFUNGAL SUSCEPTIBILITY OF DERMATOPHYTES ISOLATED FROM COMPANION ANIMALS

Jwala, Vinay C H, Sreelakshmi P, Jasmin C*

Enfys Life Science Pvt. Ltd., Nedumbassery, Ernakulam 683 578, Kerala, India
**Corresponding author: cjasmina78@gmail.com*

Background: The companion animals such as cats and dogs are prone to various skin diseases caused by insects and microorganisms, of which the infections caused by fungus (dermatophytes)

are difficult to be treated. Dermatophytes cause superficial infections on skin, hair and nail, and degrade keratin found in the hair and nail. At several times, these infections are misdiagnosed and mismanaged with the topical application of ointments and creams containing incorrect antifungal agents which contributes to the emergence of antimicrobial resistance. Current study investigates the prevalence of antimicrobial resistance among dermatophytes isolated from infected companion animals.

Method: There were 22 dermatophytes isolated from 30 clinical samples in dermatophyte test media (DTM). The dermatophytes were classified based on colony morphology and microscopic appearance of cells stained with lactophenol cotton blue. Identity of representative isolates were also confirmed by sequencing nuclear ribosomal internal transcribed spacer (ITS) gene following sanger sequencing technique. The response of dermatophytes towards Fluconazole (25mcg), Itraconazole (10mcg), Ketoconazole (10mcg), Amphotericin B (20mcg) and Miconazole (30mcg) were tested following standard disc diffusion assay in Mueller Hinton Agar (MHA) media.

Results: Based on the morphological and microscopic properties, the isolates were grouped into *Candida mucifera* (4nos), *Curvularia senegalensis* (1no), *Pencillium citrinum* (6nos), *Aspergillus assiutensis* (6nos), and *Talaromyces funicolosum* (5nos). Identity of representative isolates from each group was confirmed by comparing the sequence similarity with available sequences in NCBI and the sequence were submitted in GenBank. Majority of the dermatophytes showed resistance against Ketoconazole (73 %), followed by Fluconazole (55 %), Amphotericin B (50%). Resistance toward Itraconazole and Miconazole were found among 18 % and 14 % of isolates respectively.

Conclusion: The results indicate the prevalence of antimicrobial resistance against fungal pathogens in companion animals, which needs to be addressed with care considering the possibilities of the transfer of antimicrobial-resistant dermatophytes from animals to humans and the threat to One Health strategy.

Keywords: Dermatophytes, Zoonotic disease, Pet animals, Antifungal agents.

05-20

ESTIMATION OF ACUTE TOXICITY OF AMITRAZ IN *DAPHNIA MAGNA*

Sneha C[1], Suresh N Nair[2], Sujith S[2]

[1]MSc scholar, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy. [2]Associate Professor, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy.

Background: Amitraz, a versatile insecticide and acaricide employed in veterinary medicine and agriculture, exhibits rapid efficacy in controlling ectoparasites, including mites and ticks, with sustained persistence on hair and wool for comprehensive parasite stage management. However, its environmental impact, particularly on non-target organisms in aquatic ecosystems, has raised concerns.

Method: This study utilized *Daphnia magna*, a freshwater ecotoxicological indicator species, to assess the ecotoxicological effects of amitraz. The experiment, conducted under standardized conditions, involved four replicates, each comprising ten adult *D. magna* sourced from healthy stocks in our lab.

Results: The investigation explored the impact of amitraz on aquatic invertebrate biomass through an adult *Daphnia magna* mortality test. The concentrations of 1, 0.5, 0.1, 0.01, 0.005, 0.001, 0.0005, 0.0001 and 0.00005 µg/ml of commercial amitraz preparations were prepared by serial dilution in filtered water. Following exposure, outcomes recorded the quantification of live, mobile organisms and dead daphnia. Employing non-linear regression with log dose transformation through GraphPad Prism, the LC50 value for amitraz was determined to be 0.005020 µg/ml, with a corresponding log LC50 of -2.299.

Conclusion: Complete mortality occurred at 1 µg/ml, highlighting the highly toxic nature of amitraz towards non-target aquatic crustaceans and emphasizing potential ecological consequences in aquatic environments.

Keywords: Amitraz, veterinary medicine, *Daphnia magna*, ecotoxicology.

05-21

TEMPORAL KINETICS OF OXYTETRACYCLINE: ASSESSING CONCENTRATION-INDEPENDENT BUT TIME-DEPENDENT ADVERSE EFFECTS ON AQUATIC ARTHROPODS

Angel Benny [1], Suresh N Nair [2], Gijo Ittoop [3] and Sanis Juliet[4]

[1]Project Fellow, KSCSTE-SRS project on the Development of organogel for antibiotics administration in aquaculture, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy. [2]Associate Professor, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy. [3]Assistant Professor, Department of Aquatic Animal Health Management, Kerala University of Fisheries and Ocean Studies Panangad, Kochi. [4]Associate Professor and Head, Department of Veterinary Pharmacology and Toxicology, Kerala Veterinary and Animal Science University Pookode.

Background: Ecotoxicological risk assessment is crucial for evaluating the potential harm of oxytetracycline, a broad-spectrum antibiotic commonly used in veterinary medicine and aquaculture, on aquatic and terrestrial ecosystems. When released into the environment, oxytetracycline can impact non-target organisms.

Method: Temporal kill kinetics examines the relationship between the exposure duration of a substance and its impact on a biological organism or system, such as a living organism or a specific environment. *Artemia salina* plays a crucial role in various fields, from aquaculture and research to education, making them a notable and versatile species for aquatic non-target toxicity assessment.

Results: Oxytetracycline concentrations of 0.01µg/ml, 0.1µg/ml, 1µg/ml, 25µg/ml, 50µg/ml and 100µg/ml were used to enumerate deaths of organisms after 24 hours and acute LC 50 assessment.0.01 µg/ml, 0.1µg/ml, 1µg/ml, 25µg/ml, 50µg/ml, 100µg/ml, 200µg/ml concentrations were used to establish time-response relationship estimation by finding per cent mortality at 12hr, 15 hr, 18 hr, 21hr, 24 hr, 27 hr, 30 hr, 33 hr, 36 hr, 39 hr, 42 hr, 45 hr, 48 hr. LC50 value of oxytetracycline against Artemia was found to be45.73 µg/mL.

Conclusion: Almost complete mortality was observed for 0.01µg/ml to 200µg/ml concentrations by 48 hours demonstrating that oxytetracycline can adversely affect aquatic arthropods, irrespective of their concentrations. Even at very low concentrations, deleterious effects were observed, highlighting

that the exposure duration is more significant than its concentration for ecotoxicity.

Keywords: Oxytetracycline, *Artemia salina*, Temporal kill Kinetics, Acute Toxicity, Aquatic ecotoxicity.

05-22

INSILICO ANALYSIS OF ESSENTIAL OIL CONSTITUENTS AS A PROSPECTIVE HEPATO AND NEPHROPROTECTIVE STRATEGY

Sona Shaji[1] and Suja Rani S[2]

[1]MSc Scholar (Applied Toxicology), [2]Associate Professor, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences, Mannuthy, Thrissur- 680651, Kerala Veterinary and Animal Sciences University

Background: The present study was aimed at *in silico* analysis of some of the essential oil constituents (EOC) on molecular targets, CYP2E1 and FXR to assess its plausible protective role against hepato and nephrotoxicity. Many drugs and chemicals tend to induce toxic effects on liver and kidneys, while CYP2E1 and FXR seems to be involved in many physiological changes occurring in liver and kidneys. CYP2E1 belonging to the cytochrome P450 super family is involved in the metabolism of various xenobiotics, whereas FXR participates in several pathophysiological processes including inflammation and oxidative stress.

Method: The EOC selected in this study included beta- caryophyllene, eugenol and citral. Beta caryophyllene is found in many essential oils, particularly cloveoils, whilst eugenol is a naturally occurring phenolic molecule found in several plants such as cinnamon, clove and bay leaves. Citral is a monoterpenoid aldehyde, found majorly in lemon grass. These EOCs are found to possess anti-inflammatory, antioxidant, antifungal and analgesic properties.

Results: In the study, these EOCs were downloaded from PubChem and the target proteins from RCSB PDB. Lauric acid and chenodeoxycholic acid, natural ligands of CYP2E1 and FXR respectively were also docked with their respective receptors for the comparative analysis. Molecular docking was performed using the docking program AutoDockTools-1.5.7. and the main parameter evaluated was the binding energy. The docking score observed against the receptor CYP2E1 for the ligands beta-caryophyllene, eugenol, citral were -7.38, -6.12, -5.21 respectively. However, the natural ligand lauric acid showed a binding affinity of -5.71. Likewise, the docking score observed against the receptor FXR for the ligands beta-caryophyllene, eugenol, citral were -6.02, -5.51, -5.32 respectively, whereas -4.86 was the binding energy for the natural ligand chenodeoxycholic acid. The results thus revealed the greater binding affinity of all the tested EOCs with beta caryophyllene showing maximum docking score against both CYP2E1 and FXR, when compared to the respective natural ligands.

Conclusion: The study indicated the effective modulatory potential of beta-caryophyllene, eugenol, citral on CYP2E1 and FXR, implying the prospectiverole of these EOCs as a hepato and nephroprotective strategy in the current scenario of augmented drug and chemical induced hepato and nephrotoxicity.

Keywords: Beta-caryophyllene, eugenol, citral, CYP2E1, FXR.

05-23

EXPLORING THE CONSTRAINTS OF MUSSEL CULTURE IN KASARGOD, KERALA

Surabi, B.P., Amna Shahna, P., Akhila Jayamon, Anjitha, K.A., Abhay, P., Dona, P., Asha Gopan and Nandana, U. S.

College of Fisheries, Payyanur, Kannur, Kerala

Background: Mussel farming is a vital industry in Kerala, contributing to 75.8% of bivalve production.

Method: Women Self-help Groups (SHGs) in Northern Kerala have successfully raised *Perna viridis* (Green mussel) in Kannur and Kasaragod districts. However, a study in the Madakkal village of Kasargod district revealed the presence of *Mytella strigata*, a concern for the mussel farming sector.

Results: The brown-colored mussel (*Mytella strigata*) was found to be dominated over the native *Perna viridis*. The other constraints ranked by the farmers were siltation of backwaters, lack of seed availability, shell gaping, morbidity, and salinity changes.

Conclusion: To improve mussel production sustainably, the number of farm units should be restricted to reduce the impact on carrying capacity, farm registration and licensing practices should be strictly monitored, and a mussel seed hatchery should be established. Promoting mussel culture through SHGs could enhance rural employment opportunities and overall empowerment of women.

Keywords: Women Self-help Groups, Mussel farming, *Perna viridis*, *Mytella strigata*, Kasaragod.

05-24

PROXIMATE COMPOSITION AND PHYSICAL PROPERTIES OF AQUAFEEDS WITH FULLY AND PARTIALLY INCORPORATED SPIRULINA

A.R Nikhila Khanna*, M. Harikrishnanand, Fredrick Juma Syanya

School of Industrial Fisheries, Cochin University of Science and Technology, Lakeside campus, Cochin, Kerala -682 016

**Corresponding author: nikhilakhanna.nk@gmail.com*

Background: Spirulina (*Arthrospira platensis*), is a filamentous and multicellular blue-green alga that grows in spirals of varying tightness, thriving in both fresh and saltwater. The amino acid composition of spirulina closely resembles that of fish meal, and it boasts high levels of omega-3 fatty acids, promoting enhanced fish growth and immunity. The level of incorporation of spirulina into fish diets not only depends on the fish species, but also on the overall proximate composition and physical properties requirement of the fish feed. The present experiment was designed to assess the nutritional composition and physical properties of aquafeeds with spirulina replacing fishmeal at different levels.

Method: Five iso-nitrogenous diets, comprising a control (diet 1) and four experimental diets incorporating spirulina at 25% (diet 2), 50% (diet 3), 75% (diet 4), and 100% (diet 5), were formulated. The proximate composition of the experimental diets was determined according to AOAC (2000)

standards. Physical properties, such as water stability, were assessed following Obaldo et al. (2002). The water absorption rate of the feeds was evaluated following Bijoy et al., (2018). Expansion ratios of diets were determined by following Oliveira et al. (1992) and bulk density following Misra et al. (2002).

Results: The diets used in the present study were highly nutritive and high in protein content identical to the control feed. The proximate composition analysis of the experimental diets revealed that the protein content varied between the ranges of 38.50 to 39.75%. Physical properties showed significant variations ($p<0.05$) in experimental diets in water stability, absorption, expansion ratio, and bulk density.

Conclusion: Spirulina feeds showed potential for substitution of fishmeal in fish feed production. The fish feed formulated with 50% spirulina could be identified as good pellets owing to their higher protein content, good water stability, water absorption, expansion ratio and bulk density when compared to fish meal feed. Therefore, Spirulina meal can be an alternative protein source in improving the protein content and physical properties of fish feed. This will also reduce the feed costs elevating the farming income and the pressure on food fishes and juveniles being exploited.

Keywords: Aqua feed, Fish meal, Spirulina, Physical properties, Proximate composition.

05-25

VALORIZATION OF 'MALABAR MONSOONED ROBUSTA COFFEE' HUSK FOR SYNTHESIS OF ZINC OXIDE NANOPARTICLES: ASSESSMENT OF ANTIOXIDANT, AND BIOCIDAL PROPERTIES AGAINST MULTI-DRUG-RESISTANT PATHOGENS OF PUBLIC HEALTH IMPORTANCE

Nakkady Chathamballi Sandeep[a], Jess Vergis[a] Padikkamannil Abishad[a], Vinod Valil Kunjukunju[a], Asha Karthikeyan[a], Sanis Juliet[b], Nitin Vasantrao Kurkure[c], Sukhadeo Baliram Barbuddhe[d], and Deepak Bhiwa Rawool[d]

[a]Department of Veterinary Public Health, College of Veterinary and Animal Sciences, Pookode, Kerala Veterinary and Animal Sciences University, Wayanad- 673 576, India. [b]Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences, Pookode, Kerala Veterinary and Animal Sciences University, Wayanad- 673 576, India. [c]Department of Veterinary Pathology, Nagpur Veterinary College, Nagpur- 440 006, India. [d]ICAR- National Meat Research Institute, Hyderabad- 500 092, India

Background: In the wake of antimicrobial resistance and the problems associated with the mismanagement of agro waste products, the value addition of coffee husk through nanotechnology could offer an eco-friendly and sustainable approach.

Method: The ethanolic extract of 'Monsooned Malabar robusta coffee' husk was used to synthesize the zinc oxide nanoparticles (ZnO NPs). The antibacterial as well as antibiofilm activity of the ZnO NPs were determined against multi-drug-resistant (MDR) bacterial strains. Besides, the safety as well as antioxidant potential of ZnO NPs was assessed.

Results: The ZnO NPs were successfully synthesized using the ethanolic extract of coffee husk and was verified by spectroscopy, X-ray diffraction and electron microscopy. The ZnO NPs exhibited potential antibacterial as well as anti-biofilm activity against MDR test strains of bacteria. In addition,

ZnO NPs was found to be safe in chicken erythrocytes; no detrimental effects were observed against commensal gut bacteria. A dose- dependent antioxidant activity was also exhibited by ZnO NPs.

Conclusions: This work demonstrated a successful sustainable valorisation method for the management of coffee husk as an agro-waste using nanotechnology to combat multi-drug-resistant bacteria test strains.

Keywords: Coffee husk; Valorization; Zinc oxide nanoparticles, Multi- Drug- Resistant bacteria.

05-26

A STUDY ON THE EXTRACTION PROCESS AND FUNCTIONAL PROPERTIES OF FISH PROTEIN CONCENTRATE FROM RED-TOOTHED TRIGGER FISH, *ODONUS NIGER* (RUPELL, 1836)

Freeda Rebecca Bastian[1], Ginson Joseph*[1], Remya Kumari K. R.[2]

[1]School of Industrial Fisheries, Cochin University of Science and Technology, Cochin-682016, [2]National Institute of Fisheries Post Harvest Technology and Training, Foreshore Road, Cochin-682 016, Corresponding author: ginsonjoseph@cusat.ac.in

Background: Human consumption of fish is rising steadily globally due to increased awareness about their nutritional significance. To meet this rising demand, diversifying the fishery resources to include low-value underutilized fishes is a dire necessity. These fishes utilized by fish meal industries have not gained much acceptance for human consumption due to several reasons, hence their conversion to suitable convenient products is required to uplift their value as a fishery resource. As the trash fish component from the fishing operation is inevitable, it is better to utilize them to produce convenient fishery products to eliminate resource wastage. The development of protein concentrates and hydrolysates is one of the better methods to utilize low-value resources.

Method: Fish protein concentrates (FPC) have been developed from under-utilized red-toothed triggerfish. FPCs were developed through solvent extraction method by cold extraction conditions using 90% ethanol. FPCs were prepared from both cooked and raw meat. Three extraction cycles were undertaken. The final products were analysed for their functional properties (bulk density, emulsion capacity and stability, foaming capacity and stability, water holding capacity and oil absorption capacity) to identify the best method.

Result: The FPCs developed had a minimum level of moisture and fat content. The FPCs produced variably from raw and cooked meat exhibited different levels of functionality. Better bulk density and foaming capacity were given by FPC developed from cooked meat while greater emulsion capacity and foaming stability were shown by FPC prepared from raw meat. The water holding capacity was invariable among samples whereas oil absorption was more in cooked meat samples.

Conclusion: Developing protein concentrates from under-utilized species is one of the appropriate measures to utilize them wisely. The developed FPCs could be incorporated into various convenience-based food products. Depending upon the final product under consideration a suitable method could be chosen to prepare FPCs with required functional properties.

Keywords: Under-utilized fish, red-toothed triggerfish, fish protein concentrate, solvent extraction, cold extraction, functional properties, protein powder.

05-27

EXPLORING THE FUNCTIONAL DISPOSITION OF THE HOST DEFENCE PEPTIDE B-DEFENSIN IN GENETICALLY IMPROVED FARMED TILAPIA (GIFT - *OREOCHROMIS NILOTICUS*)

K. L. Dhanya Lenin and Swapna P. Antony

Department of Marine Biology, Microbiology, and Biochemistry, School of Marine Sciences, Cochin University of Science and Technology, Kochi – 682016, Kerala, India

Background: β-Defensins constitute an evolutionarily conserved family of host defense peptides characterized by three disulphide linkages connecting six conserved cysteine residues. Beyond their well-established antimicrobial activity, these peptides enact a decisive role in various biological processes, including angiogenesis, immunomodulation, wound healing, cell proliferation and differentiation, and reproduction. Predominantly expressed in epithelial and mucosal cells, β-defensins have emerged as multifaceted regulators contributing to the intricate balance of diverse physiological functions.

Methods: Constitutive and induced transcriptomic profiling was undertaken to elucidate the functional disposition of β-defensin in Genetically Improved Farmed Tilapia (GIFT – *Oreochromis niloticus*). Various ontogeny stages, spanning from early development to the adult stage, were systematically analyzed to provide a comprehensive understanding of the constitutive expression of the peptide. Additionally, in depth examination of various tissues in the adult stage contributed to a holistic comprehension. Moreover, *in vivo* bacterial challenges were executed to unveil the induced expression pattern of β-defensin, thereby enhancing our insight into its dynamic role in host defense within the GIFT species.

Results: The analyzed tissues exhibited a differential expression profile across various developmental stages, with no expression of the defensin gene observed in the egg stage. The *in vivo* bacterial challenge led to an up-regulated expression of the defensin gene, characterized by a distinctive and unpredictable pattern in its transcription. The observed down-regulation a few hours post-challenge indicated a decline in the transcriptional pathway.

Conclusion: The expression profiling of β-defensin uncovered distinctive constitutive expression patterns across various tissues and life stages, as well as induced expression post-challenge. The observed transcription efficiency of the gene suggests its potential utility in addressing pathogen challenges within the aquaculture scenario. These findings contribute valuable insights into the dynamic role of β-defensin, highlighting its significance in the context of immune responses and potential applications for enhancing aquaculture practices.

Keywords: Host Defence Peptides, β-defensin, Constitutive expression, Gene Expression, Genetically Improved Farmed Tilapia, Therapeutic, *Oreochromis niloticus.*

05-28

DECODING REGION SPECIFIC ALLERGENS IN KERALA- A NEW AVENUE IN THE MANAGEMENT OF CANINE ATOPIC DERMATITIS

Ambily, V. R., Usha Narayana Pillai, Ajithkumar, S. and Vinu David, P

Department of Veterinary Clinical Medicine, Ethics and Jurisprudence, College of Veterinary and Animal Sciences, Mannuthy, Kerala Veterinary and Animal Sciences University, Kerala, India

Background: Among the allergic dermatitis in dogs, atopic dermatitis is a challenging disease for veterinary practitioners round the globe. Even though diagnosis is based on history, clinical criteria and exclusion of other differentials, atopic dermatitis can be managed only by the identification and avoidance of flare factors combined with oral or topical medications to reduce pruritus and skin lesions. With this background, the present study was to identify the allergens responsible for this challenging disease in our state of Kerala.

Methods: Dogs presented to the small animal dermatology unit were screened for atopic dermatitis and animals diagnosed with atopic dermatitis were subjected to clinical sign scoring using CADESI-04 and Pruritus scoring. Based on the scores, sixteen animals with moderate to severe disease were selected at random for invitro serum allergen testing. Invitro serum allergen testing was done at the facilities of Spectrum Labs, USA.

Results: Sixty-three cases were diagnosed as canine atopic dermatitis. Based on CADESI -04 scoring, the animals were classified as having mild, moderate and severe disease. Results of *in vitro* serum allergen testing revealed that hundred per cent animals were sensitive to allergens such as grass mix, weeds and pollen grains of mulberry plant followed by pollen grains of acacia tree(68.8 per cent), house dust and house dust mites (43.8 per cent each) and storage mites (31.5 per cent).

Conclusion: The region- specific allergens identified in the present study facilitates the management of this disease by allergen avoidance or by allergen specific immunotherapy.

Keywords: allergens, atopic dermatitis, flare factors.

06–HEALTH SCIENCES

ORAL PRESENTATION

06-01

GINGEREXOSOME-LIKE NANOPARTICLES INDUCE APOPTOSIS, CELL CYCLE ARREST AND ANTI-METASTATIC EFFECTS IN TRIPLE-NEGATIVE BREAST CANCER CELLS

Anusha[a], Ashin M.[a] and Priya S[a]*

[a]Biochemistry Section, Agro-Processing and Technology Division, CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram 695019, Kerala, India
***Corresponding author:** priyasulu@niist.res.in*

Background: Breast cancer is the topmost incidence across the globe. The most common treatment is chemotherapy, which has severe side effects, necessitating the need for natural alternatives. Exosome-like nanoparticles (ELNs) from dietary sources are nano sized vesicles, similar to mammalian exosomes. These are gaining popularity due to their biocompatibility, inherent bioactivity and the ability for cross-kingdom communication. Dietary exosome-like nanoparticles are a vital part of nutrition with multiple health benefits.

Methods: This study explores the potential anti-breast cancer activity of ginger-derived ELNs (GELNs) and its underlying molecular mechanism. GELNs were isolated by ultracentrifugation method and characterized (size, charge, morphology, exosome-specific marker, protein and lipid content). Triple-negative breast cancer cells (MDA-MB231) were treated with GELNs to observe the effects on proliferation. Apoptosis-specific cellular events (nuclear fragmentation, membrane integrity, mitochondrial depolarisation, ROS generation and expression of apoptotic proteins) were studied. The effect of GELNs on cell cycle, migration and colony formation were observed. RNA-sequencing (RNA-Seq) detected the mRNA expression profiles. Protein-protein interaction (PPI) network, gene ontology and Gene-Set Enrichment Analysis (GSEA) were employed to understand the altered biological pathways.

Results: The GELNs (average size: 108±20.6 nm, zeta potential: -12.7± 0.93 mV) showed the presence of exosome-specific markers (ALIX, TSG101 and CD9). GELNs taken up by MDA-MB 231 cells inhibited proliferation and induced apoptosis in these cells. Nuclear fragmentation, loss of membrane integrity, mitochondrial depolarisation, and ROS generation indicated apoptotic cell death on treatment with GELNs. It inhibited cellular migration and caused G2/M phase arrest. The significant pathways affected were the p53 signalling, DNA replication and cell cycle. Genes in epithelial-to-mesenchymal transition, ER stress, and tight junctions were also altered.

Conclusion: Our results reveal the potential of GELNs in inhibiting breast cancer cell proliferation and, propose a potential mechanism of action using a bioinformatics approach. This study will provide a reference for developing novel ELN-based strategies to treat breast cancer.

Keywords: Ginger ELNs, Breast cancer, Apoptosis.

06-02

YOGA-NIDRA AND EXERCISE COMBO AS A NON-PHARMACOLOGICAL THERAPY FOR MANAGEMENT OF INSOMNIA IN POSTMENOPAUSAL WOMEN TO IMPROVE THEIR WELLBEING

Kamalesh K Gulia[1] and Sapna Erat Sreedharan[2]

Division of Sleep Research[1], Department of Applied Biology, Biomedical Technology Wing; Comprehensive Centre for Sleep Disorder, Department of Neurology[2], Sree Chitra Tirunal Institute for Medical Sciences and Technology

Background: In the current era of 24X7, insomnia has affected people in all age-groups globally. It is a growing health concern especially for aging population which is also on rise especially in Kerala (highest percentage of elders compared to India's Average). It is well recognized that poor sleep quality is a risk factor for hypertension, cardiovascular diseases, metabolic disorders, obesity, cognitive decline etc. In women, onset of menopause is associated with early morning awakenings, hot flashes, poor sleep quality, stress, emotional turmoil leading to reduced quality of life (QOL). These health issues including insomnia continue to impact during their remaining life which constitutes nearly one third when counted in years (20-30 years). Moreover, long term use of benzodiazepine or non-benzodiazepine hypnotics is not a viable solution due to several unwanted side effects including drug resistance, tolerance etc. There is a dire need of a non-pharmacological strategy to deal with insomnia to improve overall health this vulnerable aging postmenopausal women.

Method: One potential solution is combo of Yoga-Nidra, a special yoga practice (to be practiced in morning) and mild exercise in evening. Yoga- Nidrais an evidence based clinical remedy for insomnia.

Results: Through the practice of Yoga- Nidra, brain achieves deep relaxation and restoration similar to sleep but yet remaining in a conscious state. It may be practiced in early morning (an ideal time to utilize as early morning awakening that are common in this age) in cozy ambience of one's home lying in corpse position (Savasana) after receiving an initial training of a week. It helps in reorganization of brain to achieve positive control of thoughts and emotions by neural modulation of limbic and sleep modulation centers. Walking protocol in evening helps in strengthening the circadian rhythms in achieving maintaining good quality sleep.

Conclusions: This combo is an easy to use, viable non-pharmacological therapy as an alternative/ complementary treatment that aid in improving the overall wellbeing thus QOL in this aging population and in effectively achieving 3rd sustainable developmental goal by the United Nations.

Keywords: Yoga-Nidra, insomnia, non-pharmacological therapy.

06-03

MCM7 IN LUNG CANCER: A PIVOTAL DIAGNOSTIC AND PROGNOSTIC TUMOR MARKER IN THE CLINICAL REALM

P. Neeraja[1,#], Sanjeev Nair[2], Asha Lekshmi[1], V. S. Veena[3], K. M. Jagathnath Krishna[4] and K. Sujathan[1]

[1]Divisions of Cancer Research, [3]Pathology, [4]Epidemiology, Regional Cancer Centre; [2]Department of Pulmonary Medicine, Government Medical College Hospital, Trivandrum, Kerala, India; [#]PhD Scholar, Manipal Academy of Higher Education, Karnataka, India

Background: Minichromosome Maintenance proteins (MCM), crucial for DNA replication licensing, are under study as potential markers for detecting lung cancer (LC). While their role in sputum cytology remains unexplored, there's a suggestion that MCM proteins could serve as biomarkers in identifying malignant cells in both tissue samples and sputum, offering a possible diagnostic tool for LC in laboratory settings.

Methods: Bioinformatic data mining examined MCM protein expression (MCM2, MCM4, MCM5, MCM7) in a lung cancer (LC) cohort. A retrospective cross sectional study utilized 61 lung tissue blocks and 87 fresh sputum samples. Univariate/multivariate Cox regression assessed clinical and histological parameters for their impact on outcomes. Comparative analysis with Ki67 was conducted. Tumorigenic potential was evaluated in A549 lung tumor cells. The significantly overexpressed MCM was selected for further analysis in sputum samples.

Results: Experimental validation confirmed MCM protein overexpression in lung cancer (LC). MCM7 showed higher nuclear expression in tumor tissues, significantly associated with tumor type, poor survival ($p<0.001$), and served as an independent prognostic marker. Downregulation using specific esiRNA diminished LC cell functional properties, indicating MCM7's role in lung tumorigenesis. Immunocytochemical analysis in sputum samples demonstrated MCM7 as a potent marker for LC, with an 82.5% positive predictive value.

Conclusion: MCM7 overexpression enhances sputum cytology for lung cancer diagnosis, predicting poor survival and indicating a crucial role in lung carcinogenesis. This information suggests an alternative non-invasive technique for diagnosis.

Keywords: Lung cancer, MCM7, Sputum cytology.

06-04

HYBRID CERAMIC GRAFTS FOR ENHANCED BONE REGENERATION IN ORTHOPAEDIC DEFECT MANAGEMENT

Gayathry G., Saranya S.S., Francis B. Fernandez, Harikrishna Varma and Manoj Komath

Division of Bioceramics, Biomedical Technology Wing, Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum, Kerala, India

Background: Bone defect management with grafting is a routine procedure in orthopedic surgery. A resorbable osteogenic material with sufficient mechanical strength is grafted into the defective site to assist natural bone remodelling and achieve healing. Autologous bone grafts, i.e. bone pieces

taken from another part of the body, are the current gold standard. Synthetic ceramic grafts with bioresorbable and osteoconductive properties are suggested as an alternative, to avoid the additional surgery required for autograft harvest. However, ceramic grafts lack the biological environment within their bulk to initiate local remodelling, and therefore surgeons use them as the last resort. The present work addresses the enhancement of the osteogenic property of bare ceramic grafts by infusing bone marrow aspirate so that they will perform comparable to autografts and thereby avoid the bone harvest surgery.

Method: To make the 'hybrid graft' technique workable, the ceramic part is to be made in a special through-pore design to accommodate the biological material inside. In the work, the ceramic graft shapes with open-through pores were fabricated using the slip casting technique embedding sublimable fibers. The bone marrow aspirate collected from rat was cultured in the ceramic graft structure for 14 days and evaluated the activity inside the bulk of the samples.

Results: The hybrid graft samples exhibited high osteoblastic proliferation evidenced by an expression of osteogenic genes and formation of a mineralised calcium phosphate matrix. Viable cells were detected within the pores after two weeks of culture, as confirmed by both qualitative and quantitative assays.

Conclusions: The results suggest that the hybrid graft technique is viable and can be used instead of autograft bone harvested through a second surgery.

Keywords: Autograft, Ceramic grafts, Slip casting, Bone marrow aspirate.

06-05

GENOMIC INSIGHTS INTO THE HEALTH RISK POTENTIAL OF MULTIDRUG RESISTANT BACTERIAL PATHOGENS ISOLATED FROM HEALTHY BROILERS

Sreejith S.[1], Radhakrishnan E.K.[1], Prathiush P.R.[2], Jyothis Mathew[1]

[1]School of Biosciences, Mahatma Gandhi University, Kottayam, [2]State institute for animal diseases, Palode, Trivandrum

Background: Antimicrobial resistance (AMR) is a global concern affecting the life and economy. Unscientific usage of antibiotics in various sectors including the health, veterinary and agriculture are the driving force for the resistance emergence. Kerala is one of the prominent livestock producers in India and has huge data gap in antimicrobial resistance in veterinary and livestock sector. A coordinated antimicrobial stewardship program involving various sectors is necessary for the collective effort of fighting antimicrobial resistance in a one health approach.

Methods: In this study, antimicrobial resistance among pathogens of *Enterobacteriaceae* was screened and subjected to the detailed analysis using whole genome sequencing (WGS). For the study, 252 fecal samples were collected from 31 different farms across 6 districts of central and southern of Kerala. Bacterial isolates from *Enterobacteriaceae* were isolated and subjected to the antimicrobial susceptibility test. Selected most drug resistant strains were used for the whole genome sequencing and analysis using illumina platform. The genomes were analysed for the presence of antimicrobial resistance genes and also predicted the human pathogenic potential. Comparative metagenomics analysis was also conducted for the faecal samples from broiler chicken and the poultry farm workers. Shared microflora and AMR genes were predicted from the metagenomic data and the

potential risk factors were analysed.

Results: The majority of the isolates obtained from the poultry faecal samples were *E. coli* (47.67%) and *Klebsiella* spp. (31.39%) and rest of the *Enterobacteriaceae* contributed 20.79%. The *E. coli* strains in the isolates were mainly resistant to tetracycline (70.73%), amoxicillin-clavulanate (61.53%), and doxycycline (61.53%) and *Klebsiella* spp. showed high resistance to tetracycline (44.44%), aztreonam (17.7%), and amikacin (13.33%). The distribution of the MDR strains showed 66% from Klebsiella spp. and 30.43% from E. coli and 46.87% from other *Enterobacteriaceae*. The selected *Klebsiella pneumoniae* MS1, *Enterobacter hormaechei* MS2, *Klebsiella pneumoniae* subspecies *ozaenae* MS121, *Escherichia coli* MS122 and *Escherichia coli* MS148 strains were genome sequenced and found to have high probability to be human pathogen and contain diverse AMR genes. Among the selected strains *E. coli* MS148 and MS122 were found to have high probability to be human of 0.938 and 0.934, respectively. The strains were also found to have resistance against last resort antibiotics such as colistin and fosfomycin. Among the AMR genes, many were found to be the first report from India which includes *MCR-9*, *FosA2*, *FosK* and *ACT-69*. The comparative faecal metagenome analysis of broiler chicken and the farm workers has resulted in the identification of the shared microbiome. The H1 and P1 samples were found to share 183 species of bacteria while H2 and P2 shared 24 species. *Enterobacter kobei*, *Enterobacter ludwigii*, and *Klebsiella oxytoca* are the opportunistic pathogens identified to be shared between H1 and P1. The human health risk was studied with the help of an anticipated epidemiological triad, which will be helpful for the preparedness to fight opportunistic infectious diseases. The AMR genes such as *APH(3")-Ib*, *CRP*, *ErmF*, *ErmX*, *tet(40)* and *tetW* were found to be shared with both host groups and need detailed investigation.

Conclusion: The study signifies the need of thorough genomic surveillance at the veterinary and livestock sectors for one health based antibiotic stewardship. The prevalence of the newly reported genes in India has to be analysed to identify its role in the pathogenesis and AMR transmission. The collective efforts among veterinary and health sectors might be effective to fight the AMR concern in Kerala in a one-health aspect.

Keywords: Whole genome sequencing, one health, antimicrobial resistance, MCR9, pathogen.

06-06

GUIDE WIRE FOR LUMBAR PUNCTURE

Ayush Arun[1], Ananya L. Nair[1], Abhay Govind[1], S. C. Sreenandh[1], Athira Raj[1], Thamjeed T.[1], Anish K. John[1], Easwer H. V.[2], Prakash Nair[2], Krishna Kumar K.[2], Arun Anirudhan V.[2] and Gowtham M.[2]

[1]Government Engineering College Barton Hill, Barton Hill Colony, Kunnukuzhy, Trivandrum, [2]Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum, Kerala, India.

Background: Lumbar drains are commonly used in neurosurgical and ENT procedures in the perioperative period as intra operative adjuncts or in the post operative period to facilitate healing. Current existing methods to introduce lumbar drains include insertion of a toughy needle with trocar initially into the spinal canal. Later the toughy needle will be used as a guide to thread the lumbar drain into the spinal canal. The drawback with the existing needle is the relatively blunt tip and the amount of pressure needed to pierce through layers of the body to reach the spinal canal will be

high because of this blunt and relatively wide tip. With these characteristics there is a significant proportion of patients in whom insertion of lumbar drain becomes difficult.

Method: We propose that traditionally used lumbar puncture needle (spinal needle) can be modified to guide the toughy needle into the spinal canal. We modified the end of existing spinal needle, so that it can be detached after inserting into the spinal canal. Also we increased the length of the spinal needle to serve the purpose of guide wire. We added one middle portion which provides grip to the adjusted length.

Results: Both the end as well the middle portion works on the basis of a mechanical pencil mechanism. When the button pushes the spring it in turn pushes the split cylinder which has a taper (diameter of one end is same as that of guide wire and the other end is slightly big). When the split cylinder is acted upon by the spring force the bigger diameter end expands and we are able to remove as well as move our device. So, the spinal needle, now, can be used to guide the toughy needle, instead of requirement for the unusual force and avoiding the risk of derailing from the intended track.

Conclusions: We propose to modify the end of the spinal needle and new addition of middle portion to the spinal needle which will help to easily detach the end portion and the middle portion. This will leave a thin and longer needle tracking into the spinal needle which can be used as a guide wire to thread the toughy needle, avoiding the existing difficulties and minimizing the trauma to patient.

Keywords: Spinal needle, Toughy needle, lumbar drain, mechanical pencil mechanism.

06-07

BIOCOMPATIBILITY AND WOUND HEALING EFFICACY OF NANO-CHITOSAN-CHLORHEXIDINE FILMS IN EXPERIMENTAL ANIMAL MODELS

Rosemol Jacob M[1, 2], Amruth P[1, 2], Preethy Treesa Paul[1, 2], Jean Mary Joy[1, 2,] Suseela Mathew[1*]

[1]Biochemistry and Nutrition Division, ICAR-Central Institute of Fisheries Technology, Cochin-682029, Kerala, India

[2]Faculty of Marine Sciences, Cochin University of Science and Technology, Cochin-682022, Kerala, India

Corresponding author: suseela1962@gmail.com

Background: Biocompatible polymeric biomaterials are designed for biomedical purposes with a primary aim of enhancing the development and revitalization of tissues for wound healing. Natural biomaterials offer a therapeutic advantage as opposed to the synthetic biomaterials as the natural ones are substitutes of the extracellular matrix (ECM) and original cellular environment of the native skin. Wound healing is a highly elaborate biological phenomenon, influenced by various factors such as the wound's condition, the patient's overall health, and the application of external materials with specific physicochemical properties. Film based dressing have the advantages like gas permeability and impermeable to liquid and bacteria and hence can be used for a direct drug delivery to the wound site. Due to their flexibility there is an easy conformation to the patient's body even around difficult areas and they allow moisture evaporation, reduced pain, provide a barrier to external contamination, and endorse inspection of the wound bed without removing the dressing. Chitosan, is a linear polysaccharide composed of N-acetyl-D-glucosamine and β (1 → 4)-D-glucosamine units obtained from deacetylation of chitin found in crustacean shells. It is a desired polymer for wound

dressing preparation due to its nontoxicity, film-forming ability, low immunogenicity, antibacterial, antifungal, hemostatic and mucoadhesive properties. Furthermore, it is biocompatible, biodegradable and is efficient for controlling drug release. The low mechanical strength of natural macromolecules can be enhanced by cross-linking or blending with synthetic polymers. To enhance the flexibility, PVA, and plasticizers such as glycerol was added. Chlorhexidine, a broad-spectrum antiseptic commonly used against gram-positive, gram-negative bacteria, fungi and viruses was employed. Chlorhexidine's dicationic nature affords the agent the property of persistence of antimicrobial effect, through both bactericidal and bacteriostatic effects. In the present study, an attempt was made to synthesize chlorhexidine-grafted nanochitosan films and biocompatibility and wound healing efficacy of nano-chitosan-chlorhexidine films in experimental animal model were evaluated.

Method: Chlorhexidine nanochitosan film was prepared from 1% chitosan using sodium tripolyphosphate (STPP) and polyvinyl alcohol (PVA). Added chlorhexidine with continuous stirring until getting a clear solution. The completely dissolved solution was poured onto the tray and kept overnight in hot air oven at 55 oC for obtaining chlorhexidine nanochitosan film. The films were kept in a pocket wound model made in albino male Wistar rats for the biocompatibility studies. After the study period, the rats were euthanized and skin tissues with the surrounding implant area were collected for histopathological analysis.

Results: In the current experimental investigation, wound healing affirms the film dressing's ability to facilitate effective hemostasis, efficient healing, and re-epithelialization of wounds. The addition of polyvinyl alcohol and glycerol enhanced the mechanical strength and flexibility of the films, making them suitable for wound dressing applications. Histopathological findings indicated that the presence of the dressing stimulates the regeneration of skin cell layers, contributing to the restoration of tissue architecture. The findings from this study highlight the potential of the developed film dressing as a promising therapeutic option for wound management. The antimicrobial property of the film, its flexibility and ability to facilitate direct drug delivery make it a valuable candidate for practical use in clinical settings. The positive outcome observed in in vivo studies on experimental animals underscore the potential efficacy of the dressing.

Conclusion: The study focused on the development and evaluation of chlorhexidine-grafted nanochitosan films for wound healing applications. The use of chitosan, a natural biomaterial, in combination with chlorhexidine demonstrated notable advantages, including biocompatibility, antibacterial properties, and controlled drug release. The in vivo assessments using an experimental animal model provided encouraging results, affirming the effectiveness of the chlorhexidine-grafted nanochitosan films in promoting hemostasis, efficient wound healing, and re-epithelialization. Further research and clinical trials will be crucial to fully establish the efficacy and safety of this innovative wound dressing for broader applications in biomedical contexts.

Keywords: Chitosan, Chlorhexidine, Nanochitosan, biomaterial.

06-08

EXPRESSION OF P16, CDK4, AND MDM2 AS DIAGNOSTIC MARKER TRIOIN LIPOSARCOMA

Anju M. S.[1], Chandra Mohan K.[2] and Lakshmi Subhadradevi[1]

1Division of Cancer Research, Regional Cancer Centre (Research Centre, University of Kerala), Thiruvananthapuram, Kerala - 695011, India, 2Division of Surgical Oncology, Regional Cancer Centre (Research Centre, University of Kerala), Thiruvananthapuram, Kerala - 695011, India

Background: *Liposarcoma (LPS) is a rare malignancy of adipocytic differentiation. Distinguishing Atypical lipomatous tumor (ATL)/Well-differentiated liposarcoma (WDL) from benign adipocytic neoplasm and Dedifferentiated liposarcoma (DDL) from Pleomorphic or Myxoid liposarcoma (PLPS/MLPS) is difficult. The current study aims to assess the utility of molecular marker trio p16, CDK4, and MDM2 in the histopathological diagnosis of WDL/DDL from other adipocytic subtypes.*

Method: Tissue sections from formalin fixed paraffin blocks were subjected to immunohistochemistry using PolyExcel HRP/DAB Detection system. The expression of p16, CDK4, and MDM2 was evaluated in a total of 34 LPS tumor samples. Each tumor samples were assessed for the intensity of antibody reaction: negative (0), mild positivity (1+), moderate positivity (2+), or strong positivity (3+) and the immunoreactivity was semi quantitatively evaluated as negative (0% of cells stained), focally positive (1% to 10% of cells stained), multi focally positive (11% to 50% of cells stained), or diffusely positive (>50% of cells stained).

Results: From a total of 21 WD/DDLPS, 19 (90%) cases were positive for the MDM2, CDK4, and p16 markers. The remaining cases were either expressing at least two markers. 7/7 (100%) DDLPS, 7/7 (100%) MLPS, and 4/4 (100%) PLPS cases were positive for MDM2, CDK4, and p16 trio. We found that in all the LPS subtype, expression of CDK4 and p16 was mostly moderate to strong while MDM2 was observed to be weak and focal, in agreement with previous studies. WD/DDLPS subtypes showed 80-90% positive neoplastic cells for the MDM2, CDK4, and p16 trio whereas MLPS showed <50% positive neoplastic cells of the trio and PLPS shows 70-90% positive neoplastic cells.

Conclusions: In the present study CDK4 and MDM2 expression in DDLPS/WDLPS subtype shows less percentage of positive neoplastic cells with lower intensity of antibody staining; whereas p16 exhibit higher intensity and higher percentage of positive neoplastic cells. Hence along with MDM2/CDK4 IHC, P16 IHC could also be useful for the DDLPS/WDLPS subtype evaluation.

Keywords: Liposarcoma, Immunohistochemistry, Diagnosis.

06-09

AN ETHNOGENETIC PERSPECTIVE OF BURDEN OF STROKE AND ITS COMORBID FACTORS

Rashmi Sukumaran[1,2], Achuthsankar S. Nair[2] and Moinak Banerjee[1]

[1]Human Molecular Genetics Laboratory, Rajiv Gandhi Centre of Biotechnology, Kerala, India
2Department of Computational Biology and Bioinformatics, University of Kerala, India

Background: Globally, mortality rates of stroke remain high despite advanced treatments and care

in developed nations. Burden of stroke is often interpreted from a socio-economic perspective. We aimed to decipher an ethnogenetic perspective of burden of stroke and its comorbid conditions.

Method: We performed trend analysis on prevalence and mortality rates of stroke and seven comorbid factors in 204 countries (stratified into eight ethnogeographic regions) from 2009 to 2019. GWAS risk loci of all conditions were further analysed for population stratification in five 1000 Genomes super-populations. LD of risk loci unique to a population was determined from proxy variants within 1 Mb region.

Results: The correlation between prevalence and mortality for stroke, its subtypes, and comorbid factors shows marked ethnic differences. The nature of comorbid risk for stroke differs with socio-economic conditions – high-income regions having more metabolic risk compared to low- and middle-income regions. The genetic stratification based on GWAS risk loci displays distinct population structures. Stroke risk alleles have LD blocks of rare variants present only in the population in which the risk allele is unique, indicating a common disease/rare variant model.

Conclusions: To address the burden of stroke, we must also understand the impact of socio-economic parameters in the background of the genetic risk for comorbid conditions. The findings can help health policymakers to understand the areas of concern.

Keywords: Global health, Stroke, comorbid risk, population genetics.

06-10

FABRICATION OF ENHANCED LYOPHILIZED FILM WITH CHLORHEXIDINE AND GRAFTED SILVER NANOPARTICLES ON CARRAGEENAN FOR SUPERFICIAL WOUND DRESSING APPLICATIONS

Amruth P.[1, 2], Rosemol Jacob M.[1, 2], Jean Mary Joy[1, 2] and Suseela Mathew[1]*

[1]Biochemistry and Nutrition Division, ICAR-Central Institute of Fisheries Technology, Cochin-682029, Kerala, India

[2]Faculty of Marine Sciences, Cochin University of Science and Technology, Cochin-682022, Kerala, India

Corresponding author: suseela1962@gmail.com

Background: The effective management of superficial wounds in healthcare presents a notable challenge, necessitating the development of advanced wound dressings with enhanced antimicrobial capabilities. This study investigates the collaborative potential of chlorhexidine (CHX) and carrageenan (KC) grafted silver nanoparticles (KC-AgNPs) to reinforce lyophilized films based on κ-carrageenan, specifically designed for superficial wound dressing applications. By capitalizing on the film-forming and biocompatible properties of KC, this research enhances its characteristics by introducing KC-Ag-NPs and the antimicrobial agent CHX, resulting in a versatile dressing solution.

Method: The synthesis process entails the grafting of KC-Ag-NPs onto KC, yielding a robust composite with improved mechanical strength and modulated antimicrobial efficacy.

Results: The lyophilized films produced exhibit enhanced exudate holding capacity, structural integrity and sustained release of CHX and KC-Ag-NPs, ensuring prolonged effectiveness against microbial threats. A comprehensive examination encompassing morphological, mechanical, swelling, exudate holding and drug release kinetics aspects provides a detailed insight into the

physicochemical attributes of the developed films. Antibacterial assessments underscore the increased antimicrobial activity of the lyophilized films against a range of wound bed localized pathogens. Additionally, in vitro cytocompatibility investigations confirm the dressing's biocompatibility with human dermal fibroblasts, emphasizing its potential to support the wound healing process. Notably, the films demonstrate stability and shelf life characteristics that make them promising for practical deployment in healthcare settings. This study contributes to the ongoing advancements in wound dressing technology by synergizing the inherent advantages of KC, KC-Ag-NPs, and CHX.

Conclusions: The resulting lyophilized films demonstrate significant potential for superficial wound applications, providing a versatile and effective solution for combating microbial infections and facilitating optimal wound healing. The films undergo characterization through FTIR, SEM, TEM, XRD, and TGA. Additionally, they are assessed for in vivo wound closure and biocompatibility studies in experimental animal models.

Keywords: Carrageenan, Wound dressing, Lyophilisation.

06-11

TRACING THE EPIDEMIOLOGICAL EVIDENCE OF FATAL NECROTIZING SKIN INFECTION BY SAKSENAEA VASIFORMIS THROUGH MOLECULAR ANALYSIS

Chithra C Nath[1], Sreejith Sreekumaran[3], Nimmy Paul[1], Vinaykumar Hallur[2], Radhakrishnan E. K.[3]

1Department of Microbiology, Government Medical College, Kottayam, 2Department of Microbiology, All India Institute of Medical Sciences, Bhubaneswar, Odisha, 3School of Biosciences, Mahatma Gandhi University, Kottayam

**Corresponding author: nimmymch@yahoo.com*

Background: Saksenaea vasiformisis an emerging non-sporulating zygomycete, mainly causing subcutaneous and disseminated infections with high mortality. As compared to other Mucorales, it causes infection even in an immuno-competent host also.

Method: Case history - a 68-year-old male patient with chronic obstructive pulmonary disease presented with 2 weeks duration of fever and breathlessness and 4 days duration of multiple tender slightly warm subcutaneous tender nodules on arms, thighs and back of trunk with surface showing bluish red color. On second day of admission most of these ulcerated and similar new lesions appeared. The case was misdiagnosed and patient was started on antibiotics. A fine needle aspiration cytology from the skin lesion showed non-septate ribbon-like hyphae branching at obtuse angles.The patient deteriorated and died before starting antifungals. The diagnosis was made posthumously. Isolate was identified by fungal culture and sequencing of the ITS region of the rDNA. Environmental samples were also processed to identify the source of infection.

Results: *Saksenaea vasiformis* was identified by ITS sequencing. Virulence factors of the isolate were studied by various biochemical tests. Environmental samples also yielded the same pathogen. Phylogenetic analysis of the strains concluded the source of infection.

Conclusions: *Saksenaea* spp. is sometimes missed or causes delay in diagnosis due to its non-sporulating nature. *Saksenaea vasiformis, Saksenaea erythrospora* are present in environment and

cause infections due to insect bite, trauma, contamination of abraded skin etc. Early diagnosis and administration of antifungals can avert the eventual lethal outcome of the disease. ITS sequencing and Phylogenetic analysis help to study the emergence of new species as well as tracing the source of infection.

Keywords: *Saksenaea vasiformisis*, Mucorales, ITS sequencing, Phylogenetic analysis.

06-12

THE ONE-HEALTH APPROACH: PUBLIC HEALTH AS A TRACKER OF ENVIRONMENTAL HEALTH

Indulekha Kavila[1] and Bhava V. Hari[2]

[1]School of Pure and Applied Physics, Mahatma Gandhi University, Kerala 686560 INDIA, [2]Wipro, Electronic City Phase 1, Bengaluru, Karnataka 560100 INDIA

Background: The interconnectedness of human and environmental health is leveraged to examine environmental health by tracing a signature of its impact on public health and inferences on adoptable policy measures are drawn.

Method: An analytical study using parametric statistical methods, of the evolution over the past decade, of a defined composite variable named the vulnerability index of public health with respect to infectious diseases (VI) and its dependence on level of urbanization is presented.

Results: The base vulnerability is approximately constant for infectious diseases in general while it shows a linearly rising trend with time for acute dysenteric disorder (ADD). The 'urbanization ineffectiveness parameter' shows a linearly rising trend in both cases.

Conclusions: The rise in base vulnerability with respect to ADD compared to the approximate constancy of this parameter for infectious diseases in general can imply a scenario of worsening hydrological heath of the environment. Historically densely populated southern regions show comparatively higher vulnerability. The fact that VI(t) shows a rising trend even for districts with negative projected population growth rate could imply that the damage to environmental health due to population pressure could be longstanding.

Keywords: Endemic diseases, water borne diseases, public health index, hydrological health, Kerala.

POSTER PRESENTATION

06-13

DESIGNING NEUROCOMPATIBLE SURFACE THROUGH AMINOLYSIS FOR PERIPHERAL NERVE REGENERATION

Saranya SS, Gayathry G, Francis B Fernandez, Manoj Komath

Division of Bioceramics, Biomedical Technology Wing, SreeChitraTirunal Institute for Medical Sciences & Technology

Background: Neurocompatible materials play a crucial role in the modern day neuro surgery, mainly for designing nerve guiding conduits to regenerate the defective peripheral nerves. Synthetic biodegradable neural conduits serve as guide for joining the peripheral nerve ends which has a potential for limited growth. Appropriately functionalized material surface will act as a template to enhance the growth and complete regeneration of the detached nerve ends. Aminolysis is a surface functionalization technique for enhancing cell attachment and growth. In the present work, the potential for aminolysis is explored to make a more ideal material for nerve guide conduit. The substrate material chosen is Polycaprolactone (PCL) which is a biocompatible and viable polymer for neuronal regeneration applications. However, it lacks appropriate functional groups for cell attachment on its surface. In this study, PCL films were made by solvent casting, and immersed in HMD solutions of varying concentrations heated at 40 °C in the presence of isopropanol, for attaching NH2 groups.

Method: The samples were characterized by contact angle analysis, Fourier transformed infrared spectroscopy (FTIR), and ninhydrin assay. For assessing their cytocompatibility, neurogenicity and angiogenicity the Neuronal cell lines and Endothelial cell lines were cultured and analysed for their adhesion, morphology, proliferation,migration and viability in comparison to unmodified PCL fibers and tissue culture polystyrene (TCPS).

Results: The results showed that immobilization of NH2 groups on the PCL nanofibers significantly improved their capacity for the attachment and proliferation of the neuronal and endothelial cells.

Conclusions: The modified PCL scaffold also provided the biochemical signals for the Neuronal and endothelial cells to acquire a morphology indicating that they could be potentially used as a promising scaffold for neuronal tissue regeneration.

Keywords: Polycaprolactone (PCL), Solvent casting, ninhydrin assay, aminolysis.

06-14

PCR-BASED DETECTION OF BABESIA SPECIES IN DOGS: A RELIABLE DIAGNOSTIC APPROACH

Vinay C H[1], Sreelakshmi P[1], Soorej K[2], Gowri Menon N[2], Jwala J[1], Jasmin C[1,*]

[1]Enfys Life Science Pvt. Ltd., Nedumbassery, Ernakulam 683 578, Kerala, India
[2]The Cochin Pet Hospital, Cochin 682 020, Kerala, India
**Corresponding author: cjasmina78@gmail.com*

Background: *Babesiosis is a tick-borne parasitic infection in dogs, caused by protozoal parasites Babesia canis and Babesia gibsoni. The disease is transmitted through the bite of infected ticks and dogs housed in kennel settings with poor tick control are at higher risk. The pathogen invades the red blood cells causing anemia and the clinical signs of Babesiosis range from sudden collapse with systemic shock to a subtle and slowly progressing infection with no apparent clinical signs. Abnormally dark urine, fever, weakness, pale mucous membranes, depression, swollen lymph nodes and enlarged spleens are often found in dogs infected with babesiosis.*

Method: Blood samples collected from 454 suspected dogs in Ernakulam district in Kerala state in India during 2021 to 2023. Genomic DNA was extracted from blood samples using Macherey-Nagel blood and tissue kit. The 18S rRNA gene of *Babesia gibsoni* and *B.canis* were amplified following standard PCR techniques. The PCR products were run on an agarose gel electrophoresis, imaged in a gel documentation system and analyzed by comparing the product size. The identity of PCR products were confirmed by cloning and sequencing of positive reactions.

Result: We found that the occurrence of *Babesia gibsoni* was higher (33%) among pet dogs in the reporting period, compared to Babesia canis (25%). We also analysed seasonal variation in the occurrence of diseases.

Conclusion: Babesiosis is a zoonotic disease which can be transmitted to humans, and hence early detection and treatment are required. PCR is highly sensitive, rapid, reliable method than any other test. Current results indicate that early detection of pathogens using molecular tools would be much helpful in preventing the pathogenic invasion in pet animals, which may help the safe rearing of animals.

Keywords: Babesiosis, One Health, molecular diagnosis, veterinary pathogens.

06-15

GLOBAL CONTAMINATION OF DIOXIN AND DIOXIN-LIKE COMPOUNDS IN MEAT AND MEAT DERIVATIVES: SYSTEMATIC REVIEW AND HEALTH RISK PREDICTION

Rahul M Chiracka[1], Gayathri Krishnan & C Kesavachandran

CSIR-National Institute for Interdisciplinary Science and Technology, CSIR, Govt of India, Thiruvananthapuram, Kerala 695019, India

Background: Animal-origin foods (AOFs) are contaminated with dioxin through food chain and ecosystem services. According to National Family Health Survey (NFHS-5), 83% of men and 70% of women in India consume meat. The present study aims to explore the global trend of dioxin contamination in meat and meat derivatives and its health prediction.

Methods: Identification, screening, eligibility and inclusion of articles for the study were conducted as per the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. Quality assessment of included studies was undertaken using a scoring sheet. Risk predictions such as exposure (E), Hazard quotient (HQ), and cancer risk (CR) were calculated using validated methods.

Results: One hundred and twenty-eight observations of dioxin contamination in meat and meat derivatives were identified from 36 studies. Dioxin contamination (PCDD/Fs and PCBs) in meat of chicken (11.49pgTEQ/g), mutton (73pgTEQ/g) and liver and fat (80 and 77pgTEQ/g) exceeded the maximum limits suggested by EU (EU No. 277/2012). The only study in India observed PCDD/Fs contamination of 1.36pg TEQ/g in chicken. Out of 128 observations, predicted exposure values corresponding to the concentration of 29 observations were above the tolerable daily intake levels of 4pg TEQ/kg BW as suggested by EFSA. Among the total observations, 93 showed CR >10-5. Highest CR values of 0.032, 0.031, 0.029, and 0.0046 corresponding to PCDD/F and PCB levels at 80, 77, 73 and 11.49 pg TEQ/g respectively was observed. Thirty three observations showed HQ>1. The highest HQ values observed were 302, 290, 275, and 45 TU for the same concentrations represented for CR values.

Conclusions: The global contamination levels of dioxin in the meat and meat derivatives showed the presence of 17PCDD/Fs and 12 PCBs. Only one study from India has been reported so far on dioxin contamination in AOFs. Considering the possible presence of dioxins in AOFs like meat through various unintentional and industrial sources in India, there is an urgent need to generate country-wide inventory data on AOFs.

Keywords: Dioxin; meat and meat derivatives; systematic review; Health Risk Prediction.

06-16

IMPACT OF ENDURANCE TRAINING ON MENSTRUAL FUNCTION IN LONG DISTANCE RUNNERS: A SYSTEMATIC REVIEW

Sneha Alexander and Sathya

Sri Ramachandra Institute of Higher Education and Research, Sri Ramachandra Centre for Sports Science, Chennai, Tamil Nadu 600116

Background: Endurance training in long-distance runners can lead to menstrual dysfunctions, impacting reproductive health. Understanding their prevalence and relationship to training variables is crucial. Hormonal responses play a role in menstrual cycle regulation. To review the prevalence and the relationship between training volume and menstruation dysfunctions.

Method: This review analyzed studies from five databases, specifically focusing on the impact of endurance training on menstrual cycle function in long-distance runners. Keywords such as menstrual cycle, menstrual phase, endurance training, training volume, long-distance runners, and endurance runners were used. Included studies examined the prevalence of menstrual dysfunction and the relationship between training volume and hormonal changes in the menstrual cycle, specifically in long-distance running events.

Results: A total of 33 studies met the inclusion criteria, mostly cross-sectional in nature. The review focused on athletes participating in long- distance running events compared to a control group. The

total number of participants, including the control group and non-athletes, was 7152. Prevalent menstrual dysfunctions (amenorrhea, oligomenorrhea, dysmenorrhea) affect long-distance runners, with varying rates (primary amenorrhea: 7.7%-44%, secondary amenorrhea: 8.33%-30.8%, oligomenorrhea: 6.25%-40%, dysmenorrhea: 90.5%). The relationship with training volume is inconclusive, and hormonal responses vary without a consistent association.

Conclusions: This study concluded a comprehensive understanding of individual factors and a holistic approach to optimize menstrual health in long-distance runners.

Keywords: endurance-training, menstruation disturbances, female distance runners.

06-17

IMPACT OF GROUP INTERVENTIONS FOR CARE-GIVERS OF PERSONS WITH SCHIZOPHRENIA AND BIPOLAR MOOD DISORDER IN A GENERAL HOSPITAL PSYCHIATRY UNIT

Ismail Shihabuddeen T. M.

Psychiatry Rehab Specialist and Counselling Psychologist, Pleasure Dome/ Miracle, Near Govt ITI College, Post Vidyanagar, Kasaragod-671123, Kerala, India

Background: In India, there is a paucity of trained professionals to execute psychosocial interventions. Families or key relatives are thus assigned the role of primary care-givers of persons with chronic mental illness. To assess the perceived benefits and the feasibility of conducting group meetings among care-givers of persons with schizophrenia and bipolar mood disorders, and to evaluate the utilization pattern of general hospital psychiatric unit (GHPU) services by care-givers who regularly attend such group meetings.

Methods: Persons with schizophrenia and those with bipolar mood disorders with associated psychosocial problems and on maintenance medication were identified at the Psychiatric Rehabilitation Unit of the Department of Psychiatry. Significant care-givers of the identified persons were informed about the group meeting. Group meetings were conducted for about 45 minutes once a month for care-givers of persons with schizophrenia and bipolar mood disorders separately. Data regarding the psychosocial aspects of caregivers were collected before entry to the meeting and after 17 months of their participation. Participants who attended the meetings irregularly were excluded from the study.

Results: The group meetings led to effective monitoring of the functioning of individuals, a reduction in the subjective family burden and family distress, a better support system with adequate coping skills and good compliance with treatment programs.

Conclusion: Conducting regular care-givers' group meeting for a homogeneous population at a General Hospital Psychiatry Unit is feasible and beneficial.

Key words: Care-givers' group meeting, Schizophrenia, Bipolar mood disorders.

06-18

PRELIMINARY STUDY ON THE ANTIBACTERIAL EFFECT OF NAGARADI KASHAYAM ON MULTIDRUG RESISTANT KLEBSIELLA PNEUMONIAE

Marria C Cyriac*, Leon Ittiachen, Delsy Davis, Reena Nair, Neha Joseph, Sooraj Suresh

Department of Biotechnology, Sahrdaya College of Engineering and Technology, Affiliated to A P J Abdul Kalam Technological University, Kodakara, Kerala
**Corresponding author: marriac.cyriac@sahrdaya.ac.in*

Background: The spread of antibiotic resistant strains of *K.pneumoniae* is a significant concern in health-care settings and can lead to severe and difficult to treat infections. It is one among the most prominent multidrug resistant gram negative pathogen associated with respiratory tract infection that leads to ineffective empirical treatments and worsens the clinical condition of patients. Unlike antibiotics, polyherbal formulations can target multiple sites or mechanisms within the bacterial cell. This makes it more difficult for bacteria to develop resistance because they would need to evolve multiple resistance mechanisms simultaneously. The study is focused on exploring the antibacterial efficacy of a traditional polyherbal formulation Nagaradi Kashayam prepared in the lab as well its commercial formulation on multidrug resistant *K.pneumoniae* isolates. The formulation had been in use to treat respiratory tract infections, which is one among the leading infectious conditions prevalent in our country and also one among the recommended drug by AYUSH for post Covid conditions.

Method: The study involves collection of raw drugs and preparation of the polyherbal formulation as per the authetic text. Lab sample and a commercial sample from the market were subjected to phytochemical screening. Triplicates of both samples were checked for antibacterial activity using agar well diffusion assay. Five multidrug resistant clinical isolated were collected form a tertiary care hospital. Isolates were sub-cultured and standardized to 0.5 MFU. The Mueller Hinton agar plate was inoculated by spreading 100 µL of microbial inoculum (KP-1, KP-2, KP-3, KP-4, KP-5) over the entire agar surface. A hole with a diameter of 6 mm was punched aseptically with a sterile cork bore and a volume of 100 µL of varying concentration (25mg/ml,50mg/ml and 100 mg/ml) of the Kashayam prepared in the lab and a single concentration of commercial sample (CS 100 mg/ml) were introduced into the well. The agar plates were incubated. The antimicrobial activity was expressed in terms of Zone of Inhibition in mm.

Result: The phytochemical screening identified the presence of alkaloids, phenols, saponins and tannins. Agar well diffusion assay confirmed the antibacterial effect of the commercial formulation and lab sample with a zone of inhibition ranging from 13±0.6mm to 21±0.4mm

Conclusion: This study proposes Nagaradi Kashayam as a promising alternative strategy for treating respiratory tract infections caused by multidrug resistant *K.pneumoniae*. The work will be extended to more clinical isolates to analyze its effect on strains with different resistance profile. The metabolites of the Kashayam reported in the literature showed appreciable antibacterial effect. So, the antibacterial effect shown by the formulation could be attributed by the concerted effect of the reported metabolites.

Keywords: Agar well diffusion, polyherbal formulation, zone of inhibition.

07–LIFE SCIENCES

ORAL PRESENTATION

07-01

EXPLORATION OF CHEMICAL DIVERSITY OF SECONDARY METABOLITES OF STREPTOMYCES FROM THE WESTERN GHATS FOREST THROUGH OSMAC AND CO-CULTURE

D. K. Induja and Ravi Shankar Lankalapalli*

Chemical Sciences and Technology Division, CSIR-National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram, 695019, Kerala, India. Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 201002, India

**Corresponding author: ravishankar@niist.res.in*

Background: An important component of microbial genome mining is to find secondary metabolite-biosynthetic gene clusters (SM-BGCs) that can contribute to novel natural product discovery. The genetic potential of streptomyces has not been fully utilized because most of the SM-BGCs are silent under laboratory pure culture conditions. Activation of SM-BGCs by OSMAC (One Strain Many Compounds) and coculture are simple culture-based methods and these methods do not require prior knowledge at the gene level compared to other high-throughput techniques.

Methods: The experimental methods include fermentation of streptomyces in a suitable media and isolation of SMs by extraction with an organic solvent (ethyl acetate:methanol 95:5). The crude mixture obtained from the organic extract was subjected to silica gel column chromatography to isolate the SMs. The isolated SMs were characterized by 1D/2D NMR and HR-ESI-MS techniques for identification.

Results: Two streptomyces strains were selected and they were culturedinto three different media compositions and isolated different groups of compounds from each media, confirming the expanded diversity of secondary metabolites through the OSMAC strategy. Coculturing of strains resulted in the isolation of two new stereochemical variants of streptophenazine along with five other compounds.

Conclusion: In OSMAC, a single strain can be induced to produce various molecules by changing culture conditions. The coculture of microbes is an efficient strategy for discovering novel SMs. Careful selection of coculture partners will yield desirable results in producing novel secondary metabolites.

Keywords: Secondary metabolites, Biosynthetic gene clusters, Coculture, OSMAC, *Streptomyces* species, Natural products.

07-02

EXPLORING TRYPSIN INACTIVATION BY ENGINEERED SILVER NANOCRYSTALS - FABRICATED WITH *HOLIGARNA ARNOTTIANA*

Neethu George[b] & Gayathri Devi D[a]

[a] Department of Life Sciences, University of Calicut, Malappuram, Kerala, India- 673635, [b] Department of Biochemistry, Pazhassiraja college, Pulpally, Wayanad, Kerala, India- 673579

Background: Modification of catalytic expression of enzymes and regulating their*in vivo* activity are the goals of novel treatment strategies. A green synthetic nanostructured silver with potent trypsin inhibitory properties has not yet been developed, despite the fact that silver nanoparticles possess unique properties that allow them to efficiently block enzymes. The present study demonstrates for the first time, a facile, safe, economic, and eco-friendly synthetic route for silver nanoparticles using aqueous extract of *Holigarna arnottiana* bark (HaAgNPs) engineered to interact with trypsin and hinder its activity effectively.

Methods: A variety of methods have been employed to characterize the synthesized HaAgNPs.The studies carried out to examine the interaction between these biofabricatedAgNPs (HaAgNPs) and trypsin by UV Visible spectrophotometry and FTIR spectroscopy.

Results: The relative inhibitory potential of HaAgNPs on trypsin, exhibited about 92% of inhibitionwith 150 and 200 µg/mL HaAgNPs. *In vivo* studies on *Aedes aegypt*i larval serum support these instrumental results of HaAgNP induced trypsin inhibition and prove its application as a bio pesticide. The absence of characteristic peaks for p-NA in the UV-Vis spectrum of trypsin and BAPNA in the presence of HaAgNPs again confirms the inhibition of trypsin activity.

Conclusion: Altogether, this work demonstrates that bio fabricated HaAgNPs are multifunctional and cost-resilient biological tools that can be used as enzyme regulators possessing insecticidal features.

Keywords: Silver nanoparticle, Green synthesis, *H. arnottiana,* Trypsin inhibition.

07-03

ROBININ EXERTS PROTECTIVE EFFECT BY INHIBITING ENDOPLASMIC RETICULUM STRESS IN CARDIOMYOCYTE

Abhirami[a] and Janeesh Plakkal Ayyappan[a,b]

a.Translational Nanomedicine and Lifestyle Disease Research Laboratory, Department of Biochemistry, University of Kerala, Kariavattom campus, Thiruvananthapuram 695034, Kerala. b. Centre for Advanced Cancer Research, Department of Biochemistry, University of Kerala, Kariavattom campus, Thiruvananthapuram 695034, Kerala, India

Background: Glycosides are well known for their therapeutic effectiveness against various cardiovascular diseases. Robinin is one of the glycosyloxyflavone which has been less explored for their therapeutic application especially in the field of cardiovascular disease.

Method: In the present study, we explored the cardioprotective effect of Robinin by assigning H_2O_2 and Doxorubicin (Dox) treated H9c2 as an *in vitro* model of oxidation-damaged as well as

the endoplasmic reticulum stress (ERS) and apoptosis. H9c2 cells were pre-treated with 50µg/ml Robinin for 24 h before exposure to 100 µM H_2O_2 for 1 h. H_2O_2 treatment caused severe cellular damage to the H9c2 cells, which was accompanied by apoptosis, as revealed by analysis of cell nuclear morphology, through Hoechst 33342 staining and AO/EB staining. qPCR was used to detect the expressions of apoptosis-related markers and ERS markers. ROS generation was detected by DCFH-DA staining and FACS analysis. Signalling pathways were analyzed with Western blot.

Result: Robinin pre-treatment significantly reduced the apoptotic rate by enhancing the endogenous anti-oxidative activity of superoxide dismutase, glutathione transferase, and catalase, as well as decreasing the activity of Malonaldehyde and Lactate Dehydrogenase. Robinin pre-treatment inhibited the generation of reactive oxygen species (ROS) as well as remarkably decreased the fluorescence intensity of ROS. Robinin pre-treatment reduced the ERS associated proteins such as Bip/GRP78, IRE1-α, PDI and PERK expression thereby decrease apoptosis associated proteins such as Caspase 9 and PARP compared to H_2O_2-treated cells.

Conclusion: In conclusion, our research shows that Robinin protects H9c2 against oxidative damage and ERS and the ensuing myocardial apoptosis. The suppression of ROS, ERS-related gene and protein expression may be the cause of these effects, since it prevents the apoptotic pathway from progressing.

Key words: Myocardial infarction, ER Stress, Apoptosis, ROS.

07-04

ECOLOGICAL IMPACTS OF INVASIVE SPECIES ON TRUE MANGROVES: A CASE STUDY FROM SELECTED MANGROVE WETLANDSOF KANNUR DISTRICT, KERALA

M Swedha Madhavan[1], P Sreeja[2], K T Chandramohanan[3]

[1]Research Scholar, Department of Botany and Research Centre, Government Brennen College, Dharmadam P O, Thalassery, Kerala 670106, India. [2]Assistant professor Department of Post Graduate studies and Research in Botany, Sir Syed College, Taliparamba, Kannur, Kerala 670142, India. [3] Associate Professor & Principal, Krishna Menon Memorial Government Womens College, Pallikkunnu P O, Kannur, Kerala, 670 004, India

Background: The spread of invasive species continues to be one of the major threats to natural ecosystems and their species diversity. Mangrove wetlands are the most vulnerable ecosystems worldwide and are immediately affected by plant invasion. But little is known about the functional features of these invasive species, invasion patterns and their ecological impacts.

Method: The current study aimed to document the invasive species present, as well as their rate of invasion (RI) and their ecological impacts on mangrove plant species distributed in the selected study sites of Kannur district. The study stations include Kuppam (S_1), Kuttikkol (S_2), Mullool (S_3), Pattuvam(S_4) and Vellikkeel (S_5). Sampling of plant species were done through quadrat study. Quadrats size of 10×10 m^2 were set after every 15m distance. Mangrove species were identified and described by using Tomlinson (1986).

Results: A total of 48 plant species including 9 true mangroves and 19invasives were documented from the study. Climbers such as *Volkameria inermis*, *Derris trifoliata*, *Ipomoea cairica*, *Mikania scandens*, and *Camonea vitifolia* have been found to be highly invasive. *Acacia mangium*, *Annona*

glabra, *Gliricidia sepium* and *Lantana camara* are exotic invasives. *Derris trifoliata*, *Annona glabra*, and *Mikania scandens* are some of the most significant invasives with a high Rate of Invasion (RI) value. True mangroves such as *Avicennia marina*, *A. officinalis*, and *Sonneratia caseolaris* were completely invaded and encircled by woody lianas such as *D. trifoliata*.

Conclusion: The uncontrolled spread of invasives may lead to reduction in mangrove biomass production and alter the natural balance of the ecosystem. Proper policy formulation and management interventions are also required to control the invasive plants on mangrove wetlands for its conservation. Invasive plants and their ecological impacts must be studied in depth and this fragile wetland ecosystem should be continuously monitored.

Keywords: Invasive species, Invasion, Mangroves, Wetland.

07-05

A GENOMIC APPROACH FOR EXPLORING NOVEL SECONDARY METABOLITES FROM AN ARCTIC SEDIMENT DERIVED *SACCHAROPOLYSPORA* SP. DM62

Rojin Joseph[1], Dhaneesha M[2], Md. Umar[1] and Sajeevan T.P[2]

[1]National Centre for Aquatic Animal Health, Lakeside campus, Cochin University of Science and Technology, Fine Arts Avenue, Cochin-682016, Kerala, [2]Department of Marine Biology, Microbiology and Biochemistry, School of Marine Sciences, Lakeside campus, Cochin University of Science and Technology, Fine Arts Avenue, Cochin-682016, Kerala

Background: Natural product research has focused on isolating microbes from diverse environments as they represent an under-explored source of biosynthetic potential. Also non- streptomyces actinomycetes are an exciting prospect for drug discovery. Availability of whole genome date has led to emergence of genome mining as a powerful tool.

Method: Sediment samples from Kongsfjord, Svalbard, were used to isolate actinomycetes. Strain DM62 was isolated, purified and DNA was extracted, followed by 16SrRNA gene sequencing and analysis. It was followed by whole genome sequencing of the strain using the Illumina Hiseq 4000 sequencing platform. The genome was assembled based on the Shovill pipeline, which follows the SPADEs assembly on the Galaxy platform, and its putative biosynthetic gene clusters (BGCs) were determined using antiSMASH and MIBiG databases.

Results: 16SrRNA analysis showed strain DM62 have 99.71% similarity to *Saccharopolyspora gloriosae.* Whole genome assembly resulted in a high-quality draft genome of 65,46,894 bp with 72.50% GC content. The highest Average Nucleotide identity (ANI) score was observed with *Saccharopolyspora gloriosa* (87.1%), which is well below the threshold of 95% for delineating the species. About 24 BGC's were predicted by antiSMASH of which nine were found to have more than 40% similarity to already reported metabolite gene clusters.

Conclusions: In this study, genomic features and biosynthetic potential of a non-Streptomyces actinomycete were analysed. The gene clusters of the strain DM62 that are more similar to reported clusters may be encoded for analogues of known compounds. In contrast, remaining less similar clusters indicate the potential to produce novel secondary metabolites. This study emphasises the importance of unexplored and underexplored environments, including the Arctic and Antarctic

ecosystems, as excellent sources of rare actinomycetes, which are considered to be a good source of novel secondary metabolites.

Keywords: Genome mining, Saccharopolyspora, whole genome sequencing, antiSMASH, Biosynthetic Gene Clusters (BGC's).

07-06

PHYTOHORMONE ASSISTED AUGMENTATION OF BIOMASS AND BIOCHEMICAL PRODUCTIVITY IN SELECTED MICROALGAE

Aravind K Vijay, Syama Prabha, Basil George

Department of Botany, CMS College Kottayam (Autonomous), Kerala, India, 686001

Background: Indigenous microalgae with high growth rate, oil content and favourable biochemical composition have been regarded as potential candidate for biofuel production. Exogeneous supplementation of phytohormones to promote the selective enrichment of biomolecules without hampering biomass production is regarded as a promising approach to improve the techno-economic feasibility of biofuels and other value-added products derived from microalgae.

Method: The study focuses on the molecular characterization of native *Ankistrodesmus* sp. and *Scenedesmus obtusus* microalgae strains, utilizing 18S rRNA sequence analysis. The strains were cultivated with two different class of phytohormones (auxin & kinetin)at varying concentrations (0.01–100 µM) and their effects on growth, biomass productivity, pigment and biochemical composition, cell morphology, and neutral lipid accumulation were analysed to determine the optimal phytohormone concentration for large-scale cultivation of these microalgae.

Results: *Ankistrodesmus* sp. under the supplementation natural auxin (IAA) at 10 µMhas shown 87% increase in the biomass production along with a concomitant increase in the protein and carbohydrate content (28.6 % and 51 % DCW respectively) as compared to control. Whereas, the synthetic auxin analogues(2,4-D), at higher supplemented concentrations induced a 30– 40% increase in carotenoid production and exhibited an increased lipid content of 41–47% DCW with a substantial increment in the neutral lipid proportion (>70 %) when compared control. Meanwhile, *Scenedesmus obtusus* under kinetin supplementation (25 µM) exhibited 75% increase in biomass productivity, whereas auxin (IAA) at higher concentration (>50 µM) have incited significant increase in neutral lipid and carotenoid accumulation in the biomass.

Conclusion: The results indicate that the auxin and its analogues under study could increase the biomass production and favorably modulate the biochemical composition of *Ankistrodesmus* sp., while kinetin supplementation was found to be superior in eliciting higher biomass production in *Scenedesmus obtusus*. Both strains have shown a significant increase in lipid productivity under the optimum concentration of auxins, and hence, their supplementation can be considered in large-scale cultivation of these strains for biofuel.

Keywords: Biofuel; Microalgae; Lipid productivity; Neutral lipid; Carotenoids.

07-07

IDENTIFICATION OF CAROTENOIDS FROM PHYLLOPLANE BACTERIA *BACILLUS SUBTILIS* AND EVALUATION OF UV-SHIELDING EFFECT

P. M. Shareena [1], K. S. Shimi [2], J. Jiya [1] and N. M. Krishnakumar [1]

[1] Department of Biosciences, Rajagiri College of Social Sciences (Autonomous), Kalamassery, Kochi, Kerala-683104. [2] Department of Botany, St. Joseph's College (Autonomous), Irinjalakuda, Thrissur, Kerala-680121

Background: Carotenoids are a group of pigments that are naturally occurring in plants, fruits and vegetables. They are synthesized in photosynthetic organisms as well as in non-photosynthetic bacteria and fungi. Carotenoids are responsible for the bright red, orange and yellow colors.

Method: The pigment producing bacteria was isolated from the leaves of *Bougainvillea* species. The superior strain was selected based on its ability to produce the pigment. The strain was sub-cultured in nutrient agar. The extracted pigments were subjected to UV-visible spectrophotometry to confirm the type of pigment generated. Further phytochemical analysis has been done by LCMS – QTOF. The identification of bacterial strain was done by the employment of 16 S rRNA sequencing method. UV-protective effect was evaluated by chromosome squash technique using the root tips of *Allium cepa*.

Results: Out of various colonies isolated in the nutrient agar medium, only one shows intense yellow pigment production. From the phylogenetic analysis, it was evident that the bacterium was *Bacillus subtilis*. UV-visible spectrophotometric results indicated that the pigment belongs to carotenoid family. The effects of temperature and pH were studied for optimizing culture conditions to maximize the bacterial growth. The maximum growth was analysed at 37°C and pH 7. The bacterial growth curve was estimated by examining the growth in colorimeter. LC-MS analysis revealed the presence of carotenoid compounds such as neoxanthin, astaxanthin, adonixanthin, zeaxanthin, alpha-carotene and violaxanthin. The results of UV-protection study indicated that the root tip of *Allium cepa* treated with the pigment was not affected by the UV radiation and showed normal cytological changes after treatment compared to the control.

Conclusion: The present study suggested that *B. subtilis* can produce carotenoid pigment and since it has UV shielding activity, it can be further applicable as bioindicators, pigment in food and nutraceuticals, etc.

Keywords: *Bacillus subtilis*, UV visible spectrophotometer, Phylogenetic analysis, Phylloplane.

07-08

TITANIA-SILICA-REDUCED GRAPHENE OXIDE NANOCOMPOSITE COATINGS AS ANTIFOULING AGENTS FOR MARINE APPLICATIONS

Swargy Anson, Smitha V S*, Digilarani M, Vimala T, Resmi T R

Centre for Water Resources Development and Management (CWRDM) Kunnamangalam P. O., Calicut, Kerala, India
Corresponding author: smithavs@cwrdm.org

Background: Fouling, the unwanted accumulation of marine organisms and debris on submerged surfaces, is a pervasive problem in marine environments as it can have significant economic, environmental, and ecological consequencesimpacting marine industries. This necessitates the development of novel antifouling coating formulations for protecting marine vessels. Titania-silica nanocompositeshave gained significant attention in antibacterial as well as antifouling applications due to their photocatalytic property, high surface area, hydrophilicity, durability, self-cleaning nature, etc. Graphenewhen incorporated into a suitable matrix isconsidered an effective strategy for the development of antifouling coatings on various substrates for improved performance, considering the numerous oxygen-containing groups present in their structure.Hence, a novel coating formulation based on reduced graphene oxide (GO) incorporatedtitania-silica nanocomposite is used in the present workfor developing multifunctional coatings on substrates, suitable for marine applications.

Method: Titania-silica-reduced graphene oxide (TS-RGO) nanocomposites were synthesized successfully using a sol-gel method. The structural, morphological, and functional features of the synthesized nanocomposites were evaluated further using different characterizations such as XRD Analysis, UV-visible spectral Analysis, FTIR Analysis,Raman Analysis, BET Surface Area Analysis, and SEM Analysis. The nanocomposites thus synthesized were made into coatings of different compositions and their antifouling property against E. coli, marine bacteria, marine algae, and freshwater algae were investigated in detail.

Results: A combined chemical and thermal method used in the study helped in reducing the graphene oxide (GO) to reduced graphene oxide (RGO) in the nanocomposite. The UV-visible absorbance spectra corresponding to the π-π* and n–π *transitions in the nanocomposite indicate the presence of functional groups on the surface of the nanocomposite. Raman spectra show a significant reduction in the intensity and a slight upshift to a higher wavenumber region for the D and G bands in the TS-RGO nanocomposite which confirms the removal of oxygen-containing functional groups from GO. The high surface area and mesoporous nature of the synthesized nanocomposite were revealed from the BET adsorption-desorption isotherm and the pore size distribution curve. A uniform distribution of very fine particles of titania-silica matrix over the graphene oxide sheets was visible from the SEM images. A higher biofilm inhibition percentage of the nanocomposites and coatings was higher when compared to that of the control. The durability of the functional coatings was revealed from the swelling and degradation studies performed.

Conclusions: Antifouling studies performed with freshwater and marine organisms in the present work show that the developed TS-RGO nanocomposite and its coating possess good antifouling properties. Hence, the present work offers a facile, low cost and eco-friendly method for developing functional coatings suitable for marine applications.

Keywords: Titanium dioxide, Silica, Graphene Oxide, Nanocomposite, Antifouling Coating.

07-09

DETERMINING THE ACTIVE PRINCIPLES AND BIODIVERSITY OF THE LICHEN GENUS *PARMOTREMA* IN KERALA

Bibin Joseph and N.S. Pradeep

KSCSTE-MBGIPS, PB. No. 1, GA College Post, Kozhikode, Kerala 673014

Background: lichens are the indicators of ecological wellbeing of the biotic components of the ecosystem and pioneers of xerarch succession. The luxuriant lichen biota of the Western Ghats has significance in-terms of biodiversity as well as the source of the novel phytochemicals. The diversity assessment often provides an opportunity to the sustainable utilization of the bioresources to fulfill the needs of today impeding biodiversity loss.

Method: the present work assess the diversity of genus *Parmotrema* in Kerala and collect samples, prepare the QGIS maps of their habitat, and preserve them as herbarium and analyze the threats to these group and design conservation strategies by population assessment. The pharmaceutical potential is assessed by analyzing the phytochemical constituents and quantifies the active principles using GCMS/HPLC. The validations of medical properties are mainly done by antimicrobial and antioxidant assays.

Results: the Biodiversity assessment elucidates twenty one species of lichens of the genus *Parmotrema* are present in Kerala part of Western Ghats with a new record to India i.e. *Parmotrema clavuliferum* (Räs.) Streimann. The phytochemical investigation reveals that the newly recorded species along with three other taxon of the genus *Parmotrema* are sustainable source of the UV protective Usnic acid which intern an integral component of derma protective serums widely consuming all over the world. Usnic acid also has antimicrobial activity, ability to inhibit motility of human lung cancer cells, ability to produce anti- virulent compound against *Candida albicans*.

Conclusions: lichen diversity of the Kerala part is poorly documented and conservation measures are inadequate mainly due to the field assessment and the unawareness of the application of these bioresources. The documentation, conservation and utilization of lichens in a sustainable manner is absolutely beneficial to the mankind.

Keywords: *Parmotrema*, Usnic acid, Biodiversity, Human Lung Cancer Cells, Derma Protective.

07-10

IN SILICO EXPLORATION OF THE MECHANISTIC INSIGHTS: INTERACTIONS OF CURCUMIN, QUERCETIN, AND ETHEPHON WITH ESTROGEN RECEPTORS AND STEROIDOGENIC ENZYMES

Krishnanjana V.J.[1], Sujith S.[2], Nisaath begum[3], Nisha A.R.[4]

[1]MVSc Scholar, Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences Mannuthy,Thrissur-680651, [2]Assistant Professor,Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences Pookode,Wayanad- 673576, [3]Phd Scholar, Department of Veterinary Pharmacology and Toxicology College of Veterinary and Animal sciences, Mannuthy, Thrissur-680651, [4]Associate Professor and Head, Department of Veterinary Physiology, College of Veterinary and Animal Sciences, Mannuthy, Thrissur-680651

Background: Ethephon is a widely used plant growth regulator in agriculture to promote fruit ripening, abcission, flower induction and seed germination. Worries over ethephon's effects on the reproductive system are arising and it can have a negative impact on reproductive health by modifying sex hormones, which can be dangerous for both humans and animals. Curcumin, a polyphenolic compound obtained from turmeric and Quercetin, a flavonoid present in several vegetables and fruits can influence pituitary and ovarian hormones and mediate benefits on reproductive processes. In this

context, the present study was undertaken with the objectives of determining whether curcumin and quercetin have an ameliorative effect on reproductive toxicity by ethephon by insilico analysis.

Method: To identify mechanism of ethephon, quercetin and curcumin, molecular docking has been performed. Three dimensional structures of estrogen receptor alpha(PDB Id: 1A52), estrogen receptor beta (PDB Id: 1X7B), CYP19A1 (PDB Id: 3S79), CYP11A1 (PDB Id: 3NA1),CYP17 (PDB Id: 3RUK),17βHSD (PDB Id: 1BHS), Star proteins(PDB Id:3P0L) were retrieved from RCSB and docking was done with AutoDock V 4.0 using three ligands (ethephon, quercetin, curcumin)

Results: Curcumin and quercetin showed more binding energy ranging from -7.97 to -3.12 than ethephon with binding energy ranging from -4.44 to -1.56 with all the receptors except estrogen receptor alpha. Ethephon showed more affinity to estrogen receptor alpha than curcumin and quercetin (217.20 and 32.87 kcal/mol respectively).

Conclusion: From this study, it could be concluded that ethephon having high affinity with estrogen receptor alpha results in proliferation whereas curcumin and quercetin having high affinity to other receptors and less affinity to estrogen alpha receptor results in antiproliferative effect and these compounds can counteract all effects of ethephon.

Keywords: Ethephon, Curcumin, Quercetin, Docking, Estrogen receptor alpha and beta, CYP19A1, CYP11A1, CYP17, 17βHSD, Star.

07-11

ENDOPHYTIC FUNGI FROM AEGLE MARMELOS: POTENTIAL FOR HEAVY METAL TOLERANCE AND PLANT GROWTH PROMOTING PROPERTIES

Swetha P R and Resmi M S

Post Graduate and Research Department of Botany, Sree Neelakanta Govt. Sanskrit College, Pattambi, Kerala, India, 679306

Corresponding author: swethapramachandran@gmail.com

Background: Endophytic fungi are microorganism which resides in the plant tissue without causing any harmful effect on the plant.

Methods: In the current study, endophytic fungi were isolated from different parts of *Aegle marmelos.* From the isolates, 5 strains are evaluated for their potential for heavy metal tolerance and plant growth promoting properties (PGPR).

Results: *Amycosphaerella Africana* and *Purpureocillium liacinum* were able to produce amylase and Laccase. Most of the strains can solubilize phosphate. *Purpureocillium liacinum* exhibited a clearer zone of 6.8±0.037 around the colony and they produced IAA in the presence of tryptophan supplement. *Trichoderma* sp. produced 1.5 µg/mL IAA. Most of the strains exhibited tolerance to all the tested heavy metals (Cd, Cr and Pb). *Trichoderma* showed a maximum Tolerance Index towards Cr (0.72).

Conclusions: Morphological changes in the colonies of stressed fungi were also analysed. The results of this study suggest a potential utilization of these fungal strains for plant growth promotion and mycoremediation of contaminated areas.

Keywords: IAA, PGPR, Heavy metal, Tolerance index.

07-12

MICRO-MORPHOLOGICAL CHARACTERISTICS OF ACHENE OF SELECTED *CYPERUS* SPECIES (CYPERACEAE) FROM KERALA, INDIA

[1]Anakha B. S and [2]A. R Viji

[1]Research & P. G. Department of Botany, Christian College, Kattakada, Thiruvananthapuram, Kerala 695572, India. [2]P. G. Department of Botany, Iqbal College, Peringammala, Thiruvananthapuram, Kerala 695563, India

Background: The infrageneric taxonomy of the genus *Cyperus* L. is debatable because of the diversity of morphology and the existence of multiple convergent evolutionary lines. Within the species itself, they show considerable variation in their morphological features. Therefore, the present study aims to establish the taxonomic boundaries between the selected species of the genus *Cyperus* with their allied species in Kerala based on achene micromorphological characteristics.

Method: Specimens were collected and examined with a stereo-zoom microscope and characters regarding the size, shape, and colour of the achenes were recorded. To study the ornamentation structures SEM (Scanning Electron Microscopic) images were taken. Photographs were taken at two magnifications to show the entire nut and at a greater magnification to illustrate the surface features of each achene. Identification keys were prepared using the studied morphological features.

Results: The micromorphology of achenes of selected species including *Cyperus babakan, C. compressus, C. iria, C. platystylis, C. surinamensis, and C. stoloniferous*etc., and their allied species was examined under a light and scanning electron microscope. It was discovered that different species have distinct achene surface micromorphological characteristics. There are clear differences between epidermal cells in terms of their size, the type of periclinal wall, thickness, sinuosity of anticlinal walls within each cell, and whether or not silica bodies are present. Generally, the shape of achenes is trigonous but in *C. stoloniferous* it is biconvex. Unequally trigonous and nut angles thickened by corky tissues were observed as the characteristic features of *C. platystylis*. According to the distribution of silica bodies in some species, it is absent and, in some others, pointed or blunt-ended silica bodies are present.

Conclusion: Identification and delimitation of several *Cyperus* taxa at the species and infra-specific levels were made possible by interpreting the achene morphology, which also helped establish taxonomic connections.

Keywords: *Cyperus*, Cyperaceae, SEM Study, Kerala.

07-13

ISOLATION AND MOLECULAR IDENTIFICATION OF MULTIDRUG RESISTANT BACTERIAL PATHOGENS FROM DIABETIC FOOT ULCERS

Vipina Vinod T N[1], Sreejith S[1]Jos V Stanley[2], Nimmy Paul[3], Radhakrishnan E K[1], Jyothis Mathew[1]

[1]School of Biosciences, Mahatma Gandhi University, Kottayam, [2]Department of General surgery, Government Medical College, Kottayam, [3]Department of Microbiology, Government Medical College, Kottayam

Background: Diabetic foot ulcers (DFUs) are the most common microvascular complications associated withdiabetes mellitus which having high morbidity and mortality rate. It can lead to serious physical consequences including limb amputations as well assignificant social, psychological, and economic outcomes. However, the polymicrobial infections caused by the multidrug resistant pathogens accelerate the severity of the DFU. This study focuses on the isolation and molecular identification of bacterial pathogens from DFUs**.**

Methods: Wound swabs of ulcers (n=40) from patients with diabetic foot ulcer were collected fromGovt. Medical College, Kottayam.Bacterial pathogens were isolated and antibiotic susceptibility pattern of these organism were tested. The genomic DNA of MDR pathogens were isolated and were then subjected to 16srDNA amplification using the universal primer for the molecular identification.

Results: From the ulcer wound swabs of 40 DFU patients, 105 microorganisms were isolated.Out of these, 20 were MDR pathogens. The identification of the MDR organism was done through 16srDNA Sanger sequencing. Among these, tree was MRSA, nine of them were *Klebsiella pneumoniae*, two were *Escherichia coli*, two *Pseudomonas aeruginosa*, one *Providencia stuartii*, and 2 *Morganella morganii*, and one *Enterobacter aerogenes*.

Conclusion: The study's findings could offer valuable insights for the selection of potential antibiotics and management of DFUs**.**

Key words: Diabetic foot ulcer, multidrug resistant, polymicrobial, Molecular identification.

07-14

INVESTIGATION OF ACARICIDAL EFFICACY OF BLACK PEPPER (*PIPER NIGRUM* LINN) ESSENTIAL OIL AGAINST GALL MITE, *ACERIA PONGAMIAE* KEIFER (ACARINA: *ERIOPHYIDAE*)

Maneesha Kunnathattil[1], Sangeetha G. Kaimal[2] and Arunaksharan Narayanankutty[3]

[1]PG & Research Department of Zoology, Govt. College Madappally (Affiliated to University of Calicut), Calicut 673102, India. [2]Department of Zoology, Providence Women's College (Affiliated to University of Calicut), Calicut 673009, India. [3]Division of Cell and Molecular Biology, PG & Research Department of Zoology, St. Joseph's College (Autonomous), Devagiri, Calicut 673008, India

Background: Black pepper (*Piper nigrum*; Family:*Piperaceae*), one of the world's oldest and most popular spices, is notable for its diverse role in manufacturing perfumery and confectionery products and antimicrobial, antioxidant, and insecticidal activities.

Method: The present study was conducted to investigate the acaricidal efficacy of black pepper

essential oil (BPEO) against a notorious pest, *Aceria pongamiae* Keifer (Acarina: *Eriophyidae*) using both fumigation and contact toxicity assays under laboratory conditions for the first time. In fumigant toxicity, five concentrations (0.1%, 0.25%, 0.5%, 0.75%, and 1%) and in contact toxicity, four concentrations (0.6%, 0.7%, 0.8%, and 0.9%) of BPEO were exposed to adult *A. pongamiae* using the leaf flotation technique.

Results: Hydro-distillation of black pepper yielded 1.81% ± 0.09essential oil. A total of 32 components from BPEO were detected in Gas Chromatography–Mass Spectrometry (GC-MS) analysis, which showed that the major components were caryophyllene (32.77%), followed α-terpinolene and limonene (12.83%), β-pinene (12.75%), and á-phellandrene (11.95%).The findings from the study revealed noteworthy fumigant toxicities (LC50=1.57, 1.33, and 0.79after 24 h, 48 h, and 72 h respectively) and contact toxicity (LC50=0.92, 0.68, and 0.46after 24, 48, and 72 h respectively) against this major eriophyid pest.

Conclusions: Through fumigant and contact toxicity assessment, the significant result of this study indicated that the essential oil extracted from black pepper has great promise as an environmentally safe and effective botanical insecticide against eriophyid mites.

Keywords: Black pepper, essential oil, pest control, *Aceria*, fumigation, contact toxicity.

07-15

A NOVEL METHOD FOR JUDICIOUS UTILIZATION OF ASOKA (*SARACA ASOCA* (ROXB.) (W.J.DE WILDE) IN HERBAL DRUG INDUSTRY

Mufeeda P K, Sulaiman C T*, Indira Balachandran

Phytochemistry Division, Centre for Medicinal Plants Research, Arya Vaidya Sala, Kottakkal-676503, Kerala, India
Corresponding author: sulaimanct@aryvaidyasala.com

Background: *Saraca asoca* commonly known as Asoka is an important medicinal plant used in various traditional systems of medicines like Ayurveda. Bark of this tree is used for the treatment of various diseases like uterine disorders, skin disorders, leucorrhoea, menstrual irregularities etc. Asoka has been threatened due to over-exploitation and sustainable and judicious utilization of available materials is one of the important alternative strategies to solve the scarcity of this species. In this study, comparative phytochemical and pharmacological evaluation of bark and secondary branches of Asoka has been done to explore the possibility of using secondary branches of *S. asoca* instead of its bark.

Methods: Comparative phytochemical and pharmacological evaluation was carried out in bark and secondary branches of *S. asoca*. Phytochemical comparison was done using different chromatographic and spectroscopic techniques like HPTLC, LC/MS-MS etc. Toxicity and estrogenic activity were compared for both the parts in animal models.

Results: Phytochemical studies showed that chemical constituents of bark of *S. asoca* are unique in nature, however many of these compounds are also found in branches with variations in its abundance. Chromatographic profiling using HPTLC showed matching bands/peaks with comparatively less area percentages in branches. LC/MS based metabolite profiling showed presence of active catechins and flavonoids in both parts. Acute and repeated toxicity studies confirmed that there are no toxic

effects for both bark and secondary branches. Estrogenic activity conducted in ovariectomized rats showed that both bark and secondary branches of *S. asoca* possess significant estrogenic activity.

Conclusion: The study revealed that secondary branches of Asoka possess significant estrogenic activity without any toxic effects. The results suggest judicious utilization of secondary branches of *S. asoca* in herbal industry that may help to address the scarcity of this important drug.

Keywords: *Saraca asoca*; judicious utilization; HPTLC; LC/MS; estrogenic activity

07-16

EXPLORING THE PHYSICOCHEMICAL AND BIOLOGICAL PROPERTIES OF FIXED OIL EXTRACTED FROM THE SEEDS OF *SARCOSTIGMA KLEINII*

Harikrishnan P., Anish N P., Manoj P., Karthika S., and Chandrabhas Narayana

Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram

Background: India is currently facing a substantial demand for fixed oil (vegetable oil) for various domestic purposes and heavily depends on costly imports. India has a long tradition of extracting fixed oil from many oil-yielding plantsfor various applications. Unfortunately, the custom of oil extractionhas diminished in the present time. This study aims to document the significant oil-yielding plants, particularly in the forest regions of Kerala. *Sarcostig makleinii,* one of the documented plants, was selected for fixed oil extraction and yield analysis. In addition, we performed the physicochemical properties and anti-bacterial studies of the *S. kleinii*fixed oil. Moreover, suggesting the *S. kleinii* fixed oil for various applications in many fields based on the studies conducted.

Method: The *S. kleinii* seeds were collected from the forest region of the Idukki district of Kerala. The fixed oil was extracted via Soxhlet extraction using n-hexane. The physio-chemical parameters of the extracted oil including such as specific gravity, viscosity, saponification value, acid value, free fatty acid, iodine value, and peroxide value were performed based on the FSSAI guidelines. The fatty acid composition of the oil was determined through Gas Chromatography-Mass Spectrometry (GC-MS) analysis. Anti-bacterial studies (Agar well plate method and Broth microdilution) were performed against *Staphylococcus aureus* ATCC 25923, Multi-drug resistant *Staphylococcus aureus* (MRSA), and *Enterococcus faecalis* ATCC 29212.

Results: The *S.kleinii* has obtained a 38% oil yield. Additionally, *S. kleinii* oil comprises 40% stearic acid, 23% oleic acid, and 26% linoleic acid. Notably, *S.kleinii* oil exhibited significant antibacterial activity, demonstrating inhibitory effects against *Staphylococcus aureus* ATCC 25923, Multi-drug resistant *Staphylococcus aureus* (MRSA), and *Enterococcus faecalis* ATCC 29212, with inhibition zones ranging from 10 to 15 nm.

Conclusion: The results highlight the outstanding potential of *S.kleinii* oil, indicating promising uses in diverse sectors, with a specific focus on medicine, cuisine, and industry. This oil offers substantial biological advantages, opening the door to its versatile application.

Keywords: *S. kleinii,* Fixed oil, Extraction, Soxhlet, Physicochemical, GC-MS, Anti-bacterial

07-17

GUARDING HEALTH & WEALTH: A ONE HEALTH APPROACH TO TACKLE AMOXICILLIN RESISTANCE IN KERALA

Radhika PM

MSc Zoology, B Ed Natural Science Student, CICS College of Teacher Education, Calicut, Calicut University

Background: We are facing a crucial challenge in Kerala where the health of people, animals & the environment is closely tied to the state's economic well-being. The research navigates the landscape of Amoxicillin resistance in Kerala, weaving insights from human and veterinary healthcare professionals into a cohesive narrative. Embracing the One Health approach, this paper aims to uncover the multifaceted challenges of Amoxicillin resistance and its intertwined impact on health, the economy, and the environment.

Method: Surveys conducted among healthcare professionals including veterinary doctors and physicians in Kerala shed light on the complexities of Amoxicillin resistance, emphasizing the urgent need for a comprehensive One Health strategy.

Result: The study explored prescribing patterns, observations of resistance, and healthcare practices in the context of Kerala's economy and the One Health framework. Findings revealed that Amoxicillin remains a prevalent first-line choice for bacterial infections, but a concerning number of healthcare professionals observed a rise in resistance.

Conclusion: By recognizing the interconnectedness of health and wealth, the paper calls for robust monitoring systems, targeted education efforts, and enhanced collaboration to effectively tackle Amoxicillin resistance in Kerala.

Key words: One health, Antibiotic resistance, Amoxicillin.

07-18

ASSESSMENT OF MICROPLASTICS FROM A TROPICAL MANGROVE ECOSYSTEM ALONG THE KERALA COAST

Jestin M S, Gopika Sivan, Priyaja P*

Department of Marine Biology, Microbiology and Biochemistry, School of Marine Sciences, Cochin University of Science and Technology, Kochi-16, Kerala, India
**Corresponding author: priyaja59@gmail.com*

Background: Mangrove forests are extremely productive ecosystems offering commercially and ecologically important services and products. Mangroves can filter and accumulate plastics which in turn lead to relative microplastic prevalence within the ecosystem. Organisms inhabiting these ecosystems are susceptible to accidental feeding and accumulation of these particles. This study was conducted to assess the level of microplastic pollution in a tropical mangrove ecosystem in Kerala including water, sediment, and mangrove crabs.

Methods: Water, sediment, and crab samples were collected from the Chettuva Mangroves, Kerala and analyzed for microplastics. Microplastics from water, sediment and different body parts of crabs

collected. The abundance, morphotype, colour, size, and polymer composition (FTIR analysis) of microplastics were analyzed in the collected samples. Taxonomic identification of collected crabs was done using standard keys.

Results: In water, the abundance of MPs was found to be 5.42 ± 0.2 particles/L, and was dominated by fibres (89.5%) followed by fragments (10.5%). The transparent MPs constituted 63 % followed by blue (21 %) and red colour (15.7 %). The abundance of MPs was relatively high in the sediment (400 ± 86 particles/Kg), dominated by fibres (61.6 %), films (21.2%), fragments (16.2%) and foams (1 %). Transparent-coloured microplastics (47 %) were dominated followed by red (26 %), blue (18.7) and black (7.5 %). Three crab species were identified as *Parasesarma plicatum, Metopograpsus thukuhar* and *Metopograpsus latifrons.* A high abundance of microplastics was detected in the gastrointestinal tract of *Parasesarma plicatum* (6 particles/g) followed by *Metopograpsus thukuhar* (5 particles/g) and *Metopograpsus latifrons* (2.5 particles/g). MPs with blue colour dominated in the GIT of *P. plicatum* (58.4 %) and *M. thukuhar* (40 %). The claw muscles of *M. latifrons* were dominated by transparent coloured microplastics (60 %), *M. thukuhar* by red colour (50 %) and *P. plicatum* by blue colour (60 %).

Conclusion: In this study, microplastics were detected from water, sediment and crab samples analysed. Detection of microplastics in the mangrove crabs can be a potential pathway for the transfer of microplastics to higher trophic levels in the food chain. Studies on microplastics at different levels of the food chain are significant in understanding the impacts of microplastics at different trophic levels.

Keywords: Mangroves, microplastics, crab, Kerala coast.

07-19

POLLEN BIOLOGY OF *HAMELIA PATENS* JACQ.: A COMPREHENSIVE EXAMINATION OF PHYSIOLOGICAL AND MOLECULAR INSIGHTS

Anu Krishna K[1] and Vivek P J[2]

[1,2]Post Graduate and Research Department of Botany, Sree Neelakanta Government Sanskrit College, Pattambi, Palakkad – 679306, Kerala state, India

Background: Experiments were conducted to explore pollen viability, *in vitro* pollen germination, and *in vivo* pollen tube growth in *Hamelia patens* Jacq.

Method: The Modified Alexander staining method proved most suitable for pollen viability assessment.

Result: Using an artificial medium, with 10% sucrose and lower concentrations of boron (0.01%) and calcium (0.01%) significantly improved *in vitro* pollen germination and tube elongation. *In vivo* germination tests with aniline blue fluorescence microscopy revealed that Gametophytic self -incompatibility (GSI) system in *H. patens* is not a late-acting self-incompatibility (LSI) or ovarian sterility (OS). Furthermore, through a comparative analysis of the *de novo* transcriptome between pollen and juvenile leaf tissues 9,628 pollen-specific genes were identified.

Conclusion: Putative pollen specific transcripts associated with pollen- pistil interaction, self-incompatibility, pollen germination, tube elongation etc are also characterized.

Key words: Pollen transcriptome, leaf transcriptome, Gametophytic self- incompatibility, Aniline blue Fluorescence assay.

POSTER PRESENTATION

07-20

EMBELIN ELEVATES ENDOPLASMIC RETICULUM CALCIUM LEVELS AND BLOCKS THE SREBP2 MEDIATED PCSK9 EXPRESSION ON CULTURED HEPATOCYTES

Mahesh Chandran V.R[1], K.B Ramesh Kumar[2] and Janeesh Plakkal Ayyappan[1]

[1]Translational Nanomedicine and Lifestyle Disease Research Laboratory, Department of Biochemistry, University of Kerala, Thiruvananthapuram 695034, Kerala, India. [2]Jawaharlal Nehru Tropical Botanic Garden & Research InstitutePalode, Kerala, India

Background: Atherosclerosis is a main risk factor of cardiovascular diseases (CVDs) despite of gender, which accounts for the leading cause of deaths globally. Reducedlow-density lipoprotein cholesterol (LDLc) clearance from the circulation plays a critical role in the development of CVDs. One of the important regulators of the circulatory LDLc is the endoplasmic reticulum (ER) resident transcription factor, sterol regulatory element-binding protein 2 (SREBP2). The reduction in the ER calcium levels and the intracellular cholesterol levels activates and translocate the SREBP2 to nucleus and induces the expression of cholesterol regulatory genes like the proprotein convertase subtilisin/kexin type 9 (PCSK9) and the low-density lipoprotein receptor (LDLR**).** The LDLR plays a pivotal role in the cholesterol metabolism by internalizes circulatory LDLc and degraded itin the lysosomes whereas PCSK9 reduces its levels. These circumstances warrant the need for additional studies for identifying cost effective compounds which can target or modulates the expression levels of PCSK9 thereby enhancing the clearance of LDLc by LDLR receptors.Embelin is a major secondary metabolite of Embelia ribes Burm, one of the oldest herbs in Indian traditional medicine. Few studies have reported significant elevation in the uptake of calcium in rat models. This study is designed to investigate the role of embelin in the expression of SREBPs, PCSK9, and LDLR.

Methods: Cell Viability Assay: The cells were incubated with various concentrations of embelin (1 µM, 2.5 µM, 5 µM, 7.5 µM and 10 µM) for 24 hrs followed by the addition of MTT containing media to evaluate the mitochondrial activity.

Quantitative real-time PCR: The total mRNA was extracted using GeneJET RNA Purification Kit (Thermo Scientific), and first-strand cDNAs were synthesized using Verso cDNA Synthesis Kit and amplified with the Power SYBR® Green PCR Master Mix and quantitative measurements were analyzed using the ΔΔCt method.

Measurements of ER Ca^{2+} Levels: A low affinity calcium binding ER specific indicator dye, Mag-Fluo-4 AM were used for measuring ER calcium levels. The fluorescence was imaged using confocal microscope and the fluorescence intensity was also quantified using fluorescent reader.

ELISA: The concentration of PCSK9 in the cell culture media treated with different concentrations of embelin was measured using a Human PCSK9 ELISA kit (#RK02031, Abclonal) according to the manufacturer's instructions.

Immunoblot analysis: The protein level expression of LDLR, PCSK9, SREBP2 and Calnexin were assessed using western blots.

Results: The Key findings of the study are embelin reduces both the protein leveland mRNA level expression of PCSK9 on cultured hepatocytes.Embelin also impedes the mRNA and protein levels of SREBP2 and improves LDLR levels. The immunoblot showed increased expression levels of calnexin, a calcium binding protein in the cultured hepatocytes.Further the levels of Endoplasmic reticulum (ER) calcium werefound to be significantly improved on thapsigargin induced ER stress models which were specifically quantified and imaged using ER specific low affinity calcium binding dye.

Conclusions: This work establishes the role of embelin in blocking the expression levels of SREBP2 mediated PCSK9 levels and thereby improves the stability and expression of LDLR receptors. This suggests the potential role of embelin to be used as an anti-atherosclerotic drug.

Keywords: Embelin, Atherosclerosis, LDLR, PCSK9, SREBP2.

07-21

PHYSIOLOGICAL, ANATOMICAL AND TRANSCRIPTIONAL RESPONSES OF *ALTERNANTHERA TENELLA* COLLA. AGAINST CHROMIUM TOXICITY

Firdous K A and Resmi M S

Department of Botany, Sree Neelakanta Government Sanskrit College, Pattambi, Kerala 679306, India

Background: Intensive industrial activities have raised heavy metal levels in the environment, threatening living systems due to their cytotoxic, mutagenic, and carcinogenic properties.

Method: This study focused on the impact of heavy metals on the riparian diversity on Walayar riverbank in the Kanjikode industrial area. It identified 97 species in 34 families, with *Alternanthera tenella* as the dominant species.

Results: The study explored Cr remediation by *A. tenella*, highlighting morpho-physiological alterations, structural changes, and increased production of stress-related metabolites. High BCF and TF values indicated its suitability for chromium phytoextraction, while transcriptome analysis (44,392 DEGs) unveiled the importance of genes related to Cr uptake, transport, and accumulation mechanisms in *A. tenella*, notably involving cell wall biosynthesis, antioxidant enzymes, glutathione metabolism, chelation, and signaling pathways like MAPK were identified under Cr stress.

Conclusion: Plant hormone signal transduction, particularly abscisic acid and ethylene mediating the MAPK pathway, significantly contributed to Cr tolerance.

Keywords: Phytoremediation; chromium, transcriptome; *Alternanthera*; heavy metal; detoxification; Scanning electron microscopy, riparian vegetation; Walayar river.

07-22

EFFECT OF OXIDIZED LOW DENSITY LIPOPROTEIN ON ENDOTHELIAL FUNCTION AND ENDOTHELIAL TO MESENCHYMAL TRANSITION-*IN VITRO* STUDY

Anju Antharjanam V S and Saja K

Department of Biochemistry, University of Kerala, Kariavattom, Thiruvananthapuram 695581

Background: The Endothelium acts as primary regulator of vascular homeostasis. Most of the risk factors associated with cardiovascular diseases can activate the endothelium and modulate its biological properties. Oxidized low density lipoprotein (Ox.LDL) is a major risk factor for cardiovascular diseases. So the present study was performed to evaluate the effect of Ox.LDL on endothelial function using Mice Aortic Endothelial Cells (MAECs) as in vitro model system.

Methods: Primary culture of mice aortic endothelial cells was obtained from C57BL6 mouse aorta and it was maintained in MCDB 131 medium with 10% FBS and 1% antibiotic antimycotic solution. LDL was precipitated from human serum and it was chemically modified using $CuSO_4$. MAECs were treated with Ox.LDL. Untreated cells served as control.Media and cell layer were collected. Inflammatory markers - Nitric Oxide, Matrix Metallo Proteases (MMPs), and IL6, Endothelial marker- eNOS and the TGF β production were studied.

Results: Ox.LDLtreatment significantlyup regulated the production of inflammatory markers - Nitric Oxide, Matrix Metallo Proteases (MMPs), and IL6. The endothelial marker eNOS was down regulated in Ox.LDL treated groups. MAECs treated with Ox.LDL showed enhanced production of TGF β which is a positive regulator of endothelial to mesenchymal transition.

Conclusion: The up regulation of inflammatory markers shows the onset of inflammation induced by Ox.LDL. The eNOS down regulation shows endothelial dysfunction and increased TGF β production indicates the induction of endothelial to mesenchymal transition which is also a form of endothelial dysfunction. This preliminary study demonstrates that Ox.LDL modulates the normal biological properties of endothelium. Detailed study behind its molecular mechanisms will help to develop new therapeutic strategies for the management of cardiovascular diseases.

Key words: Endothelial cells, Oxidized low density lipoprotein, inflammation, TGF β, eNOS, MMPs, IL6.

07-23

PLANT GROWTH PROMOTING, PHYTOCHEMICAL AND ANTIOXIDANT PROPERTIES OF ENDOPHYTES FROM *LAGENANDRA TOXICARIA* DALZ.

Pooja Pushkaran and N S Pradeep

KSCSTE-Malabar Botanical Garden and Institute for Plant Sciences, Kozhikode, Kerala-673014

Background: Endophytic microbes contribute to plant growth, facilitating mineral nutrient uptake, inducing defense resistance against pathogens, and modulating the production of plant secondary metabolites. It is worth noting that while the use of these beneficial microbes as microbial fertilizers and biocontrol for plants under different environmental stresses is gaining interest, a basic

understanding of plant-microbe symbiosis is necessary to fully realize their potential.

Method: Isolation of endophytic bacteria and fungi from the medicinal aquatic plant *Lagenandra toxicaria*, plant growth promotion activity, and phytochemical and antioxidant properties of ethyl acetate extract of all isolates were observed.

Results: A total of 97 bacteria and 132 fungi were isolated. Thirty-one bacterial isolates were obtained from leaf extracts. In addition, forty-five fungal isolates were from leaf samples, eighty-one from the root, and six from the rhizome. Indole acetic acid production was highly observed in bacterial isolates from root samples and its highest concentration was up to 147.69 mg/L. Fungal isolates from root, leaf, and rhizome samples showed a higher presence of phytochemical compounds, and flavonoid, alkaloid, tannin, and protein contents were observed highest in quantitative analysis. Bacterial isolates were also screened and protein content was mostly observed. The free radical scavenging assays were held and most of the root and rhizome endophytic isolates showed more efficiency.

Conclusions: It was observed from the present study that endophytic isolates of bacteria and fungi are a rich source of organic compounds and these compounds are useful for their survival and also for commercial and therapeutic practices.

Keywords: *Lagenandra toxicaria,* endophytes, IAA production, phytochemicals, antioxidant activity

07-24

PHENOLOGY, SEED DEVELOPMENT SEED GERMINATION AND SEED CHARACTERIZATION IN *HUMBOLDTIA BRUNONIS* WALL., A SMALL TREE SPECIES ENDEMIC TO SOUTHERN INDIA

V. Mithun[1], P. Pooja[1], N. S. Pradeep[1] and P. N. Krishnan[1,2]

[1]KSCSTE-Malabar Botanical Garden and Institute for Plant Sciences, Guruvayoorappan College P.O, Kozhikode, Kerala, India, [2]Present address: Centre for Innovation in Science and Social Action (CISSA), T.C. 15/510, USRA - 55, Udarasiromani Road, Thiruvananthapuram

Background: *Humboldtia brunonis* Wall. is a small tree with a native range in Southern parts of India. It is a tree and grows primarily in the seasonally dry tropical biome. Seeds of this species show recalcitrant seed behaviour and the rate of fruit set is 31- 35%. Honeybees are the major pollinators.

Method: Floral morphology, phenology, pollinator study, seed development, seed germination, and seed storage were observed.

Result: Around 25% of the initial moisture content (after 55 DAA) was reduced when the seed was attained maturity. During maturity, the moisture of the seed decreased gradually but these seeds lacked pronounced drying at the maturity stage. In the observation of phenology, the seed-setting rate is very poor and seed emptiness is seen. Seeds remained viable only for a month in open conditions and probably the one-month viability may coincide with pre-monsoon periods in nature. The effect of decreased moisture content was depicted by enhanced three-month storability of the seeds with 31% moisture content over 53% germination.

Conclusions: Seed maturation studies indicate that the best collection time prevails from

November- January. Pollinators and floral visitors are identified. The seed seems to be recalcitrant. For conservation efforts, after a 10% reduction of seed moisture content, they may be stored in steel bottles 20°Cfor convenient regeneration over 3-4 months.

Keywords: *Humboldtia brunonis,* phenology, pollinator, seed behavior.

07-25

IN SILICO CHARACTERIZATION AND EVOLUTIONARY INSIGHTS OF A NOVEL B-DEFENSIN (PH-DEF 2) FROM THE INDIAN SPINY LOBSTER, *PANULIRUS HOMARUS*

Anne Maria Thomas and Swapna P. Antony

Department of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences, Cochin University of Science and Technology, Kochi-682016, Kerala, India

Background: Antimicrobial peptides (AMPs) synthesized by diverse organisms are integral components of innate immunity, serving as potent defenders against pathogens. The distinctive attributes of AMPs, such as a broad antibacterial spectrum, elevated selectivity with minimal toxicity, and substantially reduced potential for resistance compared to conventional antibiotics, position these peptides as promising alternatives for antibacterial therapies. This investigation is dedicated to the comprehensive characterization of the β-defensin AMP derived from the Indian spiny lobster, *Panulirus homarus*.

Method: The experimental organism utilized in this study was the Indian spiny lobster, *Panulirus homarus*. Tissues were dissected from live lobster samples under sterile RNase-free conditions immediately following the euthanasia of the lobster. RNA extraction was conducted according to the protocol provided by TRI reagent (Sigma). RNA quantity and quality were assessed through spectrophotometry and gel electrophoresis, respectively. The reverse transcription method was employed for cDNA synthesis, and the success of the process was validated through the detection of the β-actin reference gene using primers specifically designed for this purpose. PCR amplification was conducted in a 10µl reaction volume using the EmeraldAmp® PCR Master Mix (Takara Biomedical Inc., Japan) following the manufacturer's protocol. Subsequent to PCR amplification, agarose gel electrophoresis was employed to validate the existence and size of the amplified fragments.Subsequently, PCR products were purified using EXO-CIP and sent for sequencing to the Genespec sequencing facility in Kochi, India, employing gene-specific primers. The obtained sequence underwent comprehensive *in silico* characterization using various web-based tools and software applications

Results: A β-defensin AMP (Ph Def 2) gene consisting of 49 amino acids was isolated from *Panulirus homarus*. Phylogenetic examination disclosed its close association with β-defensins in other *Panulirus* lobsters and proposed an evolutionary correlation with vertebrate β-defensins. The mature peptide sequences, characterized *in silico* at the molecular level, divulged a molecular mass of 5.34 kDa, with a net charge of +2 and projected a single bactericidal segment spanning from C36 to Y48. Furthermore, *in silico* analysis also predicted antifungal, anticancer, and toxigenic motifs.

Conclusion: Ph-Def 2, a 49-amino acid β-defensin, displays considerable potential in its antimicrobial

attributes. Ph-Def 2 resembles β-defensins in other lobster species and fish β-defensins, which suggests a mutual functional role in combating microorganisms. Further scientific inquiries into the antimicrobial effectiveness of Ph-Def 2, either as a synthetic or recombinant peptide, would unveil the potential of this AMP isoform as a viable therapeutic agent in aquaculture and medicine.

Keywords: Antimicrobial peptides**,** Defensin, Innate immunity, Indian Spiny Lobster, *Panulirus homarus.*

07-26

ENDOCOMIA MACROCOMA (MIQ.) W.J. DE PRAINII (KING): A UNIQUE NUTMEG VARIETY WITH POTENTIAL EFFECTS IN IMPROVING COGNITIVE DYSFUNCTION – EVIDENCE FROM BEHAVIORAL STUDIES IN MOUSE MODELS

Nimmi Varghese*, Ali Saadi Albaer and Viji Vijayan

Neurobiology Lab, Department of Biochemistry, University of Kerala, Karyavattom

Background: *Endocomia macrocoma* (Miq.) W.J. de prainii (King) is a nutmeg variety belonging to the Family Myristicacea. It is native to Andaman and Nicobar Islands. The commonly seen variety of nutmeg *Myristica fragrance* is widely used in South Asian cuisines. The seed and aril (mace) that covers the seed of nutmeg have potential benefits in alleviating various diseases that affect the central nervous system. *Endocomia macrocoma* has a unique deep red colored aril mace indicating the difference between the two varieties. This study focuses on understanding the effect of *Endocomia macrocoma* mace extract in animal models of cognitive impairment and assessing the compounds in the mace variety.

Method: Mace collected from the Botanical Survey of India, Andaman and Nicobar Islands were cleaned, dried and extracted using methanol. Effect of mace extract was tested on two different mouse models of neurological disorders (i) scopolamine induced mouse model of dementia and (ii) ketamine induced mouse model of schizophrenia. Both models were developed in Swiss albino mice (3 to 4 months old; 30-38 g body weight). Volatile compounds in extract were assessed using GC-MS analysis.

Results: *Endocomia macrocoma* mace extract administeredat 25 mg/kg body weight showed improvement in Y-maze and Morris water maze test as compared to disease controls. GC-MS analysis revealed the presence of 32 components of which the most abundant were; 5-hydroxymethylfurfural, linolenic acid, oleic acid methyl ester, oleic acid and stearic acid. These compounds have reported effects in protecting the brain. However a unique combination of these volatile compounds is seen in the *Endocomia macrocoma* mace extract. The combination of these components is expected to alleviate the cognitive impairment.

Conclusion: Pre-clinical studies in mouse models of dementia and schizophrenia demonstrate that combination of volatile compounds in *Endocomia macrocoma* mace extract could be considered for developing a therapeutic for alleviating cognitive dysfunction in certain neurological disorders

Keywords: *Endocomia macrocoma*, Mace, Volatile Compounds, Cognitive Impairment, Dementia, Schizophrenia, Ketamine, Scopolamine.

07-27

CITRIC ACID CROSSLINKED SILK FIBROIN-GELATIN BLEND INCORPORATION AS A NOVEL STRATEGY FOR BIOSCAFFOLD MODIFICATION

P.V. Jesna, S. L. Devika and P. R. Umashankar

Division of In-vivo Models and Testing, Biomedical Technology Wing, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram-695011, Kerala, India

Background: Biologic scaffolds composed of acellular matrices prepared by removing the cellular components possess high potential in regenerative applications due to its insignificant immunogenicity. These scaffolds are associated with drawbacks such as poor mechanical strength and early degradation leading to structural failure compared to synthetic scaffolds.

Method: Present work envisages a novel approach to augment the mechanical strength by impregnation of silk fibroin-gelatin blends into the acellular porcine liver matrix followed by in-situ citric acid crosslinking. Difference in resistance to enzymatic degradation (degree of crosslinking) exhibited by the modified and unmodified scaffolds were compared using Ninhydrin assay. Augmented mechanical strength was demonstrated by tensile testing and suture retention strength estimation. Retention of GAG is demonstrated through dimethyl methylene blue assay and Alcian blue staining. In-vitro cytocompatibility studies and cell migration assay was also done in L929 cells based on ISO10993-part5 to prove biocompatibility.

Results: The degree of crosslinking determined by Ninhydrin assay showed that SFG5050DPL exhibited a crosslinking degree of 82.9±6.1 while SFG3070DPL exhibited a decreased crosslinking degree of 42.07±23.8. Alcian blue demonstrated preservation GAG in both groups. The elastic modulus of the modified scaffolds experienced a prominent increase from 9.1±1.7 to 14±1 and 15.2±1.9 MPa respectively. Suture retention strength also improved from 0.9±0.1 in DPL to 2.8±1.2 and 2.6±0.9 in the modified samples of SFG5050DPL and SFG3070DPL respectively which is expressed as maximum load (N). The materials were proved to be cytocompatible and have potency to induce cell migration.

Conclusion: The results from the above experiments proved that the scaffold produced by the above strategy augmented the mechanical property of the membranous decellularized liver scaffold enabling it to withstand mechanical stresses during surgical applications. In addition, cytocompatibility and preserved bioactive molecules will aid in early site appropriate healing.

Keywords: Bioscaffold, decellularized liver, citric acid crosslinking, cytocompatibility, tensile strength, suture retention.

07-28

INHIBITION OF HISTONE DEACETYLASES PROMOTES THE CLEARANCE OF *KLEBSIELLA PNEUMONIAE* IN HUMAN MACROPHAGES

Abhinand Kuniyil, Geetha B Kumar, Bipin G Nair, Aravind Madhavan

School of Biotechnology, Amrita Vishwa Vidyapeetham, Amritapuri, Kerala, India

Background: *Klebsiella pneumoniae*, characterized by its tenacious multidrug-resistant profile, stands as a formidable public health menace. Confronted with challenges to conventional antibiotic regimens, the exploration of alternative therapeutic paradigms, such as host-directed therapies, has gained momentum. This study delves into the intricate interplay between histone deacetylases (HDACs) and the intracellular persistence mechanisms of *Klebsiella pneumoniae* within human macrophages.

Method: Employing CI994, a potent HDAC1 inhibitor, at a precise concentration of 15 µM, this investigation meticulously assesses its impact on the survival dynamics of *Klebsiella pneumoniae* within THP1-derived macrophages. Complementary approaches involve both pre- and post-treatment of human macrophages with the HDAC1 inhibitor during *Klebsiella* infection, as well as the deployment of SiRNA to silence HDAC1 expression, comprehensively scrutinizing their respective effects.

Results: The study reveals a substantial reduction in bacterial viability within macrophages following treatment with the HDAC1 inhibitor CI994. Notably, pre-treatment with HDAC inhibitor amplifies phagocytic activity and its administration post infection, potentiates the generation of reactive oxygen species. The observed knockdown of HDAC1 through SiRNA corroborates these outcomes, affirming a similar decrease in bacterial survival.

Conclusions: This research unfolds critical insights into host-directed therapies, underscoring the pivotal role of HDAC inhibitors, particularly CI994, as a groundbreaking strategy against resilient bacterial pathogens like *Klebsiella pneumoniae*. These findings underscore the imperative for innovative therapeutic interventions, especially within the context of escalating antibiotic resistance.

Keywords: Histone Deacetylases, *Klebsiella pneumoniae*, Macrophages, Host-Directed Therapies.

07-29

MYRISTICIN MODULATE APOPTOSIS AND CELL CYCLE ARREST BY ACCUMULATION OF INTRACELLULAR ROS IN HUMAN BREAST CANCER CELL (MCF-7)

Sudhina S[1,2], Janeesh P.A*[1,2]

[1]Translational Nanomedicine and Lifestyle Disease Research Laboratory, Department of Biochemistry, University of Kerala, Thiruvananthapuram 695034, Kerala, India. [2]Centre for Advanced Cancer Research, Department of Biochemistry, University of Kerala, Thiruvananthapuram 695034, Kerala, India.
**Corresponding author: sudhinaazeem10@gmail.com*

Background: Statistically among females, breast cancer is the most common malignant disease in terms of incidence and mortality. However, due to heterogeneity some patients do not respond to multimodality treatments. So, there is need of developing new therapies to decrease breast cancer. A number of natural phytochemicals are employed for different cancer prevention and therapy, mainly because of their low toxicity profiles and multimodal actions. Myristicin is a natural alkenylbenzene compound found in nutmeg, dietary supplements and some other medicinal plants. Previous research reported that myristicin has many biological functions.

Method: Here, we demonstrated that different doses of Myristicin were added to MCF-7 estrogen positive breast cancer cells (MCF 7) and it was found that Myristicin was able to induce apoptosis

on MCF-7 cells in a dose dependent manner. The cytotoxicity was analyzed on MCF-7 cells by MTT and anticancer studies like acridine orange/EtBr staining, Hoechst stain, measurement of reactive oxygen species and scratch assays were also done in treated cells.

Results: From the image we can see that Myristicin shows high apoptotic property compared to control cells. Flow cytometry and antioxidant enzyme analysis explored that myristicin caused increased ROS generation and that will lead to cell apoptosis. Moreover, we analyzed qPCR and western blot for the expression level of pro, anti-apoptotic and cell cycle genes and proteins. Result revealed that Myristicin was significantly regulated the genes and proteins expression in MCF-7 cells.

Conclusion: This study suggests that Myristicin exhibit potent apoptotic effect as compared to control and may be a useful therapeutic intervention for breast cancer.

Keywords: Breast Cancer, Myristicin, Apoptosis, Cell cycle arrest, ROS.

07-30

MITIGATIVE EFFECT OF POLYHERBAL FORMULATIONON INFLAMMATION

Suma D

Research and Development Division, Nagarjuna Herbal Concentrates Ltd., Kalayanthani P.O., Thodupuzha. Kottayam, Kerala

Background: Polyherbal formulation combining several herbs is suggested to enhance therapeutic effects and minimize adverse effects. The purpose of this study was to unravel the anti-inflammatory and analgesic effects of the new proprietary product of polyherbal formulation.

Method: *In vitro* and *in vivo* anti-inflammatory effects of the new herbal formulation and its acute toxicity effects were assessed on adult albino Wistar rats. The formulation was also subjected to HRLC-MS analysis for compound identification.

Result: Acute toxicity studies revealed that the formulation did not display any visible signs of toxicity up to the dose of 2000 mg/kg body weight. These results indicated the safety of oral administration of the new Soft Gel capsule. The present study of the Anti-inflammatory activity of soft gel capsules, against carrageenan-induced paw edema, showed that the capsule significantly affected inflammation at the dose of 7.2 mg/kg, comparable with the standard drug diclofenac sodium. From the results on the analgesic effect of this formulation, it was seen that the formulation was showing a better result at a dose of 7.2 mg/kg.

Conclusion: It can be concluded that the medicine possessed marked anti-inflammatory, and analgesic effects and its safety usage up to 2000mg/kg body weight in an experimental animal. Hence this new formulation serves as a better therapeutic and protective agent against inflammatory response. HRLC-MS results also supported the anti-inflammatory efficacy of the new soft gel capsule.

Keywords: Polyherbal formulation, anti-inflammatory effects, analgesic effects, HRLC-MS

07-31

RECOMBINANT BACULOVIRUS WITH HYBRID PROMOTER FOR TRANSGENE EXPRESSION IN EMBRYONIC CELL CULTURES DERIVED FROM THE ECO-SENSITIVE ORGANISM *DAPHNIA MAGNA*

Sreevidya C P, Jayesh Puthumana*

National Centre for Aquatic Animal Health, Cochin University of Science and Technology, Cochin-16, Kerala, India

Background: Transgenic research represents a concerted effort to bridge the gap between fundamental and applied molecular biology, leveraging advancements in technology to wield a potent tool for precise genetic manipulations. This capability to enact genetic alterations at the cellular level holds great promise for progress in the realms of medicine, agriculture, and diverse biotechnological applications.

Methods: Primary *D.magna* cell culture was developed from *Daphnia* egg and the medium was optimized based on cell viability, attachment, proliferation and survival. XTT assay was used to assess the cells metabolic activity at 24 hrs and 5 days after seeding. DNA synthesis was confirmed by BrdU (5-Bromo-2'-deoxyuridine) incorporation assay. Recombinant baculovirus mediated transduction using shrimp-specific promoter (WSSV-Ie1 and IHHNV-P2) having green fluorescent protein as the marker (BacIe1-GFP) was developed for transgene expression in *daphnia cells.*

Results: The optimization of Schneider's insect medium, achieved by supplementing it with 0.1% glucose, 0.1% MEM vitamin mix, 0.1ng/mL selenium, and 10% FBS, yielded significant improvements in *Daphnia* primary cell culture. The efficacy of a hybrid promoter baculovirus for transduction in *Daphnia* primary culture was successfully demonstrated. Green fluorescent protein (GFP) expression was evident from the second day in sf9 cells and the third day in *Daphnia* cells.

Conclusion: The meticulous optimization of the culture medium and the successful demonstration of baculovirus-mediated transduction underscore the robustness of the *Daphnia* primary cell culture system. These findings not only enhance our understanding of in vitro microenvironments supporting active DNA replication but also pave the way for potential applications in molecular and cellular research involving *Daphnia*.

Keywords: *Daphnia magna,* Primary culture, Transduction, Baculovirus expression system.

07-32

LONG-TERM BEHAVIOURAL AND BIOCHEMICAL CONSEQUENCES OF NMDARACTIVATION IN ADULT RATS

Reena Sarah Jacob[1,2], Sowmya Gunasekaran[1,2], Mantosh Kumar[1], R V Omkumar[1]

[1]Neurobiology Division, Rajiv Gandhi Centre for Biotechnology, Thycaud, P. O., Thiruvananthapuram-695014, India, [2]Research Scholar, Manipal Academy of Higher Education, Manipal-576 104, India

Background: Glutamatergic signalling through the N-methyl-D-aspartate receptor (NMDAR) is essential for synaptic plasticity and excitotoxicity. We had previously reported the acute consequences

of NMDAR activation *in vivo*.In this study, we further investigated the long-term behavioural alterations and corresponding biochemical modifications, such as GluN2B-Ser^{1303} phosphorylation and cell death marker activities.

Methods: We activated the NMDAR by stereotaxically injecting NMDA into the prefrontal cortex of adult rats. Additionally, we administered MK-801, KN-93 or okadaic acid (OA) to elucidate the role of CaM kinases and phosphatases in modulating animal behaviour.

Results: A single injection of NMDA or MK-801 or KN-93 impairs cognition as a long-term consequence. Interestingly, intracortical OA injection resulted in increased locomotor activity and decreased anxiety-like behaviour in animals without major cognitive effects. Transient NMDAR activation *in vivo* led to increased PP1α expression as a delayed consequence, resulting in decreased phospho-GluN2B levels. Furthermore, NMDA treatment *in vivo* upregulated the caspase-independent cell death marker, apoptosis-inducing factor (AIF).

Conclusion: We demonstrate that aberrations in the activities of NMDAR signalling components can lead to diverse behavioural and molecular consequences in the longterm.

Keywords: NMDA receptor, MK-801, KN-93, okadaic acid (OA), excitotoxicity, anxiety

07-33

PHOTOCATALYTIC DEGRADATION OF PHARMACEUTICAL DRUG -HYDROXYCHLOROQUINE (HCQ) USING TIO_2 MEDIATED HETEROGENEOUS PHOTOCATALYSIS

T. Sanjay, S. Kowsalya and V. Kandavelu

Department of Chemistry, Sri Ramakrishna Mission Vidyalaya College of Arts and Science, Periyanaickenpalayam, Coimbatore – 641 020, Tamil Nadu, India

Background: The increasing demand and necessity for high quantity & quality of freshwater, would be a foremost concern confronting worldwide in future or upcoming decades due to the rapid growth of industrialization, population and their activities. The recent most water contamination of emerging concern (CEC) is pharmaceutical products which creates a serious environmental impact and the main threat to all living organisms all over the world. This paper deals with degradation of HCQ by an advanced oxidation process (AOP) such as photocatalysis.

Method: Irradiations were performed with a medium pressure mercury pencil lamp (Spectronics, USA) emitting nearly 100 % at 365 nm, which is highly suitable for TiO_2 to initiate the catalytic process. The progress of the reaction was followed by monitoring decrease in HCQ absorbance using UV-Vis spectrophotometer.

Results: The photocatalytic activity of TiO_2 on HCQ was evaluated by changing the conditions such as change in pH, catalyst weight, concentration of HCQ, atmospheric conditions [air, oxygen (O_2) & hydrogen peroxide (H_2O_2)] to find out the optimum conditions for maximum degradation.

Conclusions: This work establishes the degradation of HCQ by TiO_2 photocatalyst. The optimum condition for degradation of HCQ was found to be 500 mg/L catalyst, pH 6.5, 24 mg/L HCQ & O_2/ H_2O_2atmosphere and the maximum rate obtained was 27.46 x 10^{-7} Ms^{-1}.

Keywords: Advance Oxidation Processes, Hydroxychloroquine, TiO_2 Photocatalysis.

07-34

ANTI-INFLAMMATORY AND WOUND HEALING POTENTIAL OF *ZYSIGIUM CUMINI* – AN *IN VITRO* STUDY

Amrutha D.S[1] and A. Helen[1]

[1]*Department of Biochemistry, University of Kerala, Kariavattom, Thiruvananthapuram 695581*

Background: Skin wound healing is a very serious issue since the skin a critical barrier of the human body. It is a dynamic process, which include a cascade of events. Delayed wound healing is a major health issue nowadays, mainly in diabetic patients. A perfect cure for wound healing is not possible till now. The major intention of the current study is to check the anti-inflammatory and wound healing potential of *Zysigium cumini.*

Method: Crude Methanolic extracts of the plant (ZCME) was collected by immersing the dried leaf powder of *Zysigium cumini*in methanol for 3 days at cold condition by occasional stirring. FTIR analysis carried out to find out the functional groups present in ZCME. The Anti-inflammatory activity was monitored in LPS induced RAW 264.7 cell lines using ELISA and PCR. Disc diffusion method was used to study antibacterial activity of ZCME. Chick Chorioallantoic Membrane (CAM) used as a model for monitoring angiogenesis. Wound healing activity was screened using Scratch assay in L929 cell lines.

Results: The percentage yield was 3.2%. The FTIR spectra of ZCME reveal the presence of different functional groups. The selected dose of ZCME decreased the levels of TNF α, IL-6, and elevated the levels of IL-10 and Tgf-beta in RAW 264.7 cell lines. Agar diffusion method showed activity of ZCME against *Pseudomonas aeruginosa* which showed 12 mm and 13 mm zone of inhibition on 50 and 100 mg/mL concentration and 14- and 17-mm zone of inhibition in 150 and 200 mg/mL concentration on *Staphylococcus aureus* compared with Streptomycin. ZCME treated group of chick egg showed new vessel formation compared with DMSO treated group and normal control and the vascular density also showed the same result. The scratch wound assay/cell migration assay proven the healing capacity of ZCME compared with the untreated group within 48 hours.

Conclusions: This work enlightened the activity of *Zysigium cumini* as a remedy for wound healing, which shows good anti-inflammatory, antibacterial activity and wound healing activity. The ongoing studies will be concentrated on the molecular level mechanism of wound healing in both *in vitro* and *in vivo* models.

Keywords: Wound Healing, Angiogenesis, *Zysigium cumini*, Anti-inflammation, Anti-Microbial.

07-35

EVALUATION OF THE POTENTIAL EFFECT OF ADAGMAD HYDROGEL IN AN *IN VITRO* OSTEOARTHRITIC MODEL INDUCED VIA IL-1B UNDERSTANDING THE THERAPEUTIC POTENTIAL: ALGINATE-DI-ALDEHYDE-GELATIN (ADAGMAD) HYDROGEL IN IL-1B-INDUCED *IN VITRO* OSTEOARTHRITIS

Aswathy J [1,2,*], Sabulal Baby[1] and Annie Abraham[2]

[1]Phytochemistry and Phytopharmacology Division, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram Kerala, India, 695562, [2]Department of Biochemistry, University of Kerala, Kariavattom, 695581

**Corresponding author: aswathyjk2011@gmail.com*

Background: Osteoarthritis (OA) predominantly affects women, causing joint cartilage and bone changes. Around 528 million people globally have knee OA. The secondary metabolites from medicinal plants, with regenerative potential highlighting phytochemical-based tissue repair. Madecassoside (MAD)- a triterpenoid saponin from *Centella asiatica (C. asiatica)*, offers anti-inflammatory and wound-healing benefits. This study examines the impact of MAD-incorporated alginate-di-aldehyde-gelatin (ADAGMAD) hydrogel on cartilage nourishment in an IL-1β-induced *in vitro*OA model.

Method: MAD from *C. asiatica* was incorporated into the ADAG hydrogel to get ADAGMAD hydrogel. The FTIR analysis, gelation time, mechanical strength analysis, release mechanism etc., were carried out as per the standardised protocols. After creating an *in vitro* OA model by IL-1β, the effect of the hydrogel system was analysed systematically.

Results: The release mechanism of ADAGMAD hydrogel shows a significant cumulative release of MAD over time in an *in vitro* condition. The effect of ADAGMAD on IL-1β induced primary chondrocytes was evaluated via MTT and LDH assays, which was confirmed by the safranin-O, alcian blue, sirius red staining methods and qPCR analysis.

Conclusions: The ADAGMAD hydrogel exhibits a protective effect on chondrocytes induced by IL-1β. Based on these experiments, it can be inferred that the ADAGMAD hydrogel significantly safeguards chondrocytes in an *in vitro* OA model induced by IL-1β.

Keywords: Osteoarthritis, Cartilage, Madecassoside, Hydrogel, IL-1β.

07-36

FLUORESCENCE-SERS-GUIDED PHOTOTHERAPY EMPLOYING A MITOCHONDRIA-TARGETED CYCLOMETALATED IR(III) THERANOSTIC MOLECULAR PROBE FOR BREAST CANCER CELLS

Chandana Reghukumar[a,b], Shanmughan Shamjith[a,b], Vishnu Priya Murali[a] , Pilankatta K. Ramya[a,b], Kokkuvayil Vasu Radhakrishnan[a,b], Kaustabh Kumar Maiti [a,b]

[a] Chemical Sciences & Technology Division, Organic Chemistry Section, CSIR-National Institute for Interdisciplinary Science & Technology, Pappanamcode, Thiruvananthapuram- 695019, Kerala, India, [b] Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India

Background: A specialized photo medical approach evolves on a specific target on mitochondria for therapeutic purposes which can yield immediate and precise execution of apoptosis. As they satisfy several crucial parameters for a photosensitizer, the usage of metal complexes as photosensitizers for PDT (Photodynamic Therapy) has exponentially increased over the past decade.

Methods: The molecular probe, Ir-CN was synthesized and subjected to detailed photophysical, stability and singlet oxygen generation studies. The biological evaluations include internalization, colocalization, dark toxicity and singlet oxygen generation studies. The PDT effect was evaluated using basic staining techniques, Annexin V-FITC assay, DNA laddering, and JC-1 assay. Raman spectroscopy was also employed for the detection of cytochrome c release and all other apoptotic changes.

Results: The Ir-CN was found to exhibit a singlet oxygen quantum yield of 0.79. By virtue of thepositively charged central metal atom, Ir-CN was found to be specifically targeting mitochondria, while the intense red fluorescence, allowed for fluorescence imaging with a high colocalization coefficient (0.90) with Mito Tracker green.The cytotoxic singlet oxygen generated by Ir-CN upon laser exposure immediately disrupts mitochondrial processes, thereby leading to apoptosis, as confirmed through both fluorescence and surface-enhanced Raman spectroscopy (SERS)

Conclusions: The cyclometalated Ir-CN thereby proves to be a potential molecular probe for PDT-based cancer treatment that ensures laser-assisted mitochondrial damage which has been tracked through bimodal fluorescence and SERS.

Keywords: Mitochondria targeting, Photodynamic therapy, Iridium complex, Reactive oxygen species, Cancer Theranostics, SERS.

07-37

PREPARATION OF GELATIN, HYDROLYSATES AND PEPTIDE FRAGMENTS FROM FISH PROCESSING WASTE: INSIGHTS INTO CHARACTERIZATION AND FUNCTIONAL ATTRIBUTES

Jean Mary Joy[a,b], Joshy C. G.[a,c], Amruth Prakash[a,b], Suseela Mathew[a]*

[a]Biochemistry and Nutrition Division, ICAR-Central Institute of Fishery Technology, Cochin 682029, India, [b]Faculty of Marine Sciences, Cochin University of Science and Technology, Cochin 682016, India, [c]Fish processing Division, ICAR-Central Institute of Fishery Technology, Cochin 682029, India
**Corresponding author: suseela1962@gmail.com*

Background: The extraction of gelatin, hydrolysate, and peptide fractions from fish skin waste presents an innovative approach with multifaceted significance across various industries. Fish skin, a commonly discarded byproduct in the seafood industry, contains valuable proteins that can be transformed into these versatile components. Gelatin, widely utilized in food, pharmaceuticals, and cosmetics, serves as a versatile ingredient with remarkable functional properties. Meanwhile, hydrolysates and peptide fractions derived from fish skin showcase bioactive compounds offering health benefits, from antioxidants to antimicrobial properties. The process not only contributes to reducing environmental waste but also highlights sustainable resource utilization, catering to diverse dietary preferences and cultural needs while fostering innovation in product development. This holistic approach underscores the convergence of waste reduction, resource optimization, and the

creation of value-added products that hold promise across multiple sectors.

Method: In the current study, the gelatin was extracted from the tuna skin processing waste via hot water extraction. The hydrolysate was prepared by hydrolysis action of proteolytic enzyme and the conditions were optimised by response surface methodology. Low molecular weight peptide fractions were obtained through ultrafiltration technique. The obtained gelatin and its derivatives were characterised by scanning electron microscopy, Fortier transform infrared spectroscopy, x-ray diffractometry, thermal gravimetric analysis. The surface-active properties were screened by foaming capacity, foaming stability, emulsion activity index and emulsion stability index. Further, the bioactivity was screened by *in vitro* antioxidant assays and *in vitro* hypertensive activity.

Result: Gelatin can be obtained through the efficient utilization of fish skin waste. The gelatin extracted from tuna skin waste through hot water extraction satisfied the criteria for pharmaceutical and edible grade gelatin according to National and International standards. The enzymatic cleavage of gelatin followed by ultrafiltration resulted in the production of hydrolysate and low molecular peptide fractions. These fractions displayed structural and morphological changes distinct from the native gelatin polypeptide chain. Gelatin exhibits significant potential for applications in food technology, whereas its hydrolysates and peptide fractions have found additional uses in health-related fields, indicating the potential for a promising future as a nutraceutical. The functional characteristics of gelatin displayed variations during the processes of hydrolysis and ultrafiltration, wherein certain properties were enhanced, while others were diminished. Specifically, the surface-active attributes exhibited greater prominence in the unaltered native gelatin. Extensive hydrolysis resulted in a substantial reduction of these properties. Moreover, the subsequent ultrafiltration process led to a significant attenuation of the surface-active characteristics. Nevertheless, the antioxidant properties exhibited significant increase in both the hydrolysates and peptide fractions compared to native gelatin. Notably, a heightened hypertensive effect was discerned in the low molecular weight peptide fraction obtained through the purification of gelatin hydrolysate.

Conclusion: Fish skin waste converted into gelatin meets high standards for pharmaceutical and edible use. Enzymatic processing creates versatile gelatin forms for various applications, especially in health-related fields. The process alters properties—less surface activity, improved antioxidants. Low-weight peptides show potential for therapeutic uses, including hypertension. Overall, fish skin gelatin and its derivatives display evolving potential across industries.

Keywords: Gelatin, Gelatin hydrolysate, Peptide fraction, surface active properties, bioactive properties.

07-38

IDENTIFICATION OF DRUGGABLE TARGETS FOR FOCUSED TREATMENT OF *MAGNAPORTHE ORYZAE* THROUGH IN-DEPTH ANALYSIS OF BULK RNA-SEQ DATA

Priya V. K, Jayachandran K and Radhakrishnan E. K

School of Biosciences, Mahatma Gandhi University, Priyadarshini Hills, Athirampuzha, Kerala 686560

Background: *Magnaporthe oryzae*, a hemibiotrophic fungus causing rice blast, remains a significant global threat to food security, leading to substantial crop losses. Despite the existence of various

fungicides, the need for more effective treatment methods persists. This study aims to identify crucial genes and proteins within *Magnaporthe oryzae* that could serve as potential drug targets.

Methods: Publicly available bulk RNA-seq data from NCBI's Sequence Read Archive and the European Nucleotide Archive were utilized. The focus was on samples extracted from *in planta* conditions at different time points, allowing for an understanding of the dynamic gene expression patterns during different stages of infection. The experimental design classified samples into three phases: Phase I (within day one post-infection), Phase II (up to two days post-infection), and Phase III (up to three days post-infection). The control group consisted of mycelia grown in complete media. The RNAseq data was downloaded and differentially expressed genes were identified.

Results: The analysis revealed significant expression patterns across various gene categories, particularly those associated with Cellular Transport, Cell Rescue, Defense, and Virulence, Metabolism, Energy, and Polysaccharide Binding. Notably, during the initial stage of infection (Phase I), genes related to Channel/Pore Class Transport and Fatty Acid Metabolism were enriched among the differentially expressed genes. These genes play a crucial role in establishing infection through cellular transport and promoting invasive growth by generating energy. In phase III, genes involved in Extracellular Polysaccharide Degradation, Sugar, Glucoside, Polyol, and Carboxylate Catabolism were prominent, contributing to the organism's continued growth.

Conclusion: The identification of key genes and processes contributes to the development of improved fungicides tailored to target specifically the intial stages of infection, offering a more precise approach to combating *Magnaporthe oryzae*.

Keywords: *M. oryzae*, rice, RNAseq, metabolism, gene enrichment analysis.

07-39

NANOMATERIAL MEDIATED STIMULATION OF NEURAL ACTIVITY FOR THERAPEUTIC APPLICATIONS

M. E. Dhushyandhun, Jayasree R S*

Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram
Corresponding author: jayasree@sctimst.ac.in

Background: Neuromodulation is the stimulating or blocking the flow of action potentials and employed in Prosthetics, such as cochlear implants, such as treatment of epilepsy, depression, traumatic brain injury, Parkinsons disease, obesity, and neuroscience research for investigating the function of neurons and neural networks in the peripheral and central nervous system. Electrical neural stimulation has historically been the main technique for neuromodulation but recent developments in alternative modulation methods potentially offer significant advantages. Infrared neural stimulation is one such alternative method of neural stimulation in which infrared rays are used to produce heat to stimulate neurons. The use of nanoparticles with photothermal conversion that use these infrared rays to convert light to heat improves the efficiency of infrared neural stimulation by improving spatial resolution and penetration depth of the infrared rays. An important requirement for the use of nanoparticles in medicine is that it should be biocompatible. In this regard, Prussian Blue is a biodegradable and biocompatible compound and possesses photothermal conversion characteristics and thus serves as a suitable candidate to act asnanotransducer for the photothermal stimulation.

Prussian Blue nanoparticles can also be accordingly modified to tune its characteristics. In this study, Manganese doped Prussian Blue nanoparticles (Mn-PBNPs) have been synthesized to act as photothermal nanotransducersand have been demonstrated to stimulate neurons.

Methods: Ferric nitrate, manganese chloride and potassium hexacyanoferrate (II) were used to synthesize nanoparticles. An 808nm laser was used to stimulate the neurons. The stimulation of neurons was detected by calcium signals, which were captured by a fluorescence microscope.

Results: The as synthesized nanoparticles were characterized for its physico-chemical properties. The nanoparticles possessed good photothermal transduction characteristic in the Near-Infrared Rays (NIR) region and the ability of the nanoparticles to stimulate cells were evaluated using calcium imaging, where the occurrence of calcium signals showed that the cells were stimulated by the nanoparticles when irradiated by the laser.

Conclusion: This study demonstrates the efficacy of Mn-PBNPs nanoparticles to serve as biodegradable, biocompatible and efficient photothermal nanotransducers that were able to stimulate neurons in the presence of laser irradiation.

Keywords: Prussian Blue nanoparticles, infrared neural stimulation, lasers, neuromodulation, photothermal nanoparticles.

07-40

UNRAVELING THE ANTINUTRITIONAL COMPONENTS OF SELECTED NON-CONVENTIONAL LEAFY VEGETABLES OF KERALA

Anjana Bhaskaran, Anisha Shashidharan

St. Albert's College (Autonomous) Ernakulam, Kerala, 682018, India

Background: A plant-based diet has gained significant popularity in recent years, driven by growing awareness of its potential health benefits. Non-conventional leafy vegetables are diverse array of plant species beyond the commonly consumed greens. However, they have been less used due to poor popularity and lack of knowledge regarding the plants. The presence of compounds known as antinutrients in food crops can affect the absorption and utilization of essential nutrients in the human body. Thoroughly analysing the antinutritional compounds holds significant potential for enhancing crop's utilization. Executing suitable processing methods not only tackles issues associated with antinutrients but also diversifies the crop's potential applications. *Moringa oleifera* Lam, also called "Miracle Tree" is a well-known plant with excellent nutritional profile, which is now grown widely across the country. *Cnidoscolus chayamansa* Mc Vaugh and *Talinum triangulare* (Jacq.) Willd are leafy vegetable, introduced recently. The plants were analysed for antinutrients mainly alkaloid, tannin, phytate, oxalate and saponin. The study emphasizes the importance of understanding the specific antinutritional components of each plant, providing valuable insights that can influence dietary choices and utilization practices.

Method: Phytate was determined by the method of AOAC (2012). Oxalate was determined by the method of Day and Underwood (1986). The tannin content was determined by the method of Ranganna (1986). The alkaloid content was determined by the method of Sreevidya and Mehrotra (2003). Saponin was determined by the method of Obadoni et al., (2002).

Results: *Talinum triangulare* exhibited the highest oxalate content of about 9.9 mg/g. *Cnidoscolus chayamansa* and *Moringa oleifera* shared similar oxalate levels (6.6 mg/g). *Cnidoscolus chayamansa* demonstrated the highest tannin content of 5.53 mg/g, followed by *Moringa oleifera* 4.34 mg/g and *Talinum triangulare* 1.43 mg/g. *Talinum triangulare* had the highest phytate content of 0.729%, followed by *Cnidoscolus chayamansa* (0.247%) and *Moringa oleifera (0.154%). Talinum triangulare* exhibited the highest alkaloid content of about 7.36 mg/g. Both *Moringa oleifera* and *Talinum triangulare* share the same saponin content of 3%, while *Cnidoscolus chayamansa* had a slightly lower concentration.

Conclusion: Leafy vegetables are packed with nutrients that are essential for a healthy life. However, they also contain antinutrients that can block the absorption of these nutrients and cause health problems. The findings provide a foundation for informed dietary choices, with potential implications for individuals with specific health concerns. By understanding what antinutrients are and how to mitigate their effects, we can create healthy and effective diets that meet our needs.

Keywords: Non-conventional leafy vegetables, Antinutrients, Oxalate, Tannin.

07-41

A COMPREHENSIVE ANALYSIS OF GEOGRAPHICAL DISPERSION AND DIVERSITY OF SWAMP WEEDS

Jaseela V T and N S Pradeep

KSCSTE-Malabar Botanical Garden & Institute for Plant Sciences, GA College Post, Kozhikode673014, Kerala

Background: Understanding phytogeographical distribution patterns, diversity, and endemism is crucial for the effective conservation and utilization of native plant genetic resources. The genus *Hygrophila* R.Br., commonly known as 'swamp weeds', is a member of the Ruelliae tribe within the Acanthaceae family. Widely distributed in tropical and subtropical regions globally, this genus comprises approximately 80 species, predominantly exhibiting an affinity for aquatic or moisture-rich habitats. These herbaceous plants are commonly found in diverse ecosystems such as paddy fields, ditches, canals, marshes, stream banks, and ponds.

Method: The analysis is based on field exploration, examination of herbarium records, and a review of relevant literature. Distribution maps were meticulously prepared using GIS software.The accessions were grouped into different altitudinal classes. Cluster dendrogram based on similarity index was constructed from the incidence data matrix data using PAST software.

Results: The evaluation of distribution patterns is fundamental for the conservation of taxa. The current study presents a comprehensive overview and critical assessment of the geographic patter and diversity of the *Hygrophila* genus in India.The taxa which were grouped into 16 altitudinal classes showed maximum richness in low altitudinal range. The majority of *Hygrophila* taxa are confined to peninsular India, with the remaining species predominantly located in the northern plains. Notably, certain taxa are restricted to specific regions within the country, with some holding significant positions on the IUCN Red List.

Conclusion: This study provides valuable insights into the geographical distribution of *Hygrophila* in India, contributing to the broader efforts in biodiversity conservation and sustainable utilization

of plant resources.

Keywords: Conservation, Geographic pattern, *Hygrophila*, India.

07-42

UNRAVELLING THE MYOVIRUSES OF THE ESTUARINE SEDIMENT THROUGH METAGENOMICS

Athira Menon T. and Swapna P. Antony

Department of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences, Cochin University of Science and Technology, Kochi-682016, Kerala, India

Background: Aquatic viruses, though most abundant remains the least explored. Myoviruses are bacteriophages that are mostly lytic in nature. The current study elucidates the molecular characterization and phylogenetic analysis of the Myoviruses associated with the estuarine sediments of the Cochin backwaters.

Method: Concentration of the viral particles involved processing steps that began with centrifugation and proceeded through filtration and flocculation.

Result: Epifluorescence microscopy confirmed the presence of viral particles as well as the effectiveness of filtration. DNA extraction was followed by PCR amplification of the viral DNA using primers specific to *Myoviridae*. Sequencing was performed, and further analysis was carried out using GeneTool, ExPASy and BLASTx. A 147bp fragment encoding 49 amino acid sequence of myoviridae showing homology to the T4 portal protein gene of protein gene of Cyanophage could be obtained from the metagenomic viral DNA extracted from the Cochin estuary sediment. Looking into the phylogenetic analysis it was revealed that the retrieved amplicon from the sample showed maximum similarity to the partial capsid assembly protein of the uncultured Myoviridae.

Conclusions: This study gives a snapshot of detection of myoviruses associated with the estuarine sediment, thus helping in the further study of these viruses. The detection of myoviruses homologous to known phages and uncultured relatives underscores the ecological importance of myoviruses in estuarine ecosystems.

Keywords: Myoviruses, Epifluorescence microscopy, GeneTool, ExPASy, BLASTx.

07-43

ETHNOBOTANICAL STUDY OF KANI TRIBES IN SARKAR HILLS PEPPARA WILD LIFE SANCTUARY OF KERALA

Anooj S L, Rajkumar G and A. Nazarudeen

KSCSTE-Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode Thiruvananthapuram, 695562 Kerala, India

Background: The indigenous people of Kani have an extensive knowledge of ethno botanical plants species. An ethnobotanical study was done in the Oruparakarikkakam settlement, Peringammala Gramapanchayat.

Method: The study area was visited frequently, and ethnobotanical data (local name, useful part, uses, method of preparation, etc.) were collected using semi-structured questionnaires in the local language and discussion with the assistance of village leaders (MoottuKani) and local villagers and tribal practitioners in the settlement area.

Results: Information was received from 83 respondents, ranging in age from 20 to 90 years old. In the current study, the tribes use 60 species from 28 families for food and medicine. The traditional healers treated diabetics, snake bites, jaundice, body pain, piles, ulcers, swellings, weight loss, coughs and colds, diarrhoea, and other ailments as anti-inflammatory and anti-cancerous. The informant consensus factor (ICF) and use value (UV), etc., were calculated. Detailed information was gathered on the list of plants and their food and medicinal uses among the Kani tribal people. The number of wild plants used by the Kani community, as well as knowledge of plants, is of the utmost importance in the present-day global scenario of food security and diminishing food diversity. The information gathered will also be useful for the development of nutritionally rich products in the future.

Conclusions: Conclusion Based on survey and group discussion with Kani tribe of the study area, it was found that information about the edible plants is mostly confined to elder people. Most of the edible plants can be used not only as food but also as medicine. The new generation is ignorant about this vast Food and medicinal resources available in their surroundings. The indigenous or Vamsheeya knowledge system of herbal practice is still available among Kani tribal community of this study area. Hence it is necessary to document the traditional knowledge of useful plants and their nutritional, medicinal and other commercial uses before being lost forever from the community.

Keywords: Ethnobotany, Wild Edible Plants

07-44

DIVERSITY AND CONSERVATION OF THE GENUS *IXORA* L. IN SOUTHERN DISTRICTS OF KERALA

Ajinsha J S*, Dr. G Rajkumar and A. Nazarudeen

KSCSTE-Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode Thiruvananthapuram, 695562 Kerala, India

**Corresponding author: ajinshabhnr@gmail.com*

Background: Ixora L. is a genus of flowering plants in the family Rubiaceae. It is a predominantly tropical family that includes 611 genera and 13,150 species of herbs, shrubs, and trees, distributed primarily in tropical areas of the world (Davis et al., 2009). Ixora, also known as 'Jungle Flame,' is also known as West Indian Jasmine, Flame of the Woods, and Jungle Geranium. It is a rather big genus with around 400 species, most of which are located in the Indo-Malaysian region and several of which are endemic to India. the Diversity and Conservation of the Genus Ixora L.

Method: This research was carried out in the southern districts of Kerala between 2022 and 2023. The study mainly aimed to assess the diversity and various conservation strategies of Ixora L. in five southern districts of Kerala. An effective plant conservation strategy should focus on four primary areas: in-situ conservation, ex-situ conservation, education, and research. Campaigns should be launched to raise awareness of the importance of habitat and plant species conservation, as well as to encourage the cultivation of the Genus ixora L. **Results:** The propagation of the ixora is more

difficult so we have done with different propagation techniques. Some Endemic species like *Ixora agasthyamalayana* have less number of population and also propagules, so taking stem cutting is more difficult because of the plant extinction. In our inspection we have known that some species of ixora take more time for flower maturation, Fruit formation and fruit maturation. If we get the seeds of ixora the viability and germination percentage is very less. The collected seeds of *Ixora coccinia, I. Nigricans, I. brachiata, I. agasthyamalayana, I. johnsonii*from different localities were used to germinate under different types of seed germination techniques including hotwater treatment, Soaking method and germination medium methods.

Conclusions: Loss of biodiversity is the serous issue of plant population in the natural eco system, for the past few years the annual rainfall has decreased resulting in the decreasing population of the plant species.

Keywords: diversity, conservation, ixora.

07-45

ANTI-MICROBIAL ACTIVITY OF PLANT EXTRACTS FROM SELECTED SPECIES OF THE GENUS LIMNOPHILA R.BR. (PLANTAGINACEAE)AGAINST PATHOGENIC BACTERIA: IN VITRO EVALUATION USING DISC DIFFUSION AND MIC METHODS

E. K. Sinisha and N.S. Pradeep

KSCSTE - Malabar Botanical Garden and Institute for Plant Sciences, Kozhikode, Kerala – 673014

Background: Assessing antimicrobial susceptibility holds multifaceted applications in drug discovery, epidemiology, and forecasting therapeutic responses. The broad spectrum of complex and structurally diverse compounds sourced from plants presents significant avenues for exploration. Researchers have notably focused on studying plant and microbial extracts, essential oils, pure secondary metabolites, and newly synthesized molecules as potential antimicrobial agents. *Limnophila*, an aquatic aromatic herb, is commonly used in traditional as well as indigenous systems of medicine, often consumed as a vegetable within various tribes. It contains abundant aromatic, volatile compounds and is rich in nutrients.

Methods: The study involved in vitro evaluations employing disc diffusion and Minimum Inhibitory Concentration (MIC) methods against prevalent human pathogenic bacteria—*Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Proteus vulgaris*. The assessments were conducted using extracts derived from dried powdered samples of *L. aquatica, L. heterophylla, L. connata, and L. repens*, obtained through the use of hexane, methanol, and chloroform solvents.

Results: The findings indicated the broad-spectrum antimicrobial properties across most extracts, with the highest efficacy observed in the hexane extract of *L. heterophylla* against *Bacillus subtilis* and the methanolic extract of *L. connata* against *Proteus vulgaris*.

Conclusion: This study underscores the efficacy of *L. aquatica, L. heterophylla, L. connata, and L. repens*, extracts as potential natural antimicrobials, suggesting their potential application in pharmaceuticals to combat infectious diseases caused by the tested bacterial strains.

Keywords: Conservation, Geographic pattern, *Hygrophila*, India.

07-46

AN IN VIVO EVALUATION ON THE IMMUNOMODULATORY ACTIVITIES OF C REACTIVE PROTEIN REDUCING DRUGS OLMESARTAN AND RAMIPRIL

Jyothishna Dasan and Linu Mathew

School of Biosciences, Mahatma Gandhi University, Kottayam

Background: C reactive protein is a pentameric protein found in blood plasma. It is synthesized by the liver in response to inflammation. A wide variety of drugs belonging to the category cyclooxygenase inhibitors, angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), and many other drugs are showing marked reduction in serum levels of CRP.: This work evaluates the anti-inflammatory and immunomodulatory effects of selected CRP-reducing drugs Ramipril (Angiotensin Converting Enzyme Inhibitors) and Olmesartan (Angiotensin II Receptor Blockers), which is used in the treatment of hypertension. In addition to the lowering effect of blood pressure, its activity in acute and chronic models of inflammation and immunomodulation is to be studied and compared with known standards. This is for the development of a new adjuvant therapeutic strategy beneficial in the treatment of inflammation with co-existing hypertension.

Method: Anti-inflammatory activity was analyzed in acute and chronic animal models. Acute anti-inflammatory activity by Carrageenan induced Paw edema test. (Method of Winter, Risley, and Nuss, 1962). Chronic anti-inflammatory activity was analyzed by subcutaneous injection of 0.1 ml of 2% formalin, Igbe et al., (2010). Histopathological analysis by Haematoxylin and Eosin stain method. Immunomodulatory activities were studied by analyzing proinflammatory cytokines and anti-inflammatory cytokines.

Result: Both the crp-reducing drugs, ramipril, and olmesartan, showed significant anti-inflammatory and immunomodulatory effects in animal models.

Conclusion: The results of the present study show the anti-inflammatory and immunomodulatory effects of crp-reducing drugs ramipril and olmesartan in rat models. Hence, these pleiotropic effects of CRP-reducing drugs provide new scope for these compounds to be tried as agents for the treatment of immune-mediated inflammatory diseases with concomitant hypertension.

Keywords: CRP, anti-inflammatory, histopathology, cytokines.

07-47

EXPLORING DIFFERENT ASPECTS OF EXTRACTION AND PURIFICATION OF PHYCOBILIPROTEINS FROM TWO TAXONOMICALLY DISTINCT CYANOBACTERIA, *LEPTOLYNGBYA* SP. AND *PHORMIDIUM* SP.

Syama Prabha, Aravind K. Vijay, Basil George

Department of Botany, CMS College (Autonomous) Kottayam. Kerala, India

Background: Phycobiliproteins (PBPs) constitute the primary constituents of light-harvesting

complexes in cyanobacteria and red algae. Phycobiliproteins can be categorized into three groups based on their spectral characteristics of the bilin chromophore and are C-Phycocyanin (C-PC) C-Phycoerythrin (C-PE) and C-allophycocyanin (C-APC). Beyond their crucial involvement in photosynthesis, PBPs have primarily been investigated for their potential applications in the food and pharmaceutical industries, attributed to their inherent spectral and bioactive properties.

Method: The cyanobacterial strains were obtained from a water sample collected from Puthupally, Kottayam, Kerala (9°34'12.2"N 76°34'41.5"E). The axenic culture was established through serial dilution and streaking on BG 11 enriched agar plates. The two cyanobacterial strains were morphologically identified as *Phormidium* sp. and *Leptolyngbya* sp. The growth kinetics of both cyanobacteria were examined, and the extraction and purification of phycobiliproteins were carried out using ammonium sulfate precipitation followed by anion exchange chromatography.

Results: The recorded kinetic parameters of the cyanobacteria revealed higher biomass production for *Leptolyngbya*, while *Phormidium* sp. exhibited elevated phycocyanin concentration. *Leptolyngbya* demonstrated 1.2 g/l biomass production, with substantial amounts of phycocyanin (56.76 mg/g) and phycoerythrin (62.45 mg/g) in the biomass. *Phormidium* sp. achieved a maximum biomass concentration of 700 mg/g with a high phycocyanin content of 317 mg/g. Both cyanobacteria displayed remarkable self-flocculation, enabling cost-effective harvesting through gravity sedimentation, with over 95% of cells collected within 5 minutes. Phycocyanin from *Phormidum* reached food-grade purity in the crude extract (with a purity of 1.4) and analytical-grade purity (5.4) through anion exchange chromatography. Simultaneous purification of phycocyanin and phycoerythrin from *Leptolyngbya* was achieved using a three-stage ammonium sulfate precipitation technique, resulting in analytical-grade purities of 4.5 and 3.6 for phycocerythrin and phycocyanin, respectively.

Conclusion: The research unveils two highly productive self-flocculating cyanobacterial strains suitable for phycobiliprotein production. One strain demonstrated elevated phycocyanin content, while the other exhibited the presence of two phycobiliproteins—both phycocyanin and phycoerythrin. The study reports the simultaneous purification of these phycobiliproteins from the crude phycobiliprotein mixture. This research represents a significant advancement in the field of phycobiliproteins with promising prospects for future applications.

Keywords: Phycobiliprotein; Cyanobacteria; Phycocyanin, Phycoerythrin, Concurrent purification.

07-48

A STUDY ON THE SPIDER WASP SUBFAMILY CEROPALINAE (HYMENOPTERA: POMPILIDAE) WITH EMPHASIS ON DIVERSITY OF THE GENUS *CEROPALES LATREILLE*, 1796 IN INDIA

Anju K and Thejass P*

P.G. & Research Department of Zoology, Government College Madappally, Vadakara, Kozhikode, Kerala – 673102, India. Affiliated to University of Calicut
**Corresponding author: thejassp@gmail.com*

Background: Spider wasps are medium to large sized solitary wasps in the hymenopteran family Pompilidae. All members of the family use spider as a food source for larval development leading to their common name of spider wasps. Ceropalinae is a small subfamily of cleptoparasitic pompilid

wasps comprising two genera, *Ceropales* Latreille, 1796 and *Irenangelus* Schulz, 1906. *Ceropales* is a cosmopolitan genus comprising three subgenera viz., *Ceropales* sens. str. Latreille, 1796, *Hemiceropales* Wolf, 1965 and *Priesnerius* Móczár, 1978.

Methods: Specimens for the study were collected from the Indian states of Kerala, Tamil Nadu, Karnataka and Uttarakhand. The specimens were dried, pinned and examined under LEICA stereozoom microscope. The images were captured using LEICA 500 digital camera attached. The type specimens of the new species were deposited in the "National Zoological Collections" of the Zoological Survey of India, Western Ghat Regional Centre, Kozhikode (ZSIK). An account on Ceropalinae wasps and the species diversity of the genus *Ceropales* in India were studied based on the available published works.

Result: In India, Ceropalinae wasps are represented from both genus *Ceropales* and *Irenangelus*. Altogether 12 species are recorded from India in the subfamily Ceropalinae, eight species from the genus *Ceropales* and four species from the genus *Irenangelus*. Two new species described by Anju *et al*., 2023 from the genus *Ceropales* viz., *Ceropales* (*Ceropales*) *anaghae* Anju, Girish Kumar & Thejass, 2023 and *C.* (*C.*) *keralaensis* Anju, Binoy & Thejass, (2023) are the recent addition to the subfamily contributing to Indian *Ceropales* diversity.

Conclusion: Though Pompilidae is a widely distributed family, many genera are poorly studied and identified upto species level. The genus *Ceropales* is represented from India with less than ten species. Taxonomic studies on Pompilid wasps have to be elaborated to explore the hidden diversity of spider wasps.

Keywords: Spider wasps, Ceropalinae, *Ceropales*, Taxonomy, India.

07-49

SYSTEMATIC DOCUMENTATION OF COASTAL ETHNOBIOLOGY OF ERNAKULAM DISTRICT IN KERALA – A FIELD SURVEY

Saranya Mol S. T., Vinodkumar T. G*. Nair and S. R. Suja*

Ethnomedicine & Ethnopharmacology Division, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Pacha, Palode, Thiruvananthapuram, Kerala State, India. PIN 695562
**Corresponding authors: vaidyavinodkumar@gmail.com, drsujasremep@gmail.com*

Background: Traditional Knowledge (TK) is considered as the mother term which is directly linked with the tradition and culture and also is the basis for food, health and economic security of millions of people.TK has evolved, developed and has been transpired down through generations in the form of healing arts, agricultural practices, cultural practices, local languages, customs and customary practices for the wellbeing of the local communities. As a result of change in the lifestyle and livelihood practices of people, TK is rapidly getting eroded from the communities. Therefore, it is important to document such knowledgesystematically to conserveat least the existing TK. The ethnobiological studies of the coastal areas of Kerala have not yet been extensively studied, and hence the relevance of this work is justified.

Method: Systematic documentation of TK is carried out scientifically. Initial step is to create contact with the selected coastal Gramapanchayaths of Thrissur district. Contact and awareness programmes were conducted with the President, elected local body members and other local TK holders and the

action plan for field survey was carried out. Interaction with the TK holders/providers were done through question-and-answer sessions (with voice recorder, photographsand short video clippings), after Prior Informed Consent is signed. The recorded information was later decoded, inventorized and documented systematically using specially designed data sheets. Data pooling and analysis of the information were carried out. The information were uploaded in the electronic data base for further reference and research.

Results: Ethnobiological survey of 4 Gramapanchayaths (Edavanakkad, Elamkunnapuzha, Nayarambalam and Pallippuram) of Ernakulam district was carried out. Awareness on Traditional Knowledge (TK) and its importance was provided to 151 people including Presidents, Local body members and knowledge holders of each Gramapanchayath. A total of 64 knowledge holders were interviewed and documented335ethnobiological information. Overall, information on 142 drugs, 69 information on plants used for food, 54 information on plants used as tools and artefacts and 70 information on plants used for other uses were collected and documented.

Conclusion: Ethnobiologicaldocumentation and awareness campaign is important for making local people aware of the importance of the orally transmitted knowledge. A well designed mechanism is to be brought out to codify the remaining TK at the earliest; otherwise this valuable knowledge will be lost forever. Therefore, systematic documentation of TK among the remaining communities is highly essential to save the existing TK in the oral tradition.

Keywords: Traditional knowledge, Systematic documentation, Coastal ethnobiology.

07-50

STUDIES ON THE TAXONOMY AND ANATOMY OF PTERIDOPHYTES IN AMBOORI PANCHAYAT, KATTAKADA TALUK, THIRUVANANTHAPURAM DISTRICT, KERALA

Arya A.R[1] and A.R. Viji[2]

[1]PG Department of Botany, Christian College, Kattakada, Thiruvananthapuram-695572, [2]PG Department of Botany, Iqbal College, Peringammala, Thiruvananthapuram-695563

Background: Pteridophytes are non-flowering, spore bearing group of plants next to angiosperms and are unique in the plant world, representative of a large geographical distribution across the world. They have a key role in ecosystem services such as providing food for herbivores and insects, shelter for other creatures, preventing soil erosion, vegetation structure, and bioindicators for habitat health, in addition to having great ethnomedicinal, ecological, and economic relevance. In India, pteridophytes comprise a significant part of the flora next to angiosperms and are widely regarded as a neglected category in terms of their economic benefits.

Methods: The present study area is confined to Amboori Panchayat, in Kattakada Taluk, Thiruvananthapuram district of Kerala. Amboori is situated in the southern tip of Western Ghats. Amboori is a pristine and serene village located on the outskirts of Thiruvananthapuram district. For the collection of specimens field trips were conducted, field notes and photography were taken at the time of collection to observe habitats, habitats and localities. Ferns are collected for both herbarium and germplasm to establish a field gene bank and the voucher specimens are processed for herbarium. The collected specimens were critically studied and identified with the help of authentic

taxonomic literature. Anatomical studies of the collected specimens are carried out through double staining method.

Results: The present study deals with the morphological, anatomical and medicinal uses of pteridophytes from Amboori panchayat, Kattakada Taluk under Thiruvananthapuram district, Kerala. The present study documented 58 species under 20 families. The major collected species is under family Pteridaceae. The study identified 8 endemic species found naturally grown in the study area including *Dryopteris sparsa, Bolbitissemi chordata. Lepisorous nudus, Lindsaea heterophylla, Microlepia spelunce, Pteris quadriaurita, Prosapia quadriaurita*, and *Selaginella tenera*. The collected ferns are classified according to their habitats such as Lithophytes, Epiphytes Terrestrial, Hydrophytes etc. Out of 58 species, 69% are terrestrial under which 16% are lithophytes, 13% are epiphytes and 2 % are hydrophytes. Out of 58 species collected 78% have medicinal values. The anatomical structure of the petiole shows three regions, namely epidermis, cortex and central vascular cylinder or stele. The form and shape of the vascular bundles are variable. Fundamental forms of vascular bundles are observed in this work are X-shaped bundle, V-shaped bundle, U-shaped bundle, Hippocampus-shaped bundle, C-shaped bundle, Collateral/Flat shaped bundle, Hook-shaped bundle, Arc-shaped bundle and S-shaped bundle.

Conclusion: From this study it is evident that pteridophytes constitute an important component in the ecology of Kerala due its diverse habit and habitats and it is very essential to develop a meaningful conservation strategy.

Keywords:-Pteridophytes, Amboori, Taxonomy, Anatomy.

07-51

EXPRESSION OF CMG FAMILY HORMONE GENES IN *PM*LYO-*SF*9 HYBRID CELL LINE

Gopika V.S., Vrinda S., Jayesh P. and I.S. Bright Singh

National Centre for Aquatic Animal Health, Cochin University of Science and Technology, Cochin, Kerala, India – 682016

Background: Shrimp maturation is governed by the hormones secreted by neurosecretory structures known as XOSG (X-organ sinus gland complex) in the eyestalk such as crustacean hyperglycemic hormone (CHH), moult inhibiting hormone (MIH), and gonad inhibiting hormone (GIH). Unilateral surgical removal of eye stalk which facilitate the removal of X-organ sinus gland complex to nullify the inhibitory hormones effects is the age-old practice to induce maturation in shrimp. Being unethical and the one which delimit the repeated breeding of valuable broodstock dsRNA mediated gene silencing has been conceptualized and developed. However, a cell culture-based platform was required to demonstrate the silencing effect of dsRNA. In this context, we reported the first expression profiling of CMG family hormones in the hybrid cell line PmLyO-Sf9, developed by the fusion of shrimp lymphoid organ cells with Sf9 cells. This cell line has been identified as a suitable platform for gene silencing, with potential applications for translation to the animal model level.

Method: In this study, *Pm*LyO-*SF*9 cells were maintained and multiplied in a blend of SCCM and TNM-FH with an osmolality of 550 mOsm kg^{-1} and a pH of 6.8. These cells were employed for profiling the transcriptional expression of CHH, MIH, and GIH genes through cDNA-based

amplification, subsequently confirmed by ABITM Prism Dye termination cycle Sequencing. Additionally, the translational expression levels were investigated using immunofluorescence with their corresponding Antisera.

Results: The transcriptional level expression of CHH,MIH and GIH was confirmed by running the samples in 1% agarose gel electrophoresis. The resulting agarose gel was visualized and documented using gel documentation system. Confirmation of sequencing was done by ABI™ Prism Dye termination cycle (Microsynth, GmBH) from Agri-Genome. The sequences of CHH, MIH and GIH having 98%, 99.9% and 99.9% similarity with NCBI database. Translational expression levels were validated through immunofluorescence; with cell observation conducted using DAPI and FITC under various filters in a UV fluorescence microscope, employing excitation wavelengths of 360-370 nm and 470-490 nm.

Conclusions: This study establishes that the *Pm*lyO-*Sf*9 hybrid cell line serves as a viable platform for studying the expression of CMG family hormone genes and can be considered as an alternative to *P. monodon*. Moreover, the cell line has been identified as suitable for gene silencing, suggesting its potential translation to the animal model level.

Keywords: Crustacean hyperglycemic hormone (CHH), Moult inhibiting hormone (MIH), Gonad inhibiting hormone (GIH), PmLyO-Sf9 hybrid cell line.

8–MATHEMATICS AND STATISTICAL SCIENCES

ORAL PRESENTATION

8-01

AN INTEGRATED APPROACH FOR NAVIGATING HYDROLOGICAL MODELLING UNCERTAINTIES

Naveena K*, Shahanas P V, Sharannya T M, Drissia T K and Surendran U

Centre for Water Resources Development and Management (CWRDM), Kozhikode- 673 571

**Corresponding author:* naveenak@cwrdm.org

Background: Hydrological models serve as fundamental tools in managing water resources, particularly distributed models that account for the spatial variability and temporal dynamics of catchment characteristics. However, effective calibrating these models is difficult due to inherent uncertainties arising from inputs, parameters, and the complexities of model processing. Addressing these uncertainties from varied sources becomes essential for improved predictions.

Methods: The study employs the Soil and Water Assessment Tool (SWAT) to forecast streamflow in the Vamanapuram River basin, Kerala. To address input uncertainty, statistical techniques such as Autoregressive Integrated Moving Average (ARIMA) with Kalman smoothing are utilized. These methods aim to mitigate uncertainties arising from missing input data. For handling parameter uncertainty, Generalized Likelihood Uncertainty Estimation (GLUE), Markov Chain Monte Carlo Methods (MCMC), Sequential Uncertainty Fitting, and Particle Swarm Optimization (PSO) are compared. These techniques enable a comprehensive assessment of uncertainties associated with various model parameters. Furthermore, the study explores process uncertainty by incorporating SWAT model iterations. This iterative approach is implemented to refine stream flow predictions, enhancing the model's ability to capture the complexities inherent in hydrological processes

Results and Discussions: Sensitivity analysis identified eleven key parameters influencing the Vamanapuram River basin. Three parameter uncertainty techniques were applied for calibration and validation, revealing varied performance metrics (R2 and NSE). The hybrid model of Kalman ARIMA+SUFI 2 demonstrated superior performance for both calibration (R2= 0.66, NSE=0.64) and validation compared to other models (R2=0.52, NSE=0.52). Conversely, Kalman ARIMA+GLUE exhibited the least performance. Notably, the model's performance showed sensitivity to the number of iterations, indicating enhanced outcomes with higher iteration numbers (≥500).

Conclusion: The adoption of ARIMA with Kalman smoothing for input uncertainty combined with SUFI 2 emerged as promising techniques for addressing hydrological uncertainty, resulting in improved calibration and validation performances. The influence of iteration numbers (≥500) underscored their significance in model development, emphasizing the need for meticulous consideration to achieve robust hydrological modeling outcomes. These findings underscore the criticality of integrating diverse uncertainty techniques to elevate the accuracy of hydrological models. Such enhanced models are pivotal in facilitating informed decision-making for effective water resource management.

Key words: Soil and Water Assessment Tool; Uncertainty; Autoregressive Integrated Moving Average; Generalized Likelihood Uncertainty Estimation; Markov Chain Monte Carlo Methods; Sequential Uncertainty Fitting, and Particle Swarm Optimization

08-02

NEW HEAVY TAILED BI MODAL SKEW SYMMETRIC DISTRIBUTION AND ITS APPLICATIONS TO GENE EXPRESSION DATA

Bindu Punathumparambath*

PG and Research Department of Statistics, Govt. Arts & Science College, Calicut
**Corresponding author:* ppbindukannan@gmail.com

Background: Recently there is lot of interest in developing univariate flexible distributions that can capture departures from normality in terms of asymmetry, bimodality, tail heaviness and kurtosis. Bimodality appears in many applied sciences such as in Genetics and Geoscience. We can see that bimodality is present in many biological measurements due to a dimorphism in the population. In the present study we developed skew slash reflected Weibull distribution and explored various properties. The maximum likelihood estimation procedure is employed to estimate the parameters of the proposed distribution and an algorithm in R package is developed to carry out the estimation. A simulation study is conducted to validate the algorithm. Finally, we show that the skew slash reflected Weibull distribution is suitable for modeling microarray gene expression data.

Methods : Skewed Slash Reflected Weibull Distribution

The probability density function (pdf) skewed slash reflected Weibull distribution with parameters denoted by SSLRW () is given by

Results and conclusions: The skewed slash reflected Weibull (SSLRW) distribution introduced in this paper is useful in analyzing datasets that are asymmetric, leptokurtic, bimodal and heavy-tailed and it can model impulsiveness and skewness observed in gene expression data.

Keywords: Skew slash reflected Weibull, reflected Weibull distribution, Microarray gene expression

8-03

SOLVING SELF-REFERENTIAL PARADOXES: A NEW PERSPECTIVE

Shalini B*.

The School of the Good Shepherd, Akkulam, Thiruvananthapuram, 695021, Kerala
**Corresponding author:* shalinib2407@gmail.com

BACKGROUND: There is a category of paradoxes called self-referential paradoxes which are characterized by their tendency to involve a statement or a collection of statements that describe or refer themselves. The Liar paradox, Russell's paradox, and the Epimenides paradoxes are some very famous examples. The paper aims to redefine this category and give a new perspective on how such paradoxes function and how they can be solved and also provide an alternate framework for formal logic

METHODS: The Liar paradox asks to consider a statement like the following, 'This sentence is false' and answer whether it is true or false, this results in a paradox. Similarly, Russell's paradox asks you to consider a set within naïve set theory, the set is defined as containing all sets that do not contain themselves, asking whether the set contains itself will also give rise to a paradox.

RESULTS: The paper has proposed an alternate model of formal logic which takes elements from fuzzy logic but expands upon it. Secondly, self-referential paradoxes, for which the theory is a possible solution, are given a new category and definition, that of an outcome-locked paradox. An outcome-locked paradox is a statement or collection of statements where there are 2 (or more) possible outcomes which are the opposites of each other and cannot both (or all) be true at once, but paradoxically each point implies the other opposite point thus forming a loop.

CONCLUSION: Everything thus far discussed, is applicable to all paradoxes that come under the outcome-locked category. And so a new perspective on self-referential paradoxes is gained.

8-04

MULTIRESOLUTION ANALYSIS ON THE WEIGHTED BERGMAN SPACE OF UPPER HALF PLANE

Anusree Sreedharan*

Department of Mathematics, Cochin University of Science and Technology, Kerala, India
**Corresponding author:* anusreesreedharan3@gmail.com

Methods: In this work, we examine rational Blaschke functions that are capable to formulate a Multiresolution on the weighted Bergman space of the upper half plane $A_\alpha^2(C^+)$. We construct a rational orthogonal wavelet system that generates the levels of the multiresolution. The levels of the multiresolution are finite dimensional, which makes it easier to find a basis on each level.

Results and Discussions: We can approximate any f in $A_\alpha^2(C^+)$ by the projection operator on the nth resolution level. The projection will be an interpolation operator and whose coefficients can be computed through the evaluation of f on a given set of points in the upper half plane.

Conclusion: We introduced a new sampling set for $A_\alpha^2(C^+)$ which is connected to the Blaschke group operation. We have generated a multiresolution in $A_\alpha^2(C^+)$ and we have constructed a rational orthogonal wavelet system which generates the levels of the multiresolution. The levels of the multiresolution are finite dimensional, which makes easier to find a basis on every level, but in the same time the density condition remains valid.

Keywords: Blaschke Functions, Malmquist Takenaka System, Sampling Sequences

8-05

CLIMATIC TRENDS AND SPATIAL VARIATIONS IN RAINFALL PATTERNS FOR KOZHIKODE DISTRICT, KERALA

Fathima Jamsheena P*, Naveena K, Vivek B and Surendran U

Centre for Water Resources Development and Management (CWRDM),
Kozhikode- 673 571
**Corresponding author:fathimajamsheena31@gmail.com*

Background: Kozhikode District, nestled in the Western Ghats, faces crucial challenges in agricultural water management due to nonlinear rainfall patterns. The region heavily relies on seasonal rainfall for farming and local ecosystems. Understanding these rainfall dynamics is vital for sustaining agriculture and preserving the ecological balance in this sensitive region

Method: This study presents a spatial-temporal analysis of rainfall patterns in Kozhikode District, Kerala, spanning 37 years from 1986 to 2022. Leveraging data from multiple observatory stations and IMD grid locations, the research investigates seasonal and annual rainfall trends and climate change in points using various statistical methods.

Results: The analysis reveals distinctive spatial and temporal variations in rainfall distribution across seasons. While certain areas, notably Vadakara and Quilandy, exhibit higher precipitation level, other regions such as Thinoor and Thamarassery experience comparatively lower precipitation levels. Trend analysis indicates an overall increasing trend in annual rainfall, with notable variations across seasons and stations. Southwest monsoon months show significant shifts after the 20th century, highlighting a decline in June rainfall and a surge in September precipitation.

Conclusion: Shifts in June and September rainfall in south west monsoon demands effective adaptive strategies for local ecosystems and farming practices. Addressing spatial disparities is essential for sustainable resource allocation and informed decision-making in agriculture and ecology within the region.

Keywords: Rainfall, Kozhikode, Trend Analysis, Homogeneity Tests.

8-06

STATISTICAL DIVERGENCES AND POINT CLOUDS COMPARISON

Amit Vishwakarma* and Subrahamanian Moosath K S

Indian Institute of Space Science and Technology Valiamala, Thiruvananthapuram- 695 547. Kerala
**Corresponding author :amitvis2478@gmail.com*

Background: Comparison of shapes represented as point clouds is fundamental for many applications. Traditional methods of computing Hausdorff and Chamfer distances between them are lacking in capturing the complete geometry of point clouds. Then, we introduced a novel approach for comparing 3D point clouds using Information Geometric tools. In this paper, different divergences were used to find a suitable one for comparing point clouds.

Methods: The research employed Farthest Point Sampling (FPS) and Dynamic Graph CNNs,

followed by a Fully Convolutional Neural Network (DGCNN-FCNN) model. Gaussian Mixture Models (GMM) were used to represent point clouds as probability density functions in a statistical manifold. After fitting the point clouds to these probability density functions, different divergence measures were applied for comparison.

Results: The study found that Modified Kullback-Leibler divergence outperforms other methods (Jensen-Shannon divergence and standard Kullback-Leibler divergence) in comparing point clouds. This new method takes care of the geometric features of the data much better and improves computational efficiency.

Conclusion: The information geometric approach significantly improves the comparison of 3D point clouds, offering better geometric feature capture and application in machine learning for high-dimensional data. The modified K-L divergence measure shows a better comparison than the other two divergences.

Keywords: Information Geometry, Gaussian Mixture Model, Point Clouds, Divergences.

8-07

PHASE PORTRAIT AS A NOVEL TOOL IN AUDIO FORENSICS TO ADDRESS AI-BASED FORGERY

Aswathy S S [a*], Swapna M S [b], and Sankararaman S [a]

[a] *Department of Optoelectronics, University of Kerala, Trivandrum 695581, India*
[b] *Laboratory for Environmental and Life Sciences, University of Nova Gorica, Vipavska 13, Nova Gorica, SI-5000, Slovenia*
**Corresponding author: aswathyss.opto@gmail.com*

Background: In today's AI-driven landscape, audio forensics assumes critical importance as it balances careful audio investigation with the advanced capabilities of AI. As voice technology dominates authentication and virtual assistants, ensuring audio authenticity becomes critical. This area uses advanced signal processing and technology to validate recordings as admissible evidence in legal environments. Although digital audio is ubiquitous, its convenience poses challenges to authenticity. Complemented by advanced mathematical tools, audio analysis becomes more precise and helps in anomaly detection and accurate authentication. Machine learning and statistical methods improve AI capabilities, enable deepfake detection, and refine speaker identification. Detecting imperceptible audio manipulation requires specialized tools that go beyond traditional methods such as FFT and CWT. The development of innovative tools, such as the nonlinear time series analysis presented in this study, aims to identify content-based audio manipulations. By conducting phase portrait, FFT, and wavelet analyses of tampered signals, this study explores the potential of these tools in combating audio tampering amid the growing role of AI in audio forensics.

Method: In this study, sound signals are gathered from various databases and through real-time recordings, then analyzed and edited using MATLAB software. Initially, a system-generated C4 note is created and tampered with by removing 100 data points from two different locations within the recorded data. To determine the limit of detection of audio tampering, similar tampering is performed on a C4 note generated by a piano. Subsequently, a human voice saying the word "CAT" is recorded and similarly tampered with and compared with AI-generated voice data articulating the

same word "CAT". The analysis of the aforementioned signals is carried out using the mathematical tools – Nonlinear time series, FFT, and CWT. The execution of phase portrait analysis is carried out by utilizing the "method of delays," by R-software. In the phase portrait analysis, variation of features such as sample entropy, correlation dimension, and Lyapunov exponent with respect to audio tampering is studied.

Results: The study examines audio signal analysis in different contexts. Initial investigations using FFT and CWT on system-generated C4 notes show limited accuracy in detecting tampering, while phase portraits effectively indicate tampering through trajectory variations. The time series analysis determines a sensitive time delay of 17, corresponding to 22 microseconds, highlighting the sensitivity of the method. When analyzing real C4 piano notes, FFT and CWT observations are similar to the system-generated note. However, visual detection of tampering remains a challenge. Deeper phase portrait analyses using sample entropy, Hurst exponent, and Lyapunov exponent show increased complexity with more processing segments. When comparing human and AI voice analysis, different frequency components emerge, with human voices having fewer but stronger components and AI voices having more with a strong fundamental frequency. Phase portraits illustrate this difference by providing higher dimensions for AI voices. In addition, human voices have higher sample entropy and Lyapunov exponent values. Examining the manipulation of both voices, it is seen that the correlation, fractal dimension, and sample entropy of the phase portrait decrease with editing while the Lyapunov exponent increases. These results highlight the potential of phase portraits in audio forensics to detect nuanced manipulations in different audio sources.

Conclusion: This study demonstrates the importance of using phase portrait analysis in audio forensics. Using this methodology, high-sensitivity tampering identification is demonstrated in system-generated and real C4 notes (piano). Phase portrait's promise in audio forensics is demonstrated by its comparable success in differentiating between AI-generated and human voices and human voices.

POSTER PRESENTATION

08-08

P_3 TRANSIT FUNCTION AND BETWEENESS

Athulyakrishna K [1], T.V.Ramakrishnan [1] and Manoj Changat [2]

1Department of Mathematical Sciences, Kannur University, Mangattuparamba, Kannur, India-670567.
2 Department of Futures Studies, University of Kerala, Thiruvananthapuram-695581, India
**Corresponding author: athulyakrishna@kannuruniv.ac.in*

Background: A set C of vertices in a graph G is P_3-convex if and only if no vertex outside C has two neighbors in C.

Methods: In this paper, we explore the transit function P_3, which induces P_3-convexity and its betweenness axioms. A graph G is considered P_3-monotone if $P_3(u,v)$ is P_3-convex for all u,v in $V(G)$. We characterize all P_3-monotone graphs and graphs that satisfy $P_3(S)$ is P_3-convex for all $S \subset V(G)$. Additionally, we investigate graphs that satisfy $|P_3(u,v,w)| \leq 1$ and those for which $|P_3(u,v,w)| =$

1 for all u,v,w in $V(G)$. A gate for u in W is a vertex x in W such that x lies in $P_3(u,v)$ for each vertex in W. A set W is a P_3-gated set if every vertex z outside W has a unique P_3-gate in W. We also provide a characterization of all non-trivial proper P_3-gated sets in a graph G.

Conclusion: we prove that if G possesses a proper non-trivial P_3-gated set, then $diam(G) \leq 3$.

08-09

HILBERT SPACE DUALITY AND CROSS-CONNECTION DUALITY

Anju A* and P G Romeo

Cochin University of Science and Technology, Kochi, Kerala, India.
**Corresponding author :anjuantony842@gmail.com*

Background: K. S. S. Nambooripad developed the cross-connection theory to describe the structure of arbitrary regular semigroups using normal categories rather than regular partially ordered sets. Normal dual is a built-in duality in the cross-connection theory. In this paper, we consider the regular semigroup of all finite rank bounded operators on a Hilbert space and construct a normal full subcategory of the normal dual of the normal category of principal left ideals of , called bounded normal dual, such that the bounded normal duality corresponds with the Hilbert space duality.

Method: First, we have to identify the regular semigroup of all normal cones in the normal category of all principal left ideals of . Then, analyse the normal dual of the normal category to determine the relationship between the Hilbert space duality and the cross-connection duality.

Results: The normal category of all principal left ideals of is isomorphic to the normal category of all finite-dimensional subspace of with linear maps as morphisms. Also, the regular semigroup of all normal cones in is isomorphic to the semigroup of all finite rank operators on . Let be the full subcategory of the normal dual of , whose objects are -functors corresponding to the finite rank bounded operators on . Then, is a normal category, called bounded normal dual of , that is isomorphic to the normal category of finite-dimensional subspaces of the dual of .

Conclusions: In the cross-connection theory of finite rank bounded operators on a Hilbert space, the bounded normal duality coincides with the Hilbert space duality.

Keywords: Regular semigroup, Normal cone, Normal category, Normal dual

09 – PHYSICAL

09-01

OPTIMIZATION OF SPIN-ORBIT TORQUE EFFICIENCY USING MACHINE LEARNING MODELING

Roshna S H*, Sajil C K and V Biju*

**Department of Physics, University of Kerala, Kariavattom campus, Thiruvanthapuram-695581*
**Corresponding author: roshnanakshathra@gmail.com*

Background: This research paper presents a comprehensive analysis to optimize spin-orbit torque (SOT) efficiency through the application of polynomial regression modeling. The study aims to explore and understand the intricate relationships among material and structural properties influencing SOT efficiencies.

Method: Leveraging a dataset from various research groups' experimental measurements, we use polynomial regression to capture complex relationships in material and structural properties affecting SOT efficiencies. Our focus is on predicting "Damping-like SOT efficiency" and "Field-like SOT efficiency" as target variables, employing degree-2 polynomial regression models. Performance metrics like mean square error, mean absolute error, and Coefficient of determination (R^2) score assess predictive accuracy.

Results: The results indicate promising capabilities in capturing the nuanced patterns within the dataset. The application of polynomial regression demonstrates its potential in unraveling the intricacies of SOT phenomena. Performance metrics provide insights into the accuracy of the models in predicting "Damping-like SOT efficiency" and "Field-like SOT efficiency."

Conclusion: This research advances spintronics by providing insights into predictive modeling for Spin-Orbit Torque (SOT) efficiencies, with implications for materials science and technology. Emphasizing the potential of polynomial regression, the study highlights its value for iterative refinement and optimization in understanding spin-orbit torque phenomena.

Keywords: Spin-orbit torque efficiency, machine learning, polynomial regression, predictive modeling techniques.

09-02

UNUSUAL PHOTOLUMINESCENCE IN BA_2MGTEO_6 DOUBLE PEROVSKITE LEADING TO THE DEVELOPMENT OF CYAN EMITTING LEDS

Nithin J S*, Amrithakrishnan B, Sibi K S, Subodh G.

Department of Physics University of Kerala

***Corresponding author: nithinjs007@gmail.com**

Background: Tellurium based double perovskites attracts the attention of researchers all over

the world because of their structural characteristics and potential applications in the design and development of high-quality light emitting devices. Generally an activator ion is needed for the emission of light in phosphor materials. Even though a self-activated emission in the visible region was observed earlier in some of the tungstate and molybdate based double perovskite systems without any activator ions due to the W^{6+}/Mo^{6+} - O^{2-} charge transfer transition. In the case of tellurium based double perovskites, there is no report on their self-activated luminescence till now.

Method: This work explores the discovery of inherent emission in a tellurate based double perovskite material Ba_2MgTeO_6. The material was synthesized through simple and cost effective solid state reaction route. The raw materials were homogenously mixed and calcined at a temperature of about 1150 . The photoluminescence properties of Ba_2MgTeO_6 was studied in details which leads to the fabrication novel cyan emitting LED without using any activator ions.

Results: Photoluminescence studies reveals that Ba_2MgTeO_6 exhibit an unusual luminescence under UV excitation without incorporating any self activated complexes, transition metals, rare earth ions or any other guest materials. The unusual cyan emission of BMTO material could possibly be originated from the Te^{4+} emission centers within the system since the Te^{4+} exhibits robust absorption in the UV region and broad emission in the visible to NIR region. The presence of Te^{4+} ions within Ba_2MgTeO_6 is confirmed by XPS analysis and the luminescence of Te^{4+} can be attributed to the electronic relaxation from $5S_15P_1$ excited state to $5S_25P_0$ ground state. The activation energy is obtained as 0.40 eV which points out an excellent thermal stability for the Ba_2MgTeO_6 material. Moreover, the obtained high quantum yield of 49 % ensures a greater phosphor performance for the Ba_2MgTeO_6 ceramic. Finally a novel cyan emitting LED is fabricated based on the unusual emission of undoped Ba_2MgTeO_6 double perovskite material.

Conclusions: An inherent emission was discovered in a tellurate based double perovskite material Ba_2MgTeO_6 without the aid of any activator ions. Ba_2MgTeO_6 emit intense cyan light under 268 nm excitation and exhibit a better thermal stability (Activation energy, E_A = 0.40 eV) and higher quantum yield of 49 %. The extra ordinary luminescence performance of Ba_2MgTeO_6 material leads to the fabrication of novel cyan emitting LED based on the inherent emission within Ba_2MgTeO_6..

Key words: Tellurate double perovskite, Unusual luminescence, Cyan LED

09-03

HIGHLY THERMALLY STABLE NIR-II EMITTING SRLALITEO$_6$: ER^{3+}, YB^{3+} PHOSPHORS FOR PC-LEDS

Pooja K V*, Subodh G

Department of Physics, University of Kerala, Thiruvananthapuram, Kerala
**Corresponding author: chandrupooja97@gmail.com*

Background: Perovskite-based inorganic phosphors are taking over various domains of scientific research owing to their versatile emission characteristics that can be tailored favourably. Among them, NIR-emitting phosphors have gained considerable interest for their applications including night vision, Optical thermometry, anti-counterfeiting, NIR spectroscopy, bio-imaging, etc. Compared to NIR-I (800-1000 nm), the emission in the NIR-II window (1000-1700 nm), is highly preferred since it is less scattered and is also desirable for optical communications.

Method: The compounds are synthesized via conventional solid-state reaction route.

Results: XRD and Raman analysis confirmed the crystal structure to be monoclinic with the space group $P2_1/n$. Upon 378 nm excitation, the phosphors exhibit an intense emission at around 1541 nm, and a weak emission band around 986 nm, corresponding to $^4I_{13/2}$, $^4I_{11/2} \rightarrow {}^4I_{15/2}$ transitions respectively. For Er^{3+} singly doped phosphors maximum intensity is obtained for 10 mol%. An increase in the emission intensity is observed after Yb^{3+} co-doping and maximum intensity is observed at 1 mol% of Yb^{3+}. From the temperature-dependent analysis of the emission spectra, it is observed that the $SrLaLiTeO_6$:0.08Er^{3+}, 0.01Yb^{3+} phosphor exhibits excellent thermal stability at 500 K, by maintaining 72% of the room temperature intensity. The performance of the fabricated LED is investigated using the electroluminescence (EL) spectra, which confirms that the phosphor is a suitable candidate for applications such as night vision.

Conclusions: The present work investigates the concentration-dependent down-conversion emission of Er^{3+}/Yb^{3+} co-doped $SrLaLiTeO_6$ double perovskite phosphor for the first time. The phosphor exhibits excellent thermal stability and an NIR-II pc-LED is fabricated to demonstrate its potential for pc-LED applications.

Keywords: Perovskites, Down-conversion, Thermal stability, NIR-II pc-LEDs.

09-04

CITRIC ACID DERIVED YELLOW-EMISSIVE CARBON DOTS (Y-CDS) FOR WARM LED APPLICATION

Nima A. M*, Subodh G.

Department of Physics University of Kerala
** Corresponding author: amnima@keralauniversity.ac.in*

Back ground: Carbon dots (CDs), classified as quasi-spherical carbonaceous nanoparticles, have recently gained much attention owing to their diverse properties such as tunable emission, multi-coloured fluorescence, biocompatibility, excellent water solubility and low cost. Developing synthetic methods to fabricate CDs with high photoluminescence quantum yield (PLQY) and long wavelength emission has been a popular research area. To make efficient CDs, numerous synthesis processes are available, including pyrolysis, laser ablation, microwave-assisted synthesis, chemical oxidation, and hydrothermal methods. Most of this research has resulted in blue-emissive CDs. Hence, the production of highly efficient long wavelength emissive CDs, in the yellow or red-light regions, is still exist as a challenge. Yellow-emissive CDs (Y-CDs) with high PLQY, will be an excellent candidate for yellow phosphors in optoelectronic devices.

Method: Yellow-emissive CDs (Y-CDs) were prepared from solvothermal treatment of citric acid and melamine in toluene.

Results: Solvothermal treatment of citric acid and melamine in toluene produces CDs exhibiting bright yellow emission with PLQY of 19.3%. To investigate the general structure and fluorescence origin, we done a variety of optical and structural characterizations. The XPS and FTIR spectra along with XRD and AFM results reveal that YCDs composed of conjugated sp^2 carbon domains with different surface moieties such as hydroxyl, carbonyl, ester and amine groups. The YCDs shows maximum emission at 568 nm corresponding to 500 nm excitation with a large stoke shift of 68 nm.

The larger stoke shift, high PLQY and better stability suggests that the synthesized Y-CDs can be used for optical applications A lighting device was fabricated based on Y-CDs in combination with a 395 nm LED chip. The LED shows warm light with CIE coordinates of (0.48, 0.49), CCT of 2983 K.

Conclusions:

Y-CDs exhibiting excitation-independent PL emission at 568 nm with a high solution PL QY of 19%. A set of optical and structural characterization were performed to confirm the general structure and fluorescence origin of Y-CDs. Y-CDs contains conjugated sp^2 -carbon domains (fused rings) with different surface groups and has other advantages like bright fluorescence, good PLQY and large stoke shift. These qualities of Y-CDs make it a potential candidate as yellow phosphors for the fabrication of warm-light LEDs.

Keywords: Yellow emissive carbon dots, Excitation-independent emission, Photoluminescence quantum yield, Warm LED

09-05

PERCOLATION OF ALIGNED OVERLAPPING SHAPES ON LATTICES

Jasna C K [1*], V. Sasidevan [1]

[1] Department of Physics, Cochin University of Science and Technology,Kochi-682022, Kerala, India
**Corresponding author: jasnack00@gmail.com*

Background: Percolation is a widely studied model in statistical physics. It is a purely geometric phase transition characterized by the emergence of a spanning cluster in the system. The theory has been successfully applied to the study of many systems, natural, social, and technological. It has a remarkable impact on the study of the connectivity of random and disordered media. Important observable for the model is the percolation threshold, the critical point at which the transition occurs from disconnected state to the connected state. Apart from simple site percolation models on square lattices, there can be extended shapes which depict many real world scenarios. There are many factors which affect the transition point in percolation models. Our study focuses on aspects like alignment and shape anisotropy that affect the percolation properties of a system of overlapping shapes.

Method: In this study, we analyze the percolation behavior of aligned and overlapping shapes on square lattices, especially aligned rectangles which are anisotropic in shape. We evaluate percolation threshold for the proposed model using Monte Carlo simulations. Results are compared with predictions of recently proposed lattice version of excluded volume theory. We evaluate continuum limit of model using discrete version of excluded volume theory.

Results: We observe a trend in percolation threshold of system of aligned rectangles of constant width and the length tending to infinity. For rectangles of width one, percolation threshold is monotonically decreasing, for width three it is monotonically increasing and interestingly, for width two, it is nearly a constant. Simulation results agree well with predictions of excluded volume theory. Percolation threshold is found to be dependent upon aspect ratio of the rectangles.

Conclusions: Anisotropy in shapes affects the percolation threshold in a system of overlapping aligned rectangles. Excluded volume theory is able to predict percolation threshold of overlapping

shapes to reasonable accuracy. Continuum limit of aligned rectangle model doesn't correspond to any existing continuum percolation model.

Keywords: Lattice percolation, Percolation threshold, Anisotropy, Excluded volume theory,

09-06

EFFECT OF LATTICE DISLOCATIONS ON THERMAL DIFFUSIVITY OF ZINC OXIDE HYBRID NANOFLUIDS: A THERMAL LENS STUDY

V. Gokul[1*], M. S. Swapna[2], and S. Sankararaman[1]

[1]Department of Optoelectronics, University of Kerala, Trivandrum 695581, India
[2] Laboratory for Environmental and Life Science, University of Nova Gorica, Vipavska 13, Nova Gorica, SI-5000, Slovenia
**Corresponding author :* gokul.opto@gmail.com

Background: Hybrid nanofluids (HNF) are potential candidates in energy-efficient heat transfer applications. The work enfolds the development of HNF comprising zinc oxide (ZnO) - acetylene carbon black (AB) to address heat transfer limitations in thermal engineering. The study employs a highly sensitive mode-mismatched dual beam thermal lens (MDTL) technique to analyze the thermal diffusivity (D) variations of these HNFs.

Methods: The solution combustion synthesized ZnO is mixed with different weight percentages of acetylene black (AB) and annealed at 500 °C to develop different ZnO-AB (ZA) hybrid composites. The X-ray diffraction (XRD) and Raman spectroscopic studies unfolded the structure characteristics of the synthesized samples. A two-step synthesis process involving 1 h of ultrasonication is chosen for the preparation of ZA nanofluid (NF) in ethylene glycol as the base fluid. The D of the samples is analyzed by MDTL setup.

Results: XRD analysis revealed the formation of the ZA composites. The emergence of AB peak at 26° **is evident in the XRD pattern of ZA5, showing the proper incorporation of the dopant in the host matrices.** The structure dislocations present in the prepared composites are understood through the detailed analysis of the XRD patterns. The dislocation densities and the thermal diffusivity variations show an inverse relation.

Conclusion: The thermal lens study is conducted in the ZA-HNFs, revealing the impact of crystallite dislocations on the thermal behavior of the synthesized hybrid composites. Thus, the study suggests the possibility of lattice dislocations monitored thermal diffusivity tuning in ZA hybrid nanofluids for energy-efficient heat transfer applications

Keywords: ZnO hybrid composites, Thermal diffusivity, Thermal lens spectroscopy, Lattice dislocations.

09-07

DEVELOPING LANTHANIDE-DOPED SILICATE PHOSPHORS FOR SOLID-STATE LIGHTING AND OPTICAL THERMOMETRY

Anusree S. P[a*] and H. Padma Kumar[b]

[a]Department of Physics, Research Centre-University of Kerala, Mar Ivanios College, Bethany Hills, Nalanchira, Thiruvananthapuram, Kerala-695015, India, [b]Department of Physics, Mahatma Gandhi College, Kesavadasapuram, Pattom, Thiruvananthapuram, Kerala-695004, India.
**Correspnding author: anusreesree1996@gmail.com*

Background: The implementation of energy saving focuses on developing sustainable solid-state lighting in general lighting to reduce the cost of lighting by almost 20%. Also, accurate and precise temperature measurements of inaccessible objects are challenging, and optical temperature sensing is a promising method to achieve this. Thus, developing a multifunctional phosphor for solid-state lighting and optical thermometry has a major role in scientific research.

Method: A group of silicate apatite phosphors was prepared by conventional solid-state reaction route. Characterizations such as X-ray diffraction analysis (XRD), photoluminescence (PL), diffuse reflectance spectroscopy (DRS), temperature-dependent PL characteristics (TDPL), and decay time measurements are also carried out.

Results: The temperature-dependent PLE from 100K-500K shows a continuous fall in yellow emission (Dy^{3+}) and red emission (Sm^{3+}) respectively. Relative sensitivity obtained for the Sm^{3+} doped sample is 0.943%K^{-1} at 100K; for Dy^{3+} it is observed around 0.39%K^{-1} at 100K.

Conclusions: The comparison of relative sensitivities with existing phosphors suggests that our compound is a better choice for temperature sensing applications in temperatures 100K-500K and the CCT value suggests its application in lighting in office spaces and, in bulbs for supporting growth of indoor plants.

Keywords: Silicate phosphors, lanthanides, doping, photoluminescence, temperature sensing.

09-08

NANOENGINEERING QUANTUM CAPACITANCE FOR SUPERIOR ENERGY STORAGE IN 2D SUPERCAPACITORS

Sruthi T* and Vincent Mathew

Central University of Kerala, Department of Physics, Tejaswini Hills, Periye, Kerala and India
**Corresponding author: drsruthi2023@gmail.com*

Background: Using renewable energy sources to produce green energy on a wide scale is crucial in the current climate. Sunlight is currently the most viable renewable energy source in use on Earth. But not every region of the planet has year-round access to solar energy for energy production. As a result, economical transportation and good energy storage are essential. Building efficient energy storage systems is therefore one of the current research topics in the production of green energy. A potential replacement for energy storage could be provided by the promising technology known as two-dimensional supercapacitors. Supercapacitors should have a long lifespan, a very high ion density,

and rapid charging and discharging. It may be essential to use two-dimensional (2D) materials when designing supercapacitor electrodes. Molebdenum disulfide ($MoSe_2$) is becoming more and more well-known in the supercapacitor industry because of its unique properties. Functionalized $MoSe_2$, which provides high surface area, chemical stability, exceptional electrochemical performance, and the possibility of low-cost manufacturing, may be the best choice for supercapacitor electrodes. $MoSe_2$ has shown great promise in the role of electrodes for supercapacitors. Researchers continue to we have examined the quantum capacitance in W and S substituted $MoSe_2$ monolayer, to sum up. Our theoretical analysis shows that adding ad-atoms to the $MoSe_2$ monolayer sheet can greatly increase the quantum capacitance (C_Q) of these electrodes. Above 500 $\mu F/cm^2$, a significant quantum capacitance has been detected. These calculations demonstrate that, the quantum capacitance of these electrodes is increased by substitutional doping of W with TM ad-atoms. Our calculated C_Q values in functionalized $MoSe_2$, we discover, are significantly We find that in functionalized $MoSe_2$, our projected C_Q values are significantly higher than the previously published values. Ad-atom doped $MoSe_2$ monolayer experiences a significant charge redistribution, which leads to the buildup of several electronically charged states at the Fermi level. The addition of ad-atoms to monolayer $MoSe_2$ results in a change in carrier concentration, which shifts the Fermi level and greatly increases the system's quantum capacitance.

Method: To finish our theoretical investigation of C_Q, we employ Vienna Ab initio Simulation Package (VASP) calculations based on plane wave-based density functional theory to precisely identify the electronic structure of the substituted $MoSe_2$. The projected augmented wave technique was utilised to improve the geometric structure of the functionalized $MoSe_2$. The PBE parametrization of the generalised gradient approximation was used to estimate the exchange correlation energy functionals. We used a very high cut-off kinetic energy (>400 eV) in all of our computations to ensure dependable results. Calculations were performed using 3×3×1 supercells of $MoSe_2$ unit cells to investigate the effects oWe have examined the quantum capacitance in W and S substituted $MoSe_2$ monolayer, to sum up. Our theoretical analysis shows that adding ad-atoms to the $MoSe_2$ monolayer sheet can greatly increase the quantum capacitance (C_Q) of these electrodes. Above 500 $\mu F/cm^2$, a significant quantum capacitance has been detected. These calculations demonstrate that, the quantum capacitance of these electrodes is increased by substitutional doping of W with TM ad-atoms. Our calculated C_Q values in functionalized $MoSe_2$, we discover, are significantly We find that in functionalized $MoSe_2$, our projected C_Q values are significantly higher than the previously published values. Ad-atom doped $MoSe_2$ monolayer experiences a significant charge redistribution, which leads to the buildup of several electronically charged states at the Fermi level. The addition of ad-atoms to monolayer $MoSe_2$ results in a change in carrier concentration, which shifts the Fermi level and greatly increases the system's quantum capacitance.

Results: the way the DOS works in connection to Fermi energy. As a direct band semiconductor, meaning that no states are present close to the Fermi level, the monolayer MoSe2 semiconductor generates zero quantum capacitance. The electrical structure of a material can be altered via the process known as ad-atom doping. If states at the Fermi level accumulate and the electronic structure of the monolayer $MoSe_2$ alters, quantum capacitance may result. Next, Mo, Nb, Ta, and Tc transition metal (TM) atoms were considered as ad-atoms to replace one Mo in the $MoSe_2$ monolayer unit cell. These adatoms introduce DOS in the atom PDOS that is near Fermi energy. Our calculation shows that the C_Q value of $MoSe_2$ monolayers shifts considerably during TM-functionalization. These systems have extremely high quantum capacitance. It is possible to plot the energy variation of C_Q for any TM-doped system. There is a noticeable charge redistribution and transfer in the ad-atom

doped monolayer. The additional charge carriers in the ad-atoms change the carrier concentration in the monolayer, which in turn alters the Fermi level.

Conclusions: In summary, the quantum capacitance in Mo and Se replaced $MoSe_2$ monolayer has been investigated. Based on our theoretical study, we can significantly boost the quantum capacitance (C_Q) of these electrodes by introducing ad-atoms into the MoSe2 monolayer sheet. A notable quantum capacitance has been found over 500 μF/cm2. Through substitutional doping of Mo with TM ad-atoms, our calculations show that the quantum capacitance of these electrodes is enhanced. Our estimated C_Q values in functionalized $MoSe_2$ turn out to be much greater than the previously reported values. Ad-atom doped $MoSe_2$ monolayer undergoes a substantial charge redistribution that causes many electronically charged states to accumulate at the Fermi level. We discover that our estimated C_Q values in functionalized $MoSe_2$ are far higher than the values that have been previously published. A substantial charge redistribution occurs in the ad-atom doped MoSe2 monolayer, resulting in the accumulation of several electronically charged states at the Fermi level. Ad-atoms cause a shift in the carrier concentration in monolayer $MoSe_2$, which moves the Fermi level and significantly raises the quantum capacitance of the system.

Keywords: Supercapacitors, Energy storage, Quantum capacitance, 2D materials, Electronic structure, Density functional theory

09-09

TAILORING THE DIELECTRIC RESPONSE OF SIO_2-SNF_2 COMPOSITES THROUGH COLD SINTERING PROCESS.

Jagadeesh M*, Santha N, Jawahar I N and Subodh G

Department of Physics, University of Kerala, Karyavattom campus, Trivandrum-695581, Kerala
**Corresponding author: mjaggu82@gmail.com*

Background: The fast advancement of 5G, IoT, artificial intelligence, and other technologies requires the use of multifunctional materials for enhanced device integration and upgrading. Due to the extraordinary chemical and mechanical properties, silicate-based systems and silica (SiO_2) have gained popularity since the early 1950s. SiO_2 can be prepared by conventional solid-state methods and is usually sintered above 1200 °C, but this high sintering temperature will cause internal cracks. So, we need to reduce the sintering temperature and improve the dielectric properties of the SiO_2. The most promising sintering approach to reduce sintering temperature is the cold sintering process. In this study, we report a single-step method to synthesis a series of $xSiO_2$–$(1–x)SnF_2$ composite materials at 150 °C through the cold sintering process using SnF_2 additives and water as the transient liquid phase. And using the suitable combination, a cylindrical dielectric resonator antenna is designed and simulated for Ku-band applications.

Method: In the present work, we combine volume fractions of SiO_2 ceramic with SnF_2 at ultra-low temperatures (<150°C) in a single step along with the transient liquid phase (water) in a very short time.

Results: Crystal structure and phase purity were confirmed by XRD and Raman analysis. Density, and dielectric properties were studied. The sintering aid and transient liquid phase (SnF_2 and water in the present study) enhance the densification of the composite due to the low melting nature as

well as congruent dissolution of SnF_2 in the water phase. The density and dielectric properties of $0.5SiO_2$-$0.5SnF_2$ composite suggest it is a potential candidate for antenna fabrication in the Ku-band region. A cylindrical dielectric resonator antenna (CDRA) was designed, and simulated with $0.5SiO_2$–$0.5SnF_2$ composite.

Conclusions: This study reveals that the addition of SnF_2 enhances the density and dielectric properties of the SiO_2, and $0.5SiO_2$-$0.5SnF_2$ composite is a potential candidate for the fabrication of a low loss, light-weight, wide bandwidth CDRA for applications in the K-band.

Keywords: Silica, Tin fluoride, Cold sintering, broad-band dielectric properties, resonator antenna

POSTER PRESENTATION

09-10

RGO SUPPORTED MOTE$_2$ NANOHYBRID FOR SUPERIOR GLUCOSE SENSING: INSIGHTS FROM THEORETICAL SIMULATIONS

Seetha Lakshmy[1 a*], Nandakumar Kalarikkal[1,2,3] and Brahmananda Chakraborthy[2,3]

[1]International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam 686 560, Kerala
[2]School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam 686 560, Kerala
[3]School of Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam 686 560, Kerala
[4]High Pressure &Synchroton Radiation Physics Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, India
[5]Homi Bhabha National Institute, Anushaktinagar, Mumbai-400094, India
**Corresponding author: seethalakshmy2015@gmail.com*

Background: Diabetes mellitus is a persistent health condition where the body exhibits abnormal responses to insulin, leading to elevated blood glucose levels. Monitoring glucose concentration in the blood is crucial for diagnosing and managing diabetes symptoms. Given the rising number of diabetes cases, it is pertinent to develop affordable glucose sensors with high selectivity and sensitivity. Recent studies highlight the effectiveness of a 2D transition metal dichalcogenide, specifically the $MoTe_2$ monolayer functionalized with a Pd metal atom, as a promising glucose sensor.

Methods: The semiconducting $MoTe_2$ monolayer, when supported with a conducting 2D material like graphene, the GL sensing performance can be enhanced to a large extent. This work extensively investigates the GL sensing performance of the MoTe2 supported with reduced graphene oxide (MoTe2/rGO hybrid) system using the first-principles Density Functional Theory (DFT) simulations. The GL interaction with the hybrid system is evaluated by calculating the adsorption energy, charge transfer, and orbital interactions. The practical viability of the $MoTe_2$/rGO system, including the stability and reusability of the materials, is elaborated.

Results: The adsorption energy of GL on the $MoTe_2$/rGO hybrid system is -1.054 eV, which is twice greater than the pristine MoTe2 monolayer (-0.4 eV). This increased adsorption energy is due to the change in conductivity of the overall system due to the stress-induced (4%) in the system during

the hybrid structure formation and expedited charge transfer (0.7 e), and strong orbital interactions between the O 2p orbitals of GL and the 5p orbitals of Te in $MoTe_2$/rGO hybrid system. The $MoTe_2$/rGO system is stable at 300K and exhibits the work function sensitivity twice the pristine system. The recovery time of 38s at 320 K ensures the reusability of the MoTe2/rGO-based MoTe2 system.

Conclusion: The study suggests that the MoTe2 monolayer supported with rGO is a promising material for developing low-cost and high-performance glucometers because of its excellent sensitivity and reusability.

Keywords: Diabetes mellitus, 2D transition metal dichalcogenide, glucose sensor.

09-11

THEORETICAL EVALUATION OF SOME THERMODYNAMIC PROPERTIES OF DEUTERIUM USING MAYERS CLUSTER EXPANSION

Subina K V[1*] and Suresh T P [2]

[1]Govt College Madappally and [2]Govt Brennen College, Dharmadam, Kerala
**Corresponding author: kvsubina@gmail.com*

Background: Mayer cluster expansion technique gives the mathematical expression for various physical quantities which can be expressed as series expansion whose main term describe the corresponding ideal system while subsequent term provides corrections arising from interparticle interaction. At low densities, the deviations from ideal state are adequately explained by the second virial coefficient, but at high densities, higher virial coefficients must be taken into account.

Method: This work aims at calculating, Boyle temperature, zero pressure Joule-Thomson coefficient of deuterium using second virial coefficient in temperature range 100-500K. In this work we used the Lennard -Jones potential for modelling the pair interaction. Using the method of cluster expansion, we obtained a formula for second virial coefficient and its derivative with respect to temperature. Using these values we calculated the values of J K coefficient for deuterium.

Results: The calculated value of second virial coefficients are in agreements with experimental values in the range 500-2000K. At lower temperature deviations from experimental values are observed. The Boyle temperature and Joule-Thomson coefficients are calculated.

Conclusions: An efficient approach for calculating Boyle temperature and joule Thomson coefficient of Deuterium is discussed above and are useful in wide area of engineering sciences. The same method of cluster expansion can be used for finding thermal and physical properties of gases.

Keywords: Joule-Thomson coefficient, Boyle temperature, Second virial coefficient, Cluster expansion

09-12

DECAY CHARACTERISTICS OF EXPERIMENTALLY SYNTHESIZED SUPERHEAVY ELEMENTS

Rajeev P*, Prathapan K, Deneshan P and Suresh T P

Department of Physics, Govt. Brennan College, Thalassery 670106, India
**Correspondig author: rrajeevp@gmail.com*

Background: Cluster radioactivity is the emission of a nucleus heavier than alpha particle, but lighter than the mass of a fragment in fission. The study of alpha-cluster formation in heavy and superheavy nuclei begins soon after the Rutherford's discovery of alpha decay and is still an important tool of nuclear Physics.

Methods: In the present work, the alpha and cluster decay half-life of more than 500 experimentally synthesized isotopes of superheavy elements with Z = 104 - 118 were studied by calculating the half-life of decay based on The Universal Decay Law (UDL) and the Coulomb and Proximity Potential Model (CPPM) by calculating the Q-values using the KTUY table.

Results: It has been found that the alpha decay half-lives are very low in the range 10^{-4} to 1 seconds. For many of the superheavy nuclei, the cluster decay half-lives corresponding to the emission of ^{8}Be, $^{12,14}C$, ^{16}O,$^{30,32}Si$ are found to be well within the experimental upper limit of 10^{30} seconds. From our calculations using the UDL formula and the CPPM, we could find 70 possible cluster emissions with decay half-lives less than 10^{25} seconds. Such decay modes can be detected using the current experimental facilities.

Keywords: Cluster decay, Alpha decay, Superheavy nuclei

09-13

ELECTRICAL AND OPTICAL CHARACTERISATION OF DIP COATED $CU_{1-X}ZN_XFE_2O_4$ (X= 0.2, 0.4, 0.6, 0.8) FILMS FOR SCHOTTKY DEVICE APPLICATIONS

Aiswarya K U*, Arun K J*

Department of Physics, Sree Kerala Varma College, Thrissur 680011, Kerala, India
**Corresponding author: aiswaryaupendranath1998@gmail.com*

Background: Ferrites in thin film form shows remarkable structural, electrical, optical and magnetic properties. Copper zinc ferrites belonging to the series of $Cu_{1-x}Zn_xFe_2O_4$ (x= 0.2, 0.4, 0.6, 0.8) are synthesized by dip coating technique and analysed how Stoichiometric changes affect the properties of ferrites.

Method: Thin films of various concentrations of Zinc and copper are prepared by dip coating method which is $Cu_{0.8}Zn_{0.2}Fe_2O_4$, $Cu_{0.6}Zn_{0.4}Fe_2O_4$, $Cu_{0.4}Zn_{0.6}Fe_2O_4$ and $Cu_{0.2}Zn_{0.8}Fe_2O_4$.The changes in the particle size and optical bandgap are studied. The main scope is to analyze the relation between current and voltage measured using a source meter.

Results: XRD analysis shows an increase in the particle size with increase in Zn content and it is due to larger ionic radius of zinc than that of copper. It is also observed that the band gap increases

with increase in zinc content. From I-V characteristics it is observed that as voltage increases, the current increases for all films. Also an improved magnitude of current is shown by the film having high Zn content.

Conclusions: This work establishes how stoichiometric changes affect the structural, optical and electrical properties of thin films.

Keywords: Copper zinc ferrite, Crystallite size, Zinc content, Electrical conductivity

10-SCIENTIFIC SOCIAL RESPONSIBILITY

ORAL PRESENTATION

10-01

AI BASED DECISION SUPPORT SYSTEM FOR LANDSLIDE HAZARD MANAGEMENT IN KERALA

Achu A. L[a*], Jobin Thomas[b], Aju C D[c,d], Girish Gopinath[a]

[a]Department of Climate Variability and Aquatic Ecosystems, Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi-682 508, Kerala, India, [b]Department of Geological and Mining Engineering and Sciences, Michigan Technological University, Houghton, MI 49931, USA, [c]Department of Geology, University of Kerala, Thiruvananthapuram 695 581, Kerala, India, [d]Indian Institute of Tropical Meteorology, Ministry of Earth Sciences, Pune, India

*Corresponding author:achu.geomatics@gmail.com

Background: Landslides represent the most common geological threats impacting mountainous areas globally. Kerala, among the states in India, is regularly affected by landslides during the Indian summer monsoon season. The combination of challenging terrain, intense bouts of rainfall, and human-induced alterations to slopes renders the Western Ghats of Kerala susceptible to landslides. In addition, landslide occurrences in Kerala have intensified due to recent extreme rainfall events induced by climate change. The role of Artificial Intelligence (AI) in landslide susceptibility prediction is pivotal in enhancing our ability to forecast and mitigate potential risks. Through advanced algorithms, AI can identify intricate patterns and correlations within large datasets, allowing for a more accurate assessment of landslide-prone areas. AI, particularly deep learning models, plays a crucial role in the analysis of complex geological and environmental data.

Method: The present study used 3575 landslide locations and fifteen various geo-environmental landslide conditioning factors collected from various sources for modelling landslide susceptibility. The aim of the present study is to model the landslide susceptibility of Kerala state through deep neural network (DNN).

Result: The study indicates that ~13% of the Kerala state is extremely susceptible for landslide occurrence. In addition, there is about the study also shows an increase of 3.46 % area in extreme susceptibility zone after the 2018 event. The study finds that 2.21% of the Kerala population is living in extremely susceptible zone. Finally, the model is made open-source web enabled using ArcGIS online geodata platform. The online version is free access and anyone can access using the link provided using a smart phone. Besides using their GPS location in the phone instant decision making is possible even for layman.

Keywords: Landslide, AI-Deep learning, Kerala, India.

10-02

ASSESSING EXPOSURE, SENSITIVITY AND ADAPTIVE CAPACITY IN RELATION TO CLIMATE CHANGE IN MARGINALISED PANIYA TRIBES: A CASE STUDY FROM MANANTHAVADY, WAYANAD

Jyothi S Kumar*, Maneesha P., Naveena K., Ashish K. Chaturvedi

Land and Water Management Research Group, Centre for Water Resources Development and Management, Kozhikode-673571, Kerala

**Corresponding author :*jyothiskumar888@gmail.com

Background: Critical methodological and evident gaps exist in assessing the socioeconomic impacts, adaptation options to climate change in Tribal hamlets needs in depth analysis of socio-economical, water related, demographic and other issues related to sustenance under future. Although Kerala states have implemented a number of unique schemes and program aimed at improving tribal livelihoods in terms of food security, housing, and self-sufficiency. Various factors that enhance the exposure, sensitivity, adaptive capacity is selected. Indicators of three different components and subcomponents of each function of vulnerability are weighted accordingly for analysis along with their perceptions and resilience towards climate change.

Methods: Field survey was conducted at Manananthavady taluk in Wayanad district covering 27 Paniya tribal colonies randomly selected. The total household selected were 92 for data collection. Primary data were collected using a pre-tested structured questionnaire and focused group discussion. The questionnaire consists of relevant questions related to the Paniya community's socio-economic conditions and their exposure, sensitivity and adaptive capacity towards climate change.

Results: Results suggest that community faces socio-economic challenges, gender disparities, and limited educational opportunities. Agriculture relies heavily on rainfed methods. Positive shifts in farming practices exist, but challenges persist in accessing water and achieving equitable living conditions. The vulnerability status of marginalised Paniya farmers towards climate change explores that 96.7% of the community is medium to highly exposed to climatic events. 90.2 % of the community is high to very high sensitive to the climate change. While considering the adaptive capacity, the community is less capable (low to medium) to adapt the climate change which collectively consists of 92.39% of the selected sample size indicating less awareness about the adaptation techniques and are more vulnerability. Significant positive association between sensitivity and exposure (r=0.29**) towards climate change and with adoption capacity not associating (r=0.001) with sensitivity of people. It's clearly says this tribal colony need awareness about climate change impact and mitigation strategies for improving their adoptive capacity.

Conclusion: The marginalized Paniya community faces diverse challenges intensified by climate vulnerabilities. To strengthen resilience, vital interventions are needed: comprehensive climate education, capacity-building, sustainable agriculture, and enhanced water management. Empowering the community with adaptive strategies is crucial to combat climate impacts and promote sustainable development. Further in-depth analysis of different attributes related to climate sensitivity, exposure and adaptive capacity interlinking biophysical attributes is required to understand the Vulnerability in the region.

Keywords: Vulnerability, Adaptive capacity, Marginalised Tribes, Socio-economic factors

10-03

INVESTIGATION ON INFLUENCE OF PLASTIC IN SUSTAINABLE CLAY BRICKS: A LASER INDUCED BREAKDOWN SPECTROSCOPIC STUDY

Ajith A * and Sankararaman S

Department of Optoelectronics, University of Kerala, Kerala, India
**Corresponding author: aygeetee88@gmail.com*

Background: Laser-Induced Breakdown Spectroscopy (LIBS) is a powerful method for elemental detection in various fields. The investigation explores the possibility of producing environmentally friendly building bricks with reduced carbon emissions by incorporating waste plastic into clay. The study evaluates the impact of utilizing plastic waste on different brick properties using LIBS technique.

Method: In this study, clayey soils were stabilized by incorporating varying proportions of plastic waste (10%, 20%, 30%, 40%, 50%, and 60%) by weight into normal clayey soil. The clay-plastic mixtures are pelletized at a compressive weight of 5 tons, and subjected to tests like compressive strength, water solubility and LIBS analysis. LIBS is employed to analyse the improved properties, utilizing a second harmonic radiation of a Q-switched Nd: YAG laser (532 nm) with a pulse width of 7 ns at a fluency of 50 mJ for plasma generation and spectroscopic investigation.

Results: The experimental findings from pelletized samples demonstrated a noteworthy enhancement in strength and reduced water absorption. The emission spectrum of the generated plasma is recorded to identify plastic-added clay specimen and explored the dominant chemical elements in the mixtures. Subsequent spectrum analysis unveiled the detailed reasons behind the improved properties of the stabilized soil.

Conclusions: The utilization of LIBS has exposed the addition of plastic to clay bricks can have a noticeable impact on their mechanical strength and water absorption. The LIBS analysis discloses that the role of Calcium, in enhancing the mechanical strength of the brick. In summary, the study on the influence of plastic on the strength of clay bricks using LIBS not only contributes to the scientific understanding of construction materials but also holds promise for sustainable and innovative solutions in the construction industry

Keywords: Laser-Induced Breakdown Spectroscopy, clay-plastic bricks, compressive strength, water absorption.

10-04

SENSITIZING TRIBAL POPULATION FOR SCIENTIFIC INTERVENTION OF WATER CONSERVATION IN WAYANAD

Jaseem Moosa CK*, Ashish K. Chaturvedi, Arun P.R., C. Dinil Sony, Manoj P Samuel

Centre for Water Resources Development and Management, Kozhikode-673571, Kerala
Corresponding author:jaseemmoosack@gmail.com***

Background: Sensitization of individuals and translating scientific outputs into socially relevant domains for implementation is one of the time-consuming tasks that is critical in delivering to the

public. According to the standards, Scientific Social Responsibility (SSR) could be classified as a science-society connection since it promotes equitable and sustainable development by transferring the advantages of scientific effort to fulfil present and growing societal requirements. Instilling social responsibility in persons and institutions that practice science; raising awareness of SSR throughout society. This work provides the first steps toward implementation at Wayanad, where scientific roof top water harvesting and water conservation measures in a tribal hamlet were supported.

Methods: Under Cochin Shipyard Limited's Corporate Social Responsibility program, work was commenced at the tribal hamlet of Athikadavu colony, Wayanad, to implement RWH and Wick irrigation plots. A survey was undertaken to pick dwellings based on discussions with various stakeholders, beneficiaries, and scientifically spanning the entire colony. The workshop was initially held to sensitize the tribal peoples, explaining what, why, and how it will be done. Later, by scientific intervention, people's involvement in the program was encouraged. Further scientific measures for water conservation through roof top water harvesting and demonstration of wick irrigation method for vegetable cultivation was performed.

Results: Residents of Athikadavu colony enthusiastically engaged in the workshop, comprehended the program's know-how, and provided active support during the survey and data collection. After conducting a survey, we discovered that there were several sorts of residences. Houses with one side slope, houses with flat roofs, houses with two side slopes and GI sheet covering on concrete roofs, and houses with two side slopes and roof tile covering on concrete roofs. The roof area of each house is calculated by taking the house's dimensions and computing the effective area. The RWH system was created for each type of house to gather the most water from the rooftop and implementation began. Similarly, wick irrigation is a simple, low-cost irrigation technology that comprises of a reservoir (pipes or bucket) that serves as a water source, wicks, and a growing media in a plant container. The growing media and reservoir are connected by Wick, which absorbs water from the reservoir and delivers it to the plant container via capillary action. In comparison to conventional irrigation, wick irrigation provides a homogeneous distribution of water at the root zone, which is beneficial to crops. Wick irrigation could be a viable solution for vegetable production in limited space, as well as for homestead vegetable farming. The wick irrigation setup was put in four houses whose residents have a keen interest in farming and new agricultural approaches.

Conclusion: Initial results of this work emphasizes the importance of transferring knowledge and techniques related to water conservation to marginalized communities through implementation mode, fostering social responsibility in individuals and institutions practicing science, and raising awareness about SSR within society. This work seeks to bridge the information gap and provide vulnerable populations with the skills and insights they require to deal with the challenges of climate change. Following the implementation of this effort, it seeks to increase marginalized groups' ability to face and lessen the effects of climate change on their lives and overall welfare by passing on expertise and practical know-how. Vegetable growing may help to improve the lives of underprivileged tribal communities. Furthermore, the experiential learning from this endeavour will result in new knowledge.

Keywords: Roof top water harvesting, Wick irrigation, Scientific Social Responsibility

10-05

EVALUATING LIVELIHOOD CAPITALS IN KORAGA AND BAIRA COMMUNITIES OF KASARAGOD DISTRICT: UNVEILING OPPORTUNITIES FOR SCIENCE & TECHNOLOGY INTERVENTION

Harinarayanan. P*., Ibrahim-Bathis.K., Anas. S., Mintu Elezebath George., Sharlet Kurian Sidhardh A S Kumar., Binu Raj.K., Shamna S

Kerala State Council for Science, Technology and Environment (KSCSTE), Sasthra Bhavan, Pattom – 695004. Thiruvananthapuram

**Corresponding author:kscstescstcell@gmail.com*

Background: Koraga and Baira communities of Kerala encounter hindrances to their development, including social exclusion, economic marginalization, environmental vulnerabilities, and limited resource access., leading to low-income activities and limited asset creation obstructing sustainable development of these communities. Ensuring sustainability in livelihoods is crucial in contributing to poverty alleviation, economic stability, quality health, and education for underprivileged communities. Their livelihood assets are assessed using the Department for International Development's (DFID) widely accepted framework on Sustainable Livelihoods through the present study in order to unveil opportunities for Science and Technology Interventions.

Method: Sustainable Livelihood assessment of Koraga and Baira of Kasaragod district of Kerala are done through a comprehensive approach integrating structured field surveys, along with active participation in diverse focus group discussions and workshops to gather primary data on demography, socio-economic factors, livelihoods, and indigenous practices. The analysis of their livelihood assets, capabilities, and resources is conducted within the framework of the Department for International Development (DFID)'s Sustainable Livelihoods approach. This framework encompasses the examination of five key capitals: natural, physical, financial, human, and social capital. By employing this holistic approach, the study aims to provide a thorough understanding of the communities' sustainable livelihoods and identify areas for improvement and intervention.

Results: The Sustainable Livelihoods Framework served as an analytical tool to enhance the understanding of complexity livelihood systems and identify strengths and weaknesses in predominant livelihood systems of each settlement of Koraga and Baira community through a schematic representation (pentagon). The results after analysing five capitals of Sustainable Livelihoods Framework depicts that the both Human and Natural capitals are stronger than the remaining capitals, whereas Financial and Social capitals are weak. Empowering these capitals require skilling up them in their traditional livelihood and/or their predominant livelihood and providing a financial counselling support for implementing proper financial management in their life. This will gradually bring in changes to all these basic levels as will accelerate their transition in to the socio-economic empowerment.

Conclusions: The current study systematically illustrates the livelihood capitals and assets available to the Koraga and Baira communities in Kasaragod district, employing a pentagonal schematic representation. The unique shape of the pentagon serves as a visual aid, facilitating a comprehensive understanding of the communities' access to various assets and the disparities in acquiring them. The five major livelihood capitals, depicted in the pentagonal structure, not only offer insights into the existing conditions but also present opportunities for science and technology interventions. These interventions, whether in institutional or human capacities, hold significant potential for fostering

socio-economic-cultural empowerment within these communities.

Keywords: Koraga, Baira, Sustainable, Livelihoods, Science & Technology

10-06

EMPOWERING MUTHUVAN AND HILL PULAYA TRIBAL COMMUNITIES- A SCIENTIFIC APPROACH TO SUSTAINABLE LIVELIHOOD INTERVENTIONS

Harinarayanan. P., Ibrahim-Bathis.K., Anas. S*., Mintu Elezebath George., Sharlet Kurian., Shamna S Sidhardh A S Kumar., Binu Raj.K.,

Kerala State Council for Science, Technology and Environment (KSCSTE), Sasthra Bhavan, Pattom – 695004. Thiruvananthapuram

**Corresponding author:* kscstescstcell@gmail.com

Background: The Hill Pulaya and Muthuvan communities exhibit heterogeneity in culture, believes, livelihoods and socio-economic conditions. These communities, integral components of the forest ecosystem, possess customary rights to their forests. They have evolved distinct ways of life and traditional knowledge, entrenched within the forest or its peripheries, reflecting their harmonious coexistence with the natural habitat. However, their current lifestyle reflects a shift to settled farming, with a focus on cultivating their own lands (Muthuvan) as well as diversification in the livelihood (Hill Pulaya). This paper aims to identify the prevailing livelihood patterns and propose potential scientific interventions to enhance the livelihoods of the Muthuvan and Hill Pulaya communities in the Idukki district, Kerala.

Methods: Based on the primary data collected through a structured interview, observation and focus group discussion, the livelihood of the both communities are illustrated using geospatial platform and spreadsheets. The required science and technology-based interventions are suggested.

Results: The present study concluded that Muthuvans depend on traditional farming for their dominant livelihood, whereas Hill Pulayas are agriculture labours. Muthuvans cultivate vegetables, millets, lemon grass, spices especially cardamom etc. They also depend on collecting MFPs and NTFPs. The climate change and challenges in the marketing hinders them in converting their farming as the earning or stable income. The study revealed the abundant scope for science and technology intervention in making changes to the livelihood pattern of the Hill Pulaya and Muthuvan community. Imparting Science and Technology based interventions either capacity building of institutional or human capacity to sustain the development of livelihood leading to the overall socio-economic empowerment of Muthuvan and Hill Pulaya community is discussed. The Key intervention in their dominant livelihood including educating and training them on scientific farming methods, harvesting, value addition, product diversification, collection of NTFP etc will improve the productivity and stable income. This knowledge transfer not only ensures the sustainable livelihood of these communities but also reduces their dependency on forests and minimizes the likelihood of wildlife conflicts.

Conclusions: Muthuvans and Hill Pulaya tribes of Idukki district are the traditional agriculturists and agricultural laborers respectively. Infusing scientific interventions in improvising agriculture practices of Muthuvan and science and technology-based skilling Hill Pulayas in their respective traditional and present livelihood, brings high-quality organic products to the market with increased

demand. Along with this, certification, promotions of these certified products, proper marketing through e-marketing, tourism, and government departments etc are required.

Keywords: Muthuva and Hill Pulaya, Sustainable, Livelihoods, Science & Technology, Intervention.

10-07

GOOGLE EARTH ENGINE FOR FLOOD MAPPING & DAMAGE ASSESSMENT ON THE GREATER PAMBA RIVER BASIN, KERALA, INDIA

Vandhana T V* and Girish Gopinath

Department of Climate Variability and Aquatic Ecosystems, KUFOS, Kochi, 682508, India
**Corresponding author: vandhanatv2@gmail.com*

Background: Mapping flood inundation holds critical importance, supplying vital data for decision-makers to evaluate the magnitude of flooding. In this investigation, contemporary processing techniques for Sentinel-Synthetic Aperture Radar (SAR) data are utilized to delineate flood inundation in the Manimala, Pamba, and Achenkovil catchments situated within the broader Pamba Basin.

Method: The research combines techniques such as speckle filtering, temporal compositing, and thresholding to produce precise flood extent maps. Using Copernicus Sentinel-1 Ground Range Detected (GRD) data in VH-polarized SAR mode (IW) with specific orbit properties (descending or ascending), the study selects appropriate datasets. Various preprocessing stages, encompassing calibration and improved speckle filters, are employed to reduce interference and improve the accuracy of flood identification.

Results: The findings reveal that within the total basin area of 4,505 square kilometers, approximately 158.88 square kilometers are affected by inundation. Validation against NRSC data showcases a high level of accuracy, robustly endorsing the use of SAR data from Sentinel satellites and their processing methodologies for accurate mapping of flooded regions. Furthermore, the study evaluates the repercussions of floods on agricultural lands and infrastructure.

Conclusions: This research demonstrates the practical value of flood inundation mapping in identifying flood-prone areas. It serves as a crucial tool for future endeavors, such as infrastructure planning, by enabling the identification of flood-risk zones to mitigate potential impacts.

Keywords: Flood Mapping, SAR data, Google Earth Engine, Greater Pamba Basin

10-08

SOCIO-ECOLOGICAL DEVELOPMENT OF KERALA THROUGH SUSTAINABLE MANAGEMENT OF THREATENED TREE RESOURCES OF WESTERN GHATS

Gokul C.S *, Jose P.A , Subin K and Dipika Ayate P

KSCSTE-Kerala Forest Research Institute, Peechi, Thrissur 680653
**Corresponding author:* gokulcsurendran@gmail.com

Background: Socio- ecological development refers to the ecological richness along with the benefit

of different sections of the society. The initiative can contribute to conservation and management of ecosystems, resource augmentation of potential species with additional benefits of vegetation richness, carbon reduction, greening up of the environment. The approach is implemented through endemic and threatened trees of Western Ghats, untapped genetic resources on a participatory basis.

Method: Endemic and threatened trees species, which has high ecological, economic and social benefits have been selected on the basis of suitability of ecosystems. Development of large scale planting stock by propagules collection, multiplication, planting and seedling survival monitoring was carried out by the local people. Ecosystems both forest and non-forest areas were selected for the restoration activities.

Result: A total of 30,000 seedlings of 10 threatened tree species were developed in the nursery. Enriched planting of 2200 seedlings in 6 species carried out at Poringalkuthu forest during July-August 2023 followed by 800 seedlings in 6 Sacred groves facing degradation. Apart from these, 500 seedlings planted in School/Colleges and Public places. The flood affected riparian areas and Myristica swamps are other planting sites envisaged.

Conclusions: The large scale multiplication and enrichment planting of the threatened trees will facilitate the socio- ecological development and sustainable management of various ecosystems for the benefit of depended communities and authorities in the State.

Key Words: Threatened trees, Ecosystem management, beneficiaries, Sustainable Development.

10-9

SUSTAINABLE USE OF WATER RESOURCES IN PALAKKAD DISTRICT – A RURAL AND URBAN PERSPECTIVE ANALYSIS

Uma J Vinod[1*], Veena George M[1] and Rajesh K[2]

[1]Integrated Rural Technology Centre, Palakkad
[2]Kerala Institute of Local Administration
**Corresponding author: umajvinod@gmail.com*

Background: Kerala, one of the tropical states in India, has been experiencing increasing incidents of drought in the recent past due to the weather anomalies and developmental pressures resulting from the changes in land use, traditional practices, and life style of the people. Among all 14 districts in Kerala, Palakkad faces a severe water shortage despite having the largest number of ponds, dams and canals. Keeping in the context, this study examines the roles and level of community participation in the sustainable use of water resources in different agroecological zones fall into four panchayats of Palakkad and gives possible recommendations to enhance their participation and to identify factors that encourage the integration of women into water conservation management.

Methods: Focal Group Discussion and with a structured questionnaire, captured the opinions of respondents using a series of questions split into different sets.

Results: The results show that, the main sources of drinking water in the four panchayaths were open well (66.83%). Among the surveyed respondents, 96.28% of female member collect the water for various purpose for the family and merely 3.71% of the males do fetch water for their family. 43.07% of the respondents use environment friendly cleaning products to improve the

water quality. 83.12% of the respondents do water treatment practices in rivers, ponds, wells and tanks. The most common method of drinking water purification is boiling (70.73%). Of the total respondents, 20.19% had indicated that the main water wastage areas, the top three areas were 1) Household water consumption (43.89%), 2) Agricultural irrigation (30.40%) and, 3) construction sites (13.91%). Most of the respondents (86.17%) had not implemented any water harvesting measures. The barriers to implement water conservation measures within households were: Lack of incentives, Lack of knowledge, Cost, and lack of readiness to commit time for implementing water conservation measures.

Conclusion: The study enlightens the need to include the social background for designing and constructing policies in this pristine resource in the area. These policies should consider the differentials in perceptions, attitudes, and uses of water resources according to the locations of the residents.

Keywords: Sustainability, Water use, Focal group discussion, Conservation

10-10

URBAN WETLAND GOVERNANCE IN FAST-GROWING CITIES: A CASE STUDY OF KOTTULI WETLAND IN KOZHIKODE CITY

A Navaneeth*, U Surendran, P S Harikumar, S Sruthy

KSCSTE-Centre for Water Resources Development and Management, Kozhikode, Kerala
**Corresponding author: navi.laxman6252@gmail.com*

Background: Rapid urbanization poses significant challenges to the conservation and sustainable management of wetlands, which are crucial ecosystems for biodiversity, water purification, and flood regulation. Literatures that the impact of gaps in governance on wetland degradation remains an understudied aspect. This study focuses on assessing the current ecological status of Kottuli wetland in Kozhikode city, particularly in relation to the existing governance scenario. Kottuli wetlands has immense social significance, since they aid in flood control, water purification, and act as natural filters, mitigating the impacts of urban pollution.

Method: The study employed a combination of qualitative methods and assessment of ecosystem services and the water quality analysis. The qualitative aspect of the study was undertaken mainly through interviews, focus group discussions and, analysis of relevant policies and regulations to understand the existing governance scenario. This combined methodology offers a holistic understanding of the Kottuli wetland's ecological status and its governance dynamics.

Results: The study highlights the severe impact of rapid urbanization on wetland ecosystems, revealing a decline in water quality and ecosystem services. The findings emphasize the interconnectedness of socio-cultural and political-economic factors with the depletion of wetlands, aggravated by the lack of policy enforcement, fragmented bureaucratic structures, and insufficient public awareness. Despite these challenges, the study highlights the potential for enhancing ecosystem services through wise management practices, restoration efforts, and sustainable conservation strategies.

Conclusion: The Present study on Kottuli wetlands in Kozhikode city underscores the urgent need for attention to urban wetland governance amidst rapid urbanization. The research illuminates the significant challenges posed by urban expansion on wetland ecosystems, leading to a decline in

water quality and essential ecosystem services.

Keywords: Urban Wetlands, Governance, Water Quality, Ecosystem Services

10-11

PRELIMINARY ASSESSMENT OF WATER BALANCE COMPONENTS FOR THE MICRO-SCALE WATERSHEDS, THRISSUR

Pawan S. Wable[1*], Soorya S.[2], S. Sandeep[3], Amrutha N. S.[4], Amanpreet Singh[5]

[1,2,3,4,] Kerala Forest Research Institute, Peechi- 680 653, Thrissur, Kerala
[5]National Remote Sensing Centre, Hyderabad, Telangana
**Corresponding author:* pawan.wable@kfri.res.in

Background: It is well known that the watershed management concept helps in the effective management and planning of water resources. However, to convince stakeholders, studies on the demonstration of various cost-effective water conservation structures and monitoring of the water balance components on the micro-scale are less. So as an initiative, based on people's participation, a model watershed of an area of 7.2 ha was established in 2005 at the Field Research Centre of KFRI, Velupadam, Thrissur.

Materials and methods: The daily rainfall was measured by manual rainguage for the period of June-November months of 2023. For the same period, daily runoff was measured using the float method. The daily evapotranspiration (ET) was estimated by the Hargreaves method. Further, the change in storage (soil moisture, surface water and groundwater) was calculated using the water balance method. For comparison, the water balance components were also monitored in adjoining control (untreated) watersheds of an area of 6.7 ha. Groundwater levels from five open wells each located downstream of both the watersheds were monitored monthly.

Results: The average runoff coefficient (ratio of runoff to rainfall) for the different months was 0.07 for the model watershed and 0.15 for the control watershed. The change in storage for September and October months in the model watershed was found to be 10-12% more than the control watershed. Over the months, depletion in the groundwater levels was observed more in the wells downstream of the control watershed (2.78-13.84 m) as compared to the model watershed (1.98-8.13 m).

Conclusions: This study shows simplified techniques to monitor water balance components. The impact of the model watershed is observed in terms of groundwater level rise, which is easy to understand for any stakeholders. Such demonstration of a model watershed can help them to deal with water scarcity problems at the local scale in particular and regional scale in general.

Keywords: Watershed, Runoff, Soil and Water Conservation, Water balance, Groundwater

POSTER PRESENTATION

10-12

REGDB - DATABASE FOR AMR GENES ACROSS INDIA FOR ONE HEALTH APPROACH

Manjusha Premnath[1], Maya Mathew[1], Mary Theresa[1], Bicky Jerin Joseph[1], Jyothis Mathew[1], Radhakrishnan E.K [1]*

1 - Mahatma Gandhi University, Kottayam
** Corresponding author: radhakrishnanek@mgu.ac.in*

Our work focuses on the development of ReGDB, a specialized database dedicated to Antibiotic Resistant Genes (AMR) across India, aligning with the One Health approach. The primary objective is the complete examination of resistant genes, sourced from a diverse range of environmental, public health, and veterinary samples. Our efforts aim to help the efficient utilization of genomic data pertaining to resistant genes reported in research studies throughout India.

The main features of our work include the incorporation of AMR genes data from various regions of the country and the capability to predict resistant genes using curated databases. The database is designed to assist researchers and academicians in easily locating and analysing resistant genes. Furthermore, it provides a user-friendly platform allowing the browsing, analysis, and download of AMR genes within entire genomes.

The uniqueness of our work lies in its comprehensive coverage of AMR genes nationwide and the predictive capabilities derived from curated databases. By offering a valuable resource for researchers, our work contributes significantly to the advancement of knowledge in understanding and addressing antibiotic resistance, embodying our commitment to a One Health approach.

10-13

COMPREHENSIVE ASSESSMENT OF THE IMPACT ON COASTAL WASTE MANAGEMENT, SANITATION, AND CLEAN WATER INITIATIVES IN KERALA: A CASE STUDY OF KASARAGOD'S COASTAL REGIONS

Yadhukrishna K*., Geethika Gopinathan, Jithu Das P. P., Reshma Raju, Yadukrishnan P., Amruth G. Kumar, Muthukumar Muthuchamy, Nagalingam, Mohammed Hatha, Anbazhagi Muthukumar

Affiliation: Central University of Kerala, Tejaswini Hills, Periye, 671320, Kasaragod, Kerala Cochin University of Science and Technology, Kochi, Kerala
**Corresponding author:* yadhu3102@gmail.com

Background: This research delves into the profound influence of clean water and sanitation initiatives on the management of coastal waste in Kerala's coastal regions particularly in Kasaragod district. Considering widespread health challenges linked to water contamination, particularly prevalent in developing nations, there has been a global and national impetus to address these issues. Despite these initiatives, coastal communities encounter unique challenges, necessitating a critical

evaluation at the grassroots level to determine the extent of penetration and effectiveness of clean water and sanitation efforts. This study is pivotal in unravelling the intricacies of these initiatives within coastal communities and contributes valuable insights to the broader discourse on sustainable environmental practices.

Methods: The study covers 20 coastal villages in the Kasaragod district of Kerala that directly share geographical adjacency to the Arabian Sea. It employs a dual-method approach—primary data is collected through surveys with structured interview schedules using the Kobo Toolbox and secondary data from relevant journals and District sanitation offices. The comprehensive approach ensures a rigorous examination of clean water, sanitation practices, and waste management in coastal communities.

Results: The empirical study analyses data from 20 coastal villages in Kasargod, Kerala, revealing insights into the relationships between clean water, sanitation, and waste management. 95% of coastal regions are inhabited by native fishing communities, with fishing being the primary activity, followed by tourism and recreation. About 90% of houses in Hosdurg and Kasaragod receive clean water through government initiatives such as Jala Nidhi. Even though some parts of the Manjeswaram taluks do not receive aid from the government side in the case of both waste management and clean water.

Harithakarma Sena plays a crucial role in the segregation of household solid waste in the district. Even though these initiatives could not remove the waste across beach sides they also affect the community. The remaining 20% depends on the open well and bore well-constructed without any government aid. Hence, even though projects are developed for clean water and sanitation facilities it is not much effective in coastal areas.

Conclusion: The state of waste management, water availability, and sanitation varies greatly throughout Kasargod's coastal areas. Even while certain regions are successful, there are still issues, especially concerning government involvement, the availability of clean water, and compliance with CRZ laws. taluk-specific problems require customized approaches, yet topography and laws limit what may be done. Haritha Karma Wing does a good job of handling domestic waste, but it has trouble keeping beaches clean during high tides. To sum up, in this complex coastal setting, a comprehensive understanding of local dynamics is essential for focused actions.

Keywords: Coastal waste management, Clean Water Initiatives, Kerala's Coastal Regions, Sanitation.

10-14

COASTSAT AND DSAS APPLICATIONS FOR ASSESSING THE SHORELINE CHANGES – A CASE OF THIRUVANANTHAPURAM DISTRICT (KERALA STATE), INDIA

Jesni K C[1*], Noobiya C[1], K.Ch.V NagaKumar[1*], Gopika Rajan[1], Venu Prasad H D[1] and Naveena K[1]

[1]KSCSTE – Centre for Water Resources Development and Management (CWRDM), Kozhikode – 673571, India

**Corresponding author: jesnikc@gmail.com*

Background: Globally, coastal regions are one of the densely populated regions, and these areas are subjected for several natural and anthropogenic stresses, for example like, global warming induced sea-level changes, episodic events like tropical cyclone, construction of sea ports/seawalls, etc. leading to coastal erosion and loss of land mass, infrastructure, cultural assets, etc. In this regard, the present study investigates the long-term shoreline changes along the coastal region of Thiruvananthapuram district, Kerala state (India) using a Google Earth Engine-enabled Python toolkit (CoastSat) and Digital Shoreline Analysis System (DSAS).

Method: The study dealt with the extraction of shoreline positions, and also the rate of changes from the analysis of multi-date satellite imagery (Landsat MSS, TM, ETM+ and OLI) pertaining to 1990s, 2000s, 2010s and 2020s using the applications of 'CoastSat' and DSAS tool. The methodology include *i)* retrieval of the satellite images from the GEE archive, *ii)* pre-processing of the multi-spectral images (cloud masking, pan sharpening and down-sampling), *iii)* sub-pixel resolution shoreline extraction, and *iv)* time-series of shoreline position along the shore-normal transects using the 'CoastSat' application. Then, the shorelines that were extracted are used as an input to the DSAS module, to assess the rate of shoreline change, and finally the area lost/gained are tabulated in GIS environment.

Results: Shoreline change analysis (i.e., during 1990–2000, 2000–2010, and 2010–2020) using CoastSat toolkit and End Point Rate (EPR) methods using DSAS techniques has revealed significant changes along the ~75 km long coastal stretch of Thiruvananthapuram district, Kerala state (India). Overall, the comparison of shoreline change rate between three decade intervals, i.e., during 1990–2020 (1990s–2000s, 2000s–2010s, 2010–2020s) using Linear Regression Rate (LRR) method indicated that 27 (~20.61 km) of the Thiruvanathapuram coastal district was under coastal erosion, and another 27% (~20.80 km) showed accretion and the remaining 46% (~35.82 km) remained stable leading to a net gain of 85.3 ha of land during the 30-years period at the rate of 2.84 ha yr^{-1}.

Conclusion: The study revealed significant changes along the coastal regions of Thiruvanathapuram district during different time-periods under the study, and the database in Geographic Information System (GIS) environment shall helps the planners, decision makers, etc. to understand the hotspots of coastal erosion and the causative factors attributing for such changes along the coastal stretch of Thiruivanathapuram district, Kerala state.

Keywords: Shoreline Changes, Google Earth Engine (GEE), CoastSat, Digital Shoreline Analysis (DSAS), Kerala state (India)

11 - ENGINEERING AND TECHNOLOGY

ORAL PRESENTATION

11-01

SPATIO-TEMPORAL VARIABILITY OF STREAMFLOW AND ITS EFFECT ON HYDROLOGICAL REGIME IN A TROPICAL WATERSHED OF WESTERN GHATS, INDIA

Sharannya T.M*, Drissia T.K.

Hydrology and Climatology Research Group, Centre for Water Resources Development and Management (CWRDM), Kunnamangalam, Kozhikode - 673571, Kerala, India.
**Corresponding author: sharannyatm@cwrdm.org*

The Valapattanam River Basin, located in India's Western Ghats, faces significant challenges due to decreasing precipitation trends, which have a negative impact on its hydrology and associated water resources. This study investigates into the spatiotemporal variability of streamflow within this tropical watershed, which has significant implications for local communities and broader environmental concerns. The study integrates complex interactions among land use, soil attributes, and climatic variables to analyse hydrological variations using the Soil and Water Assessment Tool (SWAT) model, a robust watershed model. Comprehensive geospatial datasets including digital elevation, land use/land cover, soil classifications, and meteorological data were prepared to execute accurate simulations. Calibration and validation of the SWAT model using daily runoff data from 1997 to 2022 exhibited satisfactory performance indices, including an R^2 value of 0.92 and an NSE of 0.87 during calibration and 0.89 and 0.85, respectively, for validation. These findings indicate the capacity of the model to predict streamflow dynamics in the river basin and the analyses revealed remarkable patterns in streamflow dynamics. The study indicated increased streamflow rates near reservoirs, with groundwater emerging as a major influencer downstream, particularly between August and October. Upstream regions, on the other hand, were primarily governed by surface runoff, which peaks between June and August. Notably, a temporal lag of one month was observed, indicating a lag between groundwater dynamics and their subsequent impact on streamflow. The findings highlight the importance of spatiotemporal streamflow analysis in developing informed water resource management strategies, ecological sustainability, and strategic infrastructure planning. The findings of this study are crucial for providing insights to local stakeholders reliant on the Valapattanam river basin as the region faces climatic variability and changing land-use patterns, highlighting the potential of SWAT model for understanding river flow simulations and water balance challenges within tropical watersheds in the Western Ghats.

Keywords: *Reservoir, Surface Runoff, SWAT, Valpattanam River Basin, Western Ghats*

11-02

A ROTATING CASKET ARRANGEMENT FOR POSITIONING, TURNING, AND TRANSFERRING OF A HUMAN BEING

Rebin Zachria Mathew [a], P Harish Ram [a], R Rahul Dev [a], Abhiram Vinod [a], Dr. Anish K John [a], Sreekanth P [a], Sreelal S [b], Dr. Arun Anirudhan [b], Dr. Smita V [b]

Government Engineering College Barton Hill, Barton Hill Colony, Kunnukuzhy, Thiruvananthapuram, Kerala 695035 [a]; Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, Kerala 695011 [b]

Background: There are various conditions in which an anesthetized patient has to be turned from a supine position (lying head up) to a prone position (head and body facing down). The purpose of the current invention is to devise a new and easy method to transfer the patient with little to no interference from the medical personnel.

Methods: This work intends to develop a new device that can assist the medical personnel in rotating and transferring the human being with little to no effort. The device comprises an enclosure and base. The enclosure is where the patient will be located and the patient will be transferred with the help of the base. The base consists of a worm gear mechanism which helps rotate the patient safely.

Results: A preliminary prototype has been created and it has been noted that the base on the side near the base can withstand a load of up to 200kg.

Conclusions: While the load-carrying capacity is satisfactory on the side of the enclosure near the base the same cannot be said for the other side, new methods and strategies need to be developed to make a more stable structure.

Keywords: Supine position, Prone position, Patient transferring

11-03

SEISMIC AND TORSIONAL INSTABILITY EVALUATION OF MULTISTOREY BUILDING WITH SPECIAL SHAPED COLUMNS

Mahima R Shanthi* and Dr. Mathews M Paul

Mar Athanasius College of Engineering, Kothamangalam, Kerala, India

The rise in irregular building construction has been driven by both aesthetic preferences and the scarcity of available land. Irregular shaped buildings may be more vulnerable to column damage compared to buildings with regular shapes. Irregular shapes can introduce eccentricities and torsional effects in the building's structural system. These can induce twisting forces on the columns, leading to potential damage and structural instability. To address the challenges posed by irregular shaped buildings and mitigate the risks of column damage, integrating specialized shaped columns. In this study, L-shaped columns were introduced. L-shaped columns were strategically installed at its corners. The equivalent static lateral force method and response spectrum analysis will be utilized for the purpose of conducting the analysis. The measurement of structural responses will encompass various parameters, such as story displacement, and inter-story drift ratio. The software that will be employed for the analysis is ETABS.

11-04

MULTIPRONGED SPECKLEGRAM ANALYSIS OF TEMPERATURE-DEPENDENT MICROPLASTIC LEACHING FROM PAPER CUP

Rithwiq M A*, Swapna M S, and Sankararaman S

**Department of Optoelectronics, University of Kerala, Trivandrum 695581, India*
Laboratory for Environmental and Life Sciences, University of Nova Gorica, Vipavska 13, Nova Gorica, SI-5000, Slovenia
** Corresponding author:* rithwiqanil@gmail.com

Background: Plastic is a ubiquitous material that plays an integral role in our daily lives and is essential to the majority of industries. However, plastic pollution has become one of the greatest challenges posed to the society, causing detrimental effects to the environment owing to their non-degradable nature. Microplastics, due to their extremely small sizes, pose challenges in detection. Laser-based techniques, however, make it possible for the detection of microplastics with high precision. Speckle interferometry is such a non-destructive technique, used in the current study, which allows for the computation of minute changes in the deformation of the object.

Method: The study intended to determine the amount of microplastics leaching in paper cups. Here, water heated at different temperatures (40 °C, 60 °C, 80 °C, and 95 °C) is poured into respective paper cups, whose specklegrams are taken and subtracted from that of the reference sample, which is taken at room temperature. The images are analyzed using Matlab software to obtain the variations in the parameters, entropy, contrast, homogeneity, and inertia moment, with temperature.

Results: Analysis of the subtracted image revealed that the parameters, entropy, and contrast decrease with increasing temperature until a certain point and then increase, suggesting the smoothening of the surface at lower temperatures and its roughening at higher temperatures, owing to the variation of leaching of microplastics in the paper cups, at different temperatures. On the other hand, homogeneity is observed to be increasing and then dipping, beyond a certain temperature. Moment of inertia is uniform at low temperatures, but increases at higher temperatures, indicating a less uniform surface. Also, the microscopic analysis indicates that the number of microplastics leached increases with increasing temperature.

Conclusion: The current study proposes the speckle interferometric technique as a promising tool in the detection of the leaching of microplastics in paper cups.

Keywords: *Microplastics, Speckle pattern interferometry, Inertia moment.*

11-05

POWER ENHANCEMENT IN MICROBIAL CARBON-CAPTURE CELL USING ALGAE BIOCHAR-INFUSED NICKEL CATALYST

Neethu B*, Ihjas K., Chakraborty I. and Ghangrekar M. M.

Department of Civil Engineering, Indian Institute of Technology Kharagpur 721302, India
[*] Kerala State Council for Science, Technology and Environment (KSCSTE), Sasthrabhavan, Pattom, Thiruvananthapuram, India- 69500
Ecology and Environment Research Group, KSCSTE-Centre for water resources developmentand management, Kozhikode, Kerala-673571, India
**Corresponding author: neethukscste@gmail.com)*

Lately, the bio electrochemical systems are emerging as an efficient wastewater treatment and energy conversion technology. However, their scaling-up is considerably restrained by slow-rate of cathodic oxygen reduction reaction (ORR) or otherwise by the high cost associated with the available efficient ORR catalysts. In this investigation, a cost-effective and eco-friendly approach for synthesizing Ni based ORR catalyst utilizing the biosorption property of microalgae is accomplished. The synthesised Ni adsorbed algal biochar (NAB) served as an efficient cathode catalyst for enhancing ORR in a microbial fuel cell (MFC) or microbial carbon-capture cell (MCC). On increasing the initial concentration of Ni2+ in the aqueous medium from 100 mg/L to 500 mg/L, the biosorption capacity was found to increase from 3 mg/g to 32 mg/g of algae cell. The Energy dispersive X-ray mapping clearly showed the uniform distribution of Ni2+ ions on the microalgal surface as well as on the biochar surface. Further, the MCC operated with NAB based cathode catalyst loading of 2 mg/cm2 exhibited 3.5 times higher power density (4.69 W/m3) as compared to the one with commercial activated carbon. A significant organic matter removal (82%) in the anodic chamber with simultaneous algal biomass productivity (0.49 g/L.d) in the cathodic chamber was attained by MCC with cathode loaded with 2 mg/cm2 of NAB. Hence, this easily synthesised low-cost catalyst, out of waste stream, proved its ability to improve the performance of MFC/MCC.

Keywords: Biochar; Biosorption; Catalyst; Chlorella sp.; Microbial Fuel Cell

11-06

BIODRYING PROCESS FOR ENERGY RECOVERY FROM MUNICIPAL SOLID WASTE (MSW) THROUGH WASTE TO ENERGY APPROACH

Anju Anitha Vijayakumar*, Ananthu Vettiyattil Raghulal, Partha Kundu

Environmental Technology Division, CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram, Kerala-695019, India
Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India

Background: The composition of MSW in India is diverse, comprises of organic waste, plastics, paper, glass, metals, and electronic waste. High moisture content municipal solid waste is the main challenge to waste-to-energy conversion technology, which highlights the significance of the biodrying process which make use of the biological heat produced by the aerobic reactions of organic materials. The biodrying is an innovative process and easily adaptable due to the wide range of potential applications for the output.

Method: The present study outlines the comprehensive analysis and setting up of a novel biodrying reactor developed to process mixed municipal solid waste (MSW) that has high moisture percentage i.e., 65-70%, to produce RDF. The process does not produce any leachate during the operation. The various parameters were investigated in the study are air filled porosity, compressive load, pile height, pressure drop, and air velocity. A series of layer experiments were performed with special focus on effects of various process parameters.

Results: From the study, it was observed that pressure drop per kilogram MSW per kgf compressive load, appears to be independent of compressive load and shows a quadratic dependence on velocity, provided large channels for air flow are not present and as compressive load increases, pile height and air-filled porosity decreases gradually. Based on the experimental data, a second order polynomial model equation was developed.

Conclusion: From the experimental study, it can be concluded that as compressive load increases, pile height and air-filled porosity decreases gradually. Pressure drop appears to be independent of compressive load and shows a quadratic dependence on velocity, provided large channels for air flow are absent. The mathematical model equation has been developed which represents relationship between pressure drop, applied load and air velocity. Finally Type- II Refuse DerivedFuel (RDF) were produced as a result of biodrying layer experiments.

Keywords: Biodrying, Air filled porosity, Mixed municipal solid waste, Pressure drop

11-07

ASSESSMENT OF ECOSYSTEM IMPLICATIONS OF RIVER SAND MINING USING EMERGY ANALYSIS

Bincy S* and Praveen A.

**Department of Civil Engineering, Rajiv Gandhi Institute of Technology, Kottayam -686501, APJ Abdul Kalam Technological University,Kerala,India*
Professor in Civil Engineering & Registrar, APJ Abdul Kalam Technological University,Trivandrum, Kerala,India
**corresponding author:bincyneema@gmail.com*

Background: Environmental sustainability of construction sector can be ensured only through efficient utilization of natural resources. The most needed aggregates for the construction process is river sand sourced mostly from riverbed and as manufactured sand by crushing rocks thus causing serious environmental concerns. An integrated approach with emergy analysis is a potential tool to capture ecosystem responses pertaining to resource extraction towards formulating sustainable material use policies at a regional level

Methods: Emergy available per unit cost of river sand of Kerala state is computed for a span of 25 years to derive the consumptive pattern of material. An assessment of emergy deficiency for ecosystem services for 12 years of sand mining were undertaken.

Results: Emergy available per unit cost of river sand displayed a decreasing trend across years. Cumulative deficit of emergy to support ecosystem services subsequent to sand extraction reduced the carrying capacity of ecosystem. The results from research has demonstrated that the lost ecosystem functions cannot be fully recovered with increased emergy from the renewability of sand deposits.

Conclusions: The research work has clearly demonstrated that the cumulative deficit to ecosystem services, which inspite of regaining the lost materials based on regulatory actions and eventually resulted in unrepairable environmental issues.

Keywords: Emergy, Sustainability, Ecosystem Services, Natural resources,Carrying capacity

11-08

ASSESSMENT OF MICROPLASTIC ABUNDANCE IN BEACH SAND USING HYPERSPECTRAL SENSING

Sarathjith M.C*, Sherin Shibu, Surendran U, Gireesh Gopinath

**Centre for Water Resources Development and Management, Kozhikode*
Kerala University of Fisheries & Ocean Studies, Kochi

Background: Microplastic pollution in beach sand is a growing environmental concern. Assessment of spatial and temporal distribution of microplastics at finer scales is very crucial especially to judge the level of contamination, the efficacy of their mitigation strategies and variability in its distribution across the beach. But, the conventional methods are time consuming, laborious and expensive and hence pose major limitation to serve the purpose. As an alternative, this study explores the potential of proximal hyperspectral sensing (HS) operating in 350-2500 nm wavelength range to assess the abundance of virgin microplastic pellets in laboratory-controlled beach sand conditions.

Method: Sun dried sand collected from the top 3 cm of Calicut beach were used for the study. About 20g of sieved sand (1 mm) taken in a Petri dish (diameter = 7.5 cm) was artificially polluted with different microplastic pellets types namely HDPE, LLDPE, PP, a mix of HDPE & PP (HDPE-PP) and a combination of all (HDPE-PP-LLDPE). For each type, two sets of samples were prepared for calibration and validation purposes. The spectral measurements were performed using a portable FieldSpec®-4 Spectroradiometer equipped with bare optical fibre and a 200 W quartz-halogen lamp. The spectra were subjected to different pre-processing techniques and later linked with microplastic abundance values under partial least square regression framework. The regression statistics namely Akaike's Information Criterion (AIC), coefficient of determination (R^2), root mean square error (RMSE) and residual prediction deviation (RPD) of the HS models were examined.

Results: The calibration performance of HS models across different microplastic types was found to be excellent irrespective of the spectral processing technique. Based on minimum AIC criterion, first derivative based pre-processing yielded best models in most of the pellet types. All the best models (across different pellet types) demonstrated excellent validation performance resulting in R^2, RMSE and RPD in the range of 0.925-979, 0.062-0.119 and 3.697-6.913, respectively.

Conclusion: The performance of HS models in this study were excellent and hence the study endorse the use of proximal HS as a promising tool for assessing microplastic abundance in beach sand.

Keywords: Microplastics, Beach Sand, Hyperspectral Sensing, Partial Least Square Regression

11-09

A STUDY ON IDENTIFYING TRAFFIC IMPROVEMENT MEASURES AT A MEDIAN OPENING ON NH 66 IN THIRUVANANTHAPURAM CITY

Shaheem S*, Praveen P S, Adurthi N M and Abhiram M P

KSCSTE-National Transportation Planning and Research Centre (NATPAC),
K. Karunakaran Transpark, Akkulam, Thuruvikkal P O., Thiruvananthapuram-695011, Kerala

Background: With the increasing traffic volume, median openings on National Highways in India are in regular need of upgrading measures. However, the introduction of median openings in these highways, while designed to facilitate controlled access presents potential hazards. The presence of medians, especially when improperly managed or lacking proper safety measures, can contribute to various road-related risks. The implementation of improvement measures would enhance safety for road users and would help reduce the traffic conflicts at the mid-block with the median opening. Implementing measures with proper signage, pedestrian facilities and channelization are essential. This study attempts to suggest remedial measures for the safer movement of traffic at a mid-block with median opening.

Methods: Detailed road inventory was conducted in the study area to identify locations for the traffic surveys and to collect all the physical information which are necessary. Accident details including the pattern of collision, type of collision and the type of vehicle involved in the crash were collected from FIR data in police records over the last few years. Traffic surveys were conducted to ascertain the existing road conditions, speed data and vehicular traffic in the study area. Traffic volume count was collected using video graphic method by mounting a video camera at the appropriate location to capture all movements occurring at the study area. Speed data for various vehicle categories were collected using a radar speed gun by random sampling during peak hours. Data analysis was conducted and finally, traffic improvement measures were suggested based on the traffic studies conducted at the study location. The study area selected is a mid-block median opening near Pappanamcode along the Karamana – Kaliyakavila National Highway in Thiruvananthapuram District of Kerala.

Results: Median openings can contribute to an increased risk of collisions, especially when drivers attempt to make right turns or U-turns across oncoming traffic. These maneuvers can lead to conflicts between vehicles, potentially resulting in accidents. After analyzing accident data, it has been inferred that hit pedestrians, rear-end collisions and hit from side contributed 100% of road crashes. Spot speed analysis suggested that the adherence of vehicles to the posted speed limit of 50 kmph at the study location is limited.

Conclusions

Based on the traffic study conducted, following are the suggested recommendations.

1. Strict enforcement measures such as automated ANPR speed cameras shall be adopted to ensure compliance with the posted speed limit.

2. Transverse bar markings with four sets shall be provided at the approach highway before the median opening as a traffic calming measure.

3. Installation of proper traffic signs, road markings and blinker lights at either side of the highway approaches will ensure safe movement of traffic.

4. The pedestrian facilities which include pedestrian crossings and a pedestrian refuge island shall be provided for ensuring safe movement of pedestrians.

It is expected that implementing the suggested remedial measures would reduce traffic conflicts in the study area, ensuring the safety of all road users.

11-10

STUDY OF ASYMETRIC RC STRUCTURES WITH SHEAR WALLS

Rosy John Panikulam*, Indu Susan Raj

Mar Athanasius College of Engineering, Kothamangalam

The lateral load resistance of a building is of utmost importance especially when it comes to high rise buildings. The risk of lateral resistance further increases when the symmetry of the structure varies. The construction of asymmetric structures has always been a challenge. The analyses of a symmetric and an asymmetric structure is to be done with both static and dynamic loads. The asymmetric structure is then to be provided with equal percentage of cross-sectional area of shear wall in different locations on the building and then analyzed with both the loads. In order to get a result, the various structural response parameters like storey drift, of different models are compared and a conclusion is obtained.

11-11

APPLICATION OF SWAT HYDROLOGICAL MODEL IN THE FLOOD RISK ZONES OF ANJARAKANDY RIVER BASIN, KERALA

Theertha J P*, Thenmozhi M, Lysha L and Vivek B

Centre for Water Resources Development and Management, Kunnamangalam, Kozhikode, Kerala
**Corresponding author email:* thenmozhi@cwrdm.org

Background: The combined effect of flood and soil erosion can have severe consequences on river basins and the surrounding areas. Anjarakandy river basin has been experiencing continuous soil erosion and flooding for the past years. Hence it was necessary to implement suitable flood mitigation measures within the basin, in order to ensure safety for the lives and properties concerned.

Method: Soil and Water Assessment Tool (SWAT) was used to simulate hydrological processes within the basin**.** Flood return probability map of Anjarakandy was obtained from KSDMA and based on that certain points were identified as the high risk points. Later these points were classified into 3 categories such as High, Medium and Low risk on the basis of observed discharge from SWAT modelling. Based on their risk potential suitable remedial measures were suggested for each of these points.

Results: During calibration about 10 parameters were modified in SWATCUP software. After the process of calibration, the coefficient of determination, R^2 and NSE values were obtained as 0.76 and 0.74 respectively and for validation the values were 0.72 and 0.7 respectively which implies satisfactory result.

Conclusions: Based on the results obtained from SWAT modelling suitable remedial measures to prevent damages due to flood and soil erosion in Anjarakandy river basin was formulated. Potential zones of flood risk were categorized into three such as high, medium and low based on their severity. High flood areas are considered to construct RR Masonry for stream bank protection, Coir-geotextile for medium flood level areas and vegetative measures suggested for low flood level areas.

Keywords: Arc SWAT, Flood, River basin management.

11-12

VIRTUAL REALITY TOOL FOR SURGICAL PLANNING

Radev Krishna M R, Devadathan A, Anand S*, Rahul M D, Rohith H R, Vyshnav R U, Aloysious Benoy, Anish K John, Smitha SL

**Government Engineering College Barton Hill, Barton Hill Colony, Thiruvananthapuram, Sree Chitra Tirunal Institute for Medical Sciences & Technology Trivandrum*

Background: Our cost-effective 3D virtual reality tool, powered by Unreal Engine and a custom Ray Marcher plugin, aids surgical planning with a dual projector setup. Providing immersive MRI/CT scan visualization, enhances neurosurgical training for clinicians, offering improved spatial awareness for intricate vascular anomalies.

Method: The method integrates Unreal Engine and a Ray Marcher plugin for anatomical precision, using high-resolution MRI/CT scans to create detailed 3D models. Stereoscopic 3D projection through a dual projector setup ensures depth perception, especially valuable for assessing conditions like aortic aneurysms.

Results: In testing, the tool's rendering performance was positively evaluated for clarity, accuracy, and detail by surgeons. Unique features include stereoscopic vision, broader accessibility, and direct usage of DICOM images without preprocessing. The tool's capability to reproduce higher-dimensional neuroimaging structures was praised, showcasing its potential for comprehensive surgical planning.

Conclusion: In conclusion, our virtual reality tool holds transformative potential in surgical planning, offering a realistic, immersive environment with Unreal Engine 5. It minimizes surgery risks through simulated practice, presenting a superior option for high visual fidelity in medical education.

Keywords: *Virtual Reality, Surgical Planning, Unreal Engine, Ray Marcher Plugin, Stereoscopic Projection, MRI/CT Visualization, Vascular Anomalies, Scalability,*

11-13

ANALYSIS OF SEISMIC BEHAVIOUR OF POST-TENSIONED FLAT SLAB-COLUMN CONNECTION

Vidhukrishnan K*, Indu Susan Raj

Mar Athanasius College of Engineering, Kothamangalam

Structural safety of building is the primary criteria that every designer considers during the design. Slab-column connections are critical in flat slab construction because of their susceptibility to punching shear failure which is a brittle and non-ductile failure that has caused the collapse of many structures in the last century. The connections are expected to undergo deformations into the inelastic range, and hence it is necessary to design connections with adequate strength and ductility. Post-tensioning is a technological advancement that offers cost-effective, elegant and efficient structural solutions for various applications. A Post-Tensioned (PT) slab is a type of concrete slab that has additional high-strength steel tendons or cables that are stressed after the concrete sets. This method increases the strength and durability of the slab and reduces cracking and instability. PT slabs are used for various construction projects, such as bridges, roads, parking lots, and foundations The cost of construction and the time required to build may be lower with post-tensioned flat slab than RC flat slab. In this study the aim is to analyse the seismic behaviour of PT flat slab-column connection. The objectives of this study include finite element modelling of PT flat slab-column connections and analysis of seismic behaviour of PT flat slab-column connections using ANSYS workbench software.

11-14

BUILDING A HOLISTIC INNOVATION ECOSYSTEM BASED ON KERALA'S REQUIREMENTS

Shaghna Nath R.U*, Unnikrishnan, Potheri Vasudevan,

Kerala Development Innovation Strategic Council Trivandrum.

Kerala has come up with a unique model for innovation driven transition to Knowledge Economy for other states to emulate. The Kerala Development Innovation Strategic Council (K-DISC) has strived to develop a contextual holistic strategy for Kerala's second-generation development problems without sacrificing its inclusiveness and sustainability goals. This approach has led to the creation of holistic development model which has four key areas anchored by a set of innovations programs. This has developed a strategy of innovation led development by creating Centres of Excellences in strategic areas like Centre of Excellence in Microbiome, Centre of Excellence in Nutraceuticals, Kerala Genome Data Centre, Clean Energy Business Incubation Centre and Kerala Open Talent CoE. Consortia involving eminent partners namely Accelerated Blockchain Competency Development Programme, Electric Vehicle Consortium, Kerala Medical Technology Consortium have been established. The co-ordinated projects initiated by K-DISC like the Wayanad Smart Coffee Project, Miyawaki Urban Afforestation Programme and Atal Community Innovation Centre, are major action research interventions aiming at high impact community intervention models. The employability program of K-DISC called the Kerala Knowledge Economy Mission aims at providing access for educated unemployed to opportunities in the capital intensive, technology driven enterprises in the

private sector through demand driven skilling programmes. A a variety of non-linear innovation programmes have been crafted by K-DISC for building a holistic innovation system for Kerala which includes The Young Innovator Programme, Manchadi, Mazhavillu, One District One Idea, One Local Government One Idea and Accelerating Adoption of Emerging Technology Solutions in Government. The programmes have been implemented only for the last few years and it is too early to assess the outcomes. It is however interesting to record that by virtue of the comprehensiveness of the programme and its contextualisation it has started yielding early results. It is evident from the discussions in the paper that the results are indeed encouraging.

11-15

PORTABLE TRASH COMPACTOR FOR SOLID WASTE MANAGEMENT

Muneera C*, Refny,SafidaTT, Shafna P .V, Reniya Akbar

Department of Civil Engineering, MES College of Engineering Kuttipuram, Kerala India,
**Corresponding author:* muneerames@gmail.com

Results: The developed system is suitable for public areas wheretons of garbage are generated each day. implementation of dustbin compactor in publicareas such as railway station, college premisesand hospitalsshow us the result by reducing the number of trash-emptying trips. Results show that thetrash that has been collected three to four times a day has reduced to one by the implementation of trash compactor.It also stops the garbage container bins from overflowing, reducing unauthorized deposition of the wastes in commercial and public areas. In general, it shows the result that waste can be compacted to one-third of its original volume resulting to increase in the capacity of existing dustbins.

Conclusions: Result shows that the use of trash compactor can compress waste better than using manpower. Improvements can be made with this project by adding sensors to detect garbage levels and automatically compress them to a preset level which helps to reduce the time used to monitor the trash bin to compress the waste.The system can be upgraded to compact bio-degradable waste by providing a liquid venting path to flow from the bin.Moreover, the addition of GPS (Global Positioning System) tracking and messaging system can be added which will send a message when maximum amount of compaction is done which helps to reduce the visit to site.Theproduction of this prototype is one of many equipment design ideas that aids the improvement of wastemanagement. It can contribute to improve the ability of the city administrators to manage the municipal solid wastes with least cost, thus providing economical and feasible transport of solid waste collections while minimizing the risk to human health and the environment. This will gradually help in reducing diseases being spread, air pollution, and carbon monoxide emissions and will keep the natural environment clean and hygiene.

11-16

DEVELOPMENT OF AN E-DRIVE ADAPTIVE TROLLEY FOR SAFE PATIENT TRANSPORT IN MEDICAL CLINICS

Arjun A*, Goutham Sai Krishna, Aparna Govind Jayakrishnan C., Ayush Arun, Anish K John, Sreekanth P., Rajeev Rajan, Dinesh Gopinath, Dr. Smita V., Subin S., Dash P.K, Sreelal S., Arun Anirudhan

Government Engineering College Barton Hill, Trivandrum, Kerala and Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, Kerala

Background: Traditional manual stretcher methods, especially in emergencies or on inclined surfaces, can be challenging and unsafe, leading to delays. Current motorized patient stretchers are costly single-unit systems designed for a specific bed.

Method: Developed in collaboration with medical professionals at the Sree Chitra Tirunal Institute for Medical Sciences and Technology, the Adaptive Trolley E-drive for hospital bed transportation is designed using SolidWorks. Universally adaptable to different bed sizes, it features secure attachment clamps, a hub-motor powered wheel, castor wheels, a rechargeable battery, and a speed-limiting controller. Safety measures include a cable brake, Stainless Steel body, battery case, and a key activation system for controlled mobility in hospital settings.

Results: The Adaptive Trolley E-drive is a versatile design with a height-adjustable clamping mechanism for easy universal application. Despite a hub-motor capable of 7 m/s, it's limited to 1 m/s for safety. The charger allows a 4-hour charge for the 800W hub-motor, running for almost 2 hours. Castor wheels aid directional control, and safety features include a braking system, speed limiter, and extending clamping arms. Successfully tested with a 150 kg load, the cost-efficient system receives positive feedback for reducing manual effort and time delays in medical clinics.

Conclusion: The prototype successfully reduces manual effort and time delays in pushing patient beds, especially in emergencies. Suggested improvements include adding a hand-brake and integrating a vital parameter monitoring system. A patent application has been filed.

Keywords: *Patient bed, Universal trolley, Safety, Rechargeable battery, Transportation*

11-17

INVESTIGATION OF CORROSION ASSESSMENT OF CONCRETE FILLED STEEL TUBE COLUMNS

Rameesha T V* and Veena P Nair

KSCSTE National Transportation Planning Research Centre
School of Engineering, CUSAT, Kochi

Composite structures that encompass the favorable properties of different materials have been well recognized in practice, among which concrete-filled steel tubular (CFST) members are widely utilized due to their outstanding structural performance and excellent constructability. Encompassing the beneficial properties of both steel and concrete, CFST members have a wide utilization in construction practices because of the great advantages in terms of strength, stiffness,

ductility and construction speed. CFST columns with circular, square, and rectangular cross-sections have been widely used in civil engineering applications owing to their good structural performance. In addition, the special-shaped (L-, T- and +-shaped) CFST columns have been increasingly favored by many researchers and designers owing to their advantages of avoiding column protrusions from walls and increasing room space. These columns have been applied in construction in China. Given the successful application of CFST in infrastructures on land, their broad utilization prospects in offshore and marine structures can be foreseen and CFST related infrastructures are actually emerging in various ocean platforms, bridges and offshore electricity towers.

However, given the harsh ocean environment, the steel component is inevitably and constantly suffered from corrosion, leading to continuous loss in structural properties and significantly shortened service life due to the increased probability of catastrophic failure associated with corrosion deterioration. Even with standard protections such as coating and galvanization that would function well in the first few years or even decades, critical CFST components in the splash zone will still face the longstanding erosion from ocean environment while many of them would then retire early and cause massive resource loss. Corrosion seriously reduces the axial compression capacity of the material and endangers the safety of the structure. Therefore, corrosion and its effect on the bearing capacity have always been the concerns of scientific community. This study contributes to the understanding of corrosion-related challenges in T-shaped CFST columns and provides valuable insights for engineers, researchers, and practitioners involved in structural integrity assessment and maintenance.

Keywords: Concrete filled steel tube (CFST), corrosion, special-shaped CFST columns

11-18

STIFFENING AND STRENGTHENING OF STEEL SQUARE HOLLOW SECTIONS IN BEAM-COLUMN CONNECTION

Mar Athanasius College of Engineering, Kothamangalam

Beam-Column connections can become structurally inadequate to different loading conditions.SHS (square hollow sections) which is used widely in many structural forms and produced by hot-form or cold-form processes. The aim of this project was to do a lateral load analysis for beam-column connection. In hollow sections at the place of joints, there is a chance of buckling so when this happens it leads to failure of the connection. Therefore we model the beam-column connection and provide a stiffener plate between the damaged locations to enhance the structural integrity of the location. Here the modeling and analysis were done using Ansys workbench. The loading condition is monotonic and the support condition provided is pinned support.It also focused on comparing the structural performance in terms of moment capacity, ductility, stiffness under monotonic loading.

11-19

MOBILE HOIST WITH HOIST-ASSISTED MOTORIZED WHEELCHAIR

Vishal V. J., Mithun M., Jebin Jose, Vaisakhan M. S.*, Adithya S. R., Dr. Anish Karimpannur John,

Dr. Lincy Philip, Dr. Sruthi S. Nair

Sree Chitra Tirunal Institute for Medical Sciences and Technology,
Government Engineering College Barton Hill, Thiruvananthapuram, Kerala

Background: The conventional patient hoist is made to transport paralyzed patients from bed to a wheel chair and vice versa. This takes a lot of effort and time by the care taker. Also, the comfort and safety of the patients are to be considered while doing this. This research explores the design, functionality and benefits of a mobile hoist system specifically tailored to accommodate motorized wheelchairs. The system comprises a motorized hoist mechanism with adjustable features to ensure compatibility with various wheelchair models and user needs. By incorporating this technology, individuals with limited mobility can effortlessly make transition between the wheelchair of the machine and different surfaces, eliminating the physical strain often associated with transfers

Method: Developed in collaboration with medical professionals at the Sree Chitra Tirunal Institute for Medical Sciences and Technology, Mobile hoist with motorized Wheelchair is designed using SolidWorks. It features a combination of wheel chair and modified patient hoist to facilitate easy and more efficient transportation for paralyzed patients. It is equipped with additional features such as automated hydraulic lifts, hook and safety measures to transfer patients to and from the bed.

Results: The mobile hoist for motorized wheelchair is a versatile design with a height-adjustable hydraulic lift for easy universal application. The objective of this project is to make a patient hoist easy to use and can safely transport patients to and from the bed and to facilitate their short distance transportation of patients.

Conclusion: The Mobile hoist for motorized wheelchair can successfully reduces manual effort and time delays in transporting patients. A patent application has been filed.

Keywords: Hoist, Wheelchair, Transportation

11-20

ANALYSIS OF REINFORCED CONCRETE BUILDING WITH VISCOUS DAMPER AND CROSS BRACINGS

Anitta Baiju*, Indu Susan Raj

Mar Athanasius College of Engineering, Kothamangalam

A reinforced concrete building should be designed to have a capacity to carry combined loads (dead, live and seismic loads) at certain safety level and at certain degree of reliability. Retrofitting of deficient existing building to improve its seismic performance will be a pathway to assure the safety of the structure in the event of future earthquake. There are several technologies that could be chosen for this purpose such as adding a diagonal structural element (bracing), shear walls etc. The use of steel bracing for retrofitting reinforced concrete structures has some advantages such as it is

relativelycost-effective, does not significantly add the structural weight, is easy in application and can be customized with the necessary strength and rigidity in recent years. Fluid viscous damper which is a technique used for lateral load resisting system for tall building. Here comparative analysis ofreinforced concrete frame buildings having soft stories with and without X bracings and Viscous dampers in ETABS is to be done.

POSTER PRESENTATION

11-21

A PATTIE MAKING DEVICE

P Harish Ram[b], Amith S Nair[b], Dev Narayan[b], Rahul Das AH[b], Devika S Nair[b], Dr. Anish K John[b], Dr. Sanjay HM[a], Dr. Gowtham M[a], Dr. Easwer HV[a], Dr. Prakash Nair[a], Dr. Arun Anirudhan[a]

[a]Sree Chitra Tirunal Institute for Medical Sciences and Technology,
[b]Government Engineering College Barton Hill, Thiruvananthapuram, Kerala

Background: Cotton patties, or surgical patties, are used for a variety of applications, especially in neurosurgery. By placing a cotton patty between the brain and the barrier, the absorptive force can be distributed uniformly, removing just the collected fluid and protecting the brain from harm. The cotton patties can also be used in various ways, such as covering the brain with it to prevent direct pressure when using self-retaining retractor. To further accomplish pressure homeostasis, moist patties might be positioned across the field. The surgical patty has one significant drawback, which affects these and numerous other applications. The possibility of developing a gossypioma when losing a patties in the operating field. Adding a suture tail to the remaining portion of the patties would be an easy fix.

Method: The steps involved in manufacturing patties are as follows. 1. A cotton roll is fed into the machine. 2. The length and breadth wise cutting of cotton is carried out. 3. A tail is attached to the patty using a sewing machine. 4. Patties come out of the machine in a rolled form for ease of packing. Motors, rollers, conveyor belts, circular blades and a sewing machine are used for the process.

Results: The patty/cottonoid making device is a machine designed to make neurosurgical patties or cottonoids of different dimensions and dispense them in specific numbers, i.e., a pack of 10 or 20. This machine is intended to be placed in the instrument assembling area/packing area of neurosurgical suite. It is designed to be operated by any personnel who is a working member of the neurosurgery team with the technical competence and knowledge regarding the simple steps to operate this device. The manufacturing process for the device has started.

Conclusions : Manual preparation of patties before / during the surgery is cumbersome, since it is difficult to predict the number and size of the patties used during a procedure. The process of making

patties manually during the procedure (tailing them and rounding off to appropriate sizes) diverts the attention of the scrub nurse, attention that is better served by staying with the surgeon and following each surgical step. This machine thus is a much needed solution with unique attributes to enable preparation of patties of different dimensions in adequate numbers

Keywords: Cotton pattie, Neurosurgery

11-22

TREATMENT OF SLAUGHTERHOUSE WASTEWATER BY A HYBRID SEQUENCING BATCH BIOFILM REACTOR FOR SIMULTANEOUS REMOVAL OF ORGANICS AND NUTRIENTS

Chithra V. S.*, Manu A., Digila Rani M, Ihjas K., J. Beslin Joshi, Shika Suren

Ecology & Environment Research Group, Centre for Water Recourses Development and Management, Calicut

Department of Civil Engineering, M.Dasan Institute of Technology, Calicut

**Corresponding author:* chithravs@cwrdm.org;

Background: Although various technologies for slaughterhouse wastewater management are available in developed countries, the effective utilization of slaughterhouse wastewater management is still missing in developing countries like India. Therefore, this study explores the performance efficacy of a Sequencing Batch Biofilm Reactor (SBBR) for simultaneous removal of soluble carbonaceous organic matter and nutrients from slaughterhouse wastewater under two different combinations of react periods (aerobic/anoxic).

Methods: The SBBR operates by a cycle of periods consisting of fill, react, settle, decant and idle phase. During operation, filling time is set as 5 minutes, then it is reacted for 7 hours settled about 40 minutes and the decantation time is set as 5 minutes.

Results: The COD and BOD of the treated effluent by SBBR was found to be 200 mg/L and 81 mg/L, respectively. COD and BOD removal efficiency was found to be 92-94%. The study found that the denitrification in the aerobic/anoxic react phase was more efficient than the aerobic react phase for pollutant removal and maintaining higher quality water.

Conclusion: It is found that the SBBR system performs satisfactorily in treating wastewater having high BOD, nitrogen, and phosphorous concentrations. This information could be useful for designing and optimizing the SBBR system for future applications.

Keywords: *Sequencing Batch Reactor, Slaughterhouse, Wastewater treatment, BOD, COD*

11-23

PERFORMANCE COMPARISON OF LOW VOLUME ROADS CONSTRUCTED USING NEW TECHNOLOGY AND CONVENTIONAL METHOD

Ashik K Azad*., Shijith P.P., Ann Lilly Thomas

**Kerala State Council for Science, Technology and Environment - National Transportation Planning and Research Centre (KSCSTE - NATPAC), K.Karunakaran Transpark, Aakkulam, Thuruvikkal, P.O., Thiruvananthapuram, Kerala – 695011*
Department of Civil Engineering, National Institute of Technology Calicut Calicut, Kerala – 673601
**Corresponding author:* ashik.natpac@gmail.com

Low-volume roads play a crucial role in providing essential transportation connectivity to rural and remote areas. In Kerala, during recent years, the low volume roads have been constructed using several non-conventional techniques with the objective of reducing the effective thickness of the layers coming over the subgrade as well as reducing the utilization of virgin aggregates. However, the performance of the low-volume roads constructed using these non-conventional techniques is hardly investigated. In the present study, the performance of two low volume roads in which one road (Test Section-TS) was constructed by cement stabilized subgrade whereas the other road (Control Section -CS) were constructed using conventional method, was evaluated. Based on the analysis, it was found that the remaining pavement life (based on 80% reliability) of the Test Section Road were much higher than the Control Section Road, indicating longer life for the TS. On conducting the performance check, both TS and CS were found to be satisfactorily safe in terms of fatigue performance of bituminous layer and rutting performance based on subgrade layer. The use of innovative technologies has the potential to extend the service life of low volume roads, reduce maintenance costs and improve transportation accessibility for communities. In this regard, it is expected that the research findings will contribute to the advancement of sustainable and cost-effective road infrastructure in rural and remote areas.

11-24

ASSESSMENT OF ECOSYSTEM IMPLICATIONS OF RIVER AND MINING USING EMERGY ANALYSIS

Bincy S* and Praveen A.

**Department of Civil Engineering, Rajiv Gandhi Institute of Technology, Kottayam -686501, APJ Abdul Kalam Technological University,Kerala,India*
Professor in Civil Engineering & Registrar, APJ Abdul Kalam Technological University,Trivandrum, Kerala,India
**corresponding author:bincyneema@gmail.com*

Background: Environmental sustainability of construction sector can be ensured only through efficient utilization of natural resources. The most needed aggregates for the construction process is river sand sourced mostly from riverbed and as manufactured sand by crushing rocks thus causing serious environmental concerns. An integrated approach with emergy analysis is a potential tool to capture ecosystem responses pertaining to resource extraction towards formulating sustainable material use policies at a regional level

Methods: Emergy available per unit cost of river sand of Kerala state is computed for a span of 25 years to derive the consumptive pattern of material. An assessment of emergy deficiency for ecosystem services for 12 years of sand mining were undertaken.

Results: Emergy available per unit cost of river sand displayed a decreasing trend across years. Cumulative deficit of emergy to support ecosystem services subsequent to sand extraction reduced the carrying capacity of ecosystem. The results from research has demonstrated that the lost ecosystem functions cannot be fully recovered with increased emergy from the renewability of sand deposits.

Conclusions: The research work has clearly demonstrated that the cumulative deficit to ecosystem services, which inspite of regaining the lost materials based on regulatory actions and eventually resulted in unrepairable environmental issues.

Keywords: Emergy, Sustainability, Ecosystem Services, Natural resources,Carrying capacity

11-25

ANALYZING COASTAL VULNERABILITY AND SHORELINE CHANGES ALONG SOUTH-WEST COAST OF INDIA

Fathima Shirin, Mydhili S, Abhinand R, Shamna Sherin* and Alka Abraham

Department of Civil Engineering Mar Athanasius College of Engineering, Kothamangalam, 686666
**Corresponding author:* fathimashirin16rayya@gmail.com

Background: Shoreline assessments helps to gather critical data on shoreline changes, sediment transport, and erosion rates. This data is essential for predicting future coastal hazards and developing strategies to mitigate their impacts. CVI is the indicator of all the physical and geological risk factors in the coastal zone region. It combines different parameters to create a single Vulnerability Index, making it simple to understand and identify coastal risk zones along the coastline.

Method: For shoreline analysis, ArcGIS utilizes DSAS tool where shorelines positions are compiled with different attribute fields and change is calculated across the transects with respect to the baseline and the shorelines. Analytical Hierarchical Process (AHP) which is a multicriteria decision analysis method, is used to derive Coastal Vulnerability Index (CVI), that indicates by how much one item predominates over another with respect to a given attribute.

Results: From the transacts drawn using Digital Shoreline Analysis System (DSAS) tool, and the baseline of the shorelines, the change occurred to the position of shoreline can be derived as change rates or distance itself.

Conclusions: From the shoreline change rates calculated using DSAS tool in ArcGIS, the coastal region can be categorised to areas of Very High Erosion, High Erosion, Stable, High Accretion and Very High Accretion.

Keywords: Shoreline, ArcGIS, DSAS, Coastal Vulnerability Index (CVI)

11-26

STRUCTURAL PERFORMANCE OF COMPOSITE WALLS COMPOSED OF PROFILED STEEL SKIN AND RUBBERISED CONCRETE

Rasla Kareem N*, Deepa Varkey

Mar Athanasius College of Engineering, Kothamangalam

Composite walls comprise of a number of layers of different materials with different properties and thickness. Profiled Double-Skin Composite Wall (PDSCW) is a new type of composite member, which originates from composite flooring system. It consists of two profiled steel plates and the space between them is filled with concrete. Here, the conventional concrete is to be replaced with rubberised concrete as it possess rubber content that enhances the strength when compared to normal concrete. In this study the finite element analysis of profiled steel composite walls infilled with rubberised concrete using ANSYS software is also to be done. The performance of profiled composite wall is being studied using a numerical parametric analysis considering the profile parameter as well as a static analysis of the composite wall that takes into account buckling performance, ultimate load, and failures.

11-27

ROBUST STABILITY VALIDATION OF A POLYTOPIC AEROSPACE SYSTEM MODEL USING EDGE THEOREM

Johnson Y

Department of Futures Studies, University of Kerala, Thiruvananthapuram
Corresponding author: mrjohnsony12@gmail.com

The present paper discusses about a control plant model, taken from a leader-follower UAV close formation flight control profile, which is subjected to robust closed loop control mechanism and the validation of associated stability and control aspects with post-Kharitonov Edge theorem. The control plant model is framed with polytopic polynomials having multiple linear dependency among their coefficients. The Segment Lemma helps to test the stability of the edges of polytopic model.

Keywords: Edge theorem, Polytopic system, Segment Lemma, Robust control, UAV, formation flight

11-28

ANALYSIS OF LONG TERM TREND IN MAXIMUM AND MINIMUM TEMPERATURE OVER CENTRAL KERALA

Ashly Sara Issac, Krishnapriya K B, Mariya Eldose*, Riya Uday and Alka Abraham

Department of Civil Engineering, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India
**Corresponding author:* mariyaeldose12@gmail.com

Background: Climate change has received worldwide attention as it affects all sectors of life. The intensification of human activities has caused global warming and increasingly dramatic climate

changes, leading to an increase extreme precipitation and temperature, resulting in destructive floods and landslides. The paper discusses the trend analysis of maximum and minimum temperatures in the Ernakulam district of Kerala.

Method: The study makes use of daily temperature gridded data (1°x1°) from the Indian Meteorological Department (IMD) spanning 72 years (1951-2022). The data preparation has been completed with the goal of doing the trend analysis. The Mann-Kendall test is used as a methodology for performing trend analysis on climatic variables. The trend test is accomplished using 'R Studio', software that helps with data analysis by importing, gathering, modifying, analyzing, charting, modelling, and producing machine learning predictions.

Results: The results obtained for maximum and minimum temperature at all four grids revealed a statistically significant increasing trend for the study area as the computed p-values are lower than 0.05, leading to the rejection of the null hypothesis.

Conclusions: The increasing trend of maximum and minimum temperature due to climate change and other factors can lead to weather extremes. Maximum and minimum temperature trend research provides crucial insights into long-term climatic patterns. Examining these trends allows us to gain a better understanding of our climate system's dynamics and predict potential implications for ecosystems, human health, and other sectors.

Keywords: Temperature, Mann – Kendall Test, Trend.

11-29

A CASE STUDY ON FORCED GAP BEHAVIOUR AT UNSIGNALISED INTERSECTIONS IN THIRUVANANTHAPURAM CITY

Praveen P S*, Ashik K Azad, Leander G, Malavika R N, Nauzzin D and Shivani P S

KSCSTE-National Transportation Planning and Research Centre (NATPAC),
K. Karunakaran Transpark, Akkulam, Thuruvikkal P O., Thiruvananthapuram-695011, Kerala
Mar Ivanios Vidyanagar, Nalanchira P.O,
Thiruvananthapuram-695015, Kerala

Background: An unsignalized intersection is one in which vehicle movement is at the discretion of the driver as there is no traffic signals or islands present in the area. When a vehicle from a minor street enters a major street with a high speed, it causes the major street vehicle to suddenly reduce their speed. The gap created in the major street due to the aggressive behaviour of the minor street vehicle is termed as forced gap behaviour. In the present study, the concept of forced gap entry in unsignalised intersections with respect to the speed threshold value is estimated at one 'T' intersection which is considered as base intersection and two 'Y' intersections which are considered as non-base intersections and a comparative study is carried out. This study also estimates the influence of forced gap behavior on critical gap and capacity at 'Y' intersections.

Methods: Data collection consist of collection of details of study stretches such as geometric characteristics like width of intersecting roads, number of intersecting streets, angle of the intersection and traffic data. Traffic data collection at the three unsignalised intersections are carried out during peak and off-peak hours using videography technique. Data analysis included identification of different movements possible in the intersections and estimation of conflicting flows at the selected

study sites. The vehicle behaviour was defined based on three cases (the absence of vehicles on the minor road (base case), the presence or waiting of vehicles on the minor road approach, the entry of vehicles from the minor road on the intersection area). In this study, the procedure suggested by Indo HCM is used as the basis for capacity estimation at unsignalised intersections.

Results: The forced gap behaviour and capacity of right turn movement from minor to major of three intersections were investigated in this study. The changes in speed of major road vehicles was used as the basis to analyse forced gap behaviour at the intersections. The major road vehicles were grouped into three cases. These cases were analysed by extracting speeds at three demarcated sections on intersection using four reference lines on the ground. The percentile and percentage reduction values of speeds along the demarcated sections were estimated and used as the basis to identify speed reduction threshold values to quantify the forced gap behaviour. The speed reduction threshold values obtained are 60% and 63% for the Y intersections. The critical gap values estimated at Y intersections are 7.4 seconds and 6.9 seconds, respectively. The capacity of right turning movement from minor to major induced by forced gap was also quantified.

Conclusions: In the present study, it is observed that there is considerable variation in threshold values estimated for defining forced gap at unsignalised intersections. The ability to accommodate a forced gap increases as the critical gap value increases. The capacity of a right turn movement from minor to major is inclusive of traffic flow induced by forced gap.

Keywords: Unsignalized Intersection, Critical Gap, Forced Gap, Capacity

12–ENVIRONMENTAL SCIENCES, FORESTRY AND WILDLIFE

ORAL PRESENTATION

12-01

THERMAL STABILITY OF SOIL CARBON STORED IN CONTRASTING FOREST ECOSYSTEMS OF KERALA WESTERN GHATS

Binsiya. T K and Sandeep. S

Kerala Forest Research Institute, Thrissur, Kerala

Background: Humans control the planet earth, exploit its resources, and have an impact on its ecology. The soils are an integral part of the natural system and is increasingly utilised for accomplishing sustainable development goals through restoration and rehabilitation strategies. Since the industrial revolution, greenhouse gases emissions, particularly carbon dioxide has shown a constantly rising trend on a global scale. Objective of the study is to analyse the thermal stability of soil carbon stored in four contrasting forest ecosystems of Kerala western ghats.

Method: Soil samples were collected using the pit method from four contrasting forest types vis – a – vis moist deciduous, dry deciduous, evergreen and shola forests in the southern high hills agroecological zone. Soil samples collected from the surface 0 – 20 cm depth of different forest types were sieved by wet sieving, air-dried and used for the thermal stability studies. Samples were separated into macro (>2mm) and micro (<2mm) aggregates. The decomposition rate and activation energies of soil carbon were investigated by an incubation experiment of 75 days duration at different temperatures i.e.., 25^0C, 30^0C, 35^0C and 40°C.

Results: It has been shown that micro aggregates provide better protection to organic carbon by a greater complexation mechanism compared to macroaggregates. In agreement with this the evergreen forest and moist deciduous forest, the results shows that decomposition rate of carbon stored in microaggregates, as indicated by reaction rates, were lower than corresponding values for macroaggregates. The strong physico – chemical and physical protection offered by microaggregates to organic carbon effectively increases energy of activation (Ea) leading to decreased decomposition rates. In shola forest the rate constat (k) of macro and micro aggregates are comparatively equal in all temperature. But in dry deciduous forest expect at 25°C the micro aggregate shows higher value of rate constant than macroaggregates indicating that the carbon stored in microaggregates are more vulnerable for decomposition than macroaggregates. The activation energy for decomposition of organic carbon in microaggregates ranged from 17.75 to 49.80 kJ/mol and in macroaggregates from 2.11 to 33.44 kJ/mol. In general, shola forest had significantly higher activation energies for carbon stored in both micro- and macro - aggregates than other forest systems indicating a higher stability against decomposition. The temperature control on carbon decomposition was found to be more significant in microaggregates of shola and dry deciduous forest. Macroaggregates show low-temperature dependency of carbon than microaggregates in shola and dry deciduous forest.

Both shola and dry deciduous forest are present in climate restricted areas with lower and higher temperatures respectively. And over the next few decades, as per the predicted climate change scenarios mean temperature in tropics are expected to increase.

Conclusions: Present study concludes that the forest soils show the potential to revert to a carbon source than sink. Therefore for advancing towards sustainable development goals of UN and ensuring effective soil carbon sequestration in the projected climate change scenarios, it is necessary to optimize forest management by increasing organic matter on the input side and avoiding soil disturbances as much as possible on the output side.

Keywords*: Soil Carbon Sequestration, Climate Change, Forest Carbon, Carbon Stability*

12-02

CARCINOGENIC AND NON-CARCINOGENIC HUMAN HEALTH RISK ASSESSMENT OF HEAVY METALS IN SEAFOOD RESOURCES FROM AN URBAN ESTUARY

Neethu K V [1*], Hari Praved P [1], Bijoy Nandan S[1], Joseph K. J[1], Marigoudar S. R.[2]

1)Department of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences, Cochin University of Science and Technology, Cochin 682016, Kerala, India
2) National Centre for Coastal Research, NIOT Campus, Ministry of Earth Sciences, Govt. of India, Pallikaranai, Chennai 600100, India
Corresponding author email id:neethukv457@gmail.com*

Background: Situated on the southwest coast of India, the Cochin Estuarine System (CES) houses an industrial belt notorious as a global "toxic hotspot" with an alarming increase of heavy metal contamination. But, there is limited understanding of heavy metal bioaccumulation and associated health risks.

Mehtod: Fish samples were collected from the Cochin Estuary on seasonal basis. Heavy metals from the muscle tissue were extracted using diacid mixture of perchloric acid and nitric acid, and analysed in an Inductively Coupled Plasma Optical Emission Spectrometer. Non carcinogenic risk was assessed using Target Hazard Quotient (THQ) and Hazard index (HI) and carcinogenic risk was assessed using Target Cancer Risk (TCR).

Result: Cadmium and lead surpassed the standards set by the Food Safety and Standards Authority of India. The hazard index (0.13 to 0.93) indicates that consumers are on the verge of risk from the combined effects of metals. The cancer risk for cadmium (2.15E-3) and chromium (3.90E-4) suggests that consumers are susceptible to long-term risks. Notably, cadmium emerged as the most influential metal in the risk analysis.

Conclusion: In conclusion, the study reveals concerning levels of cadmium and lead in native food fishes from the Cochin Estuarine System, surpassing established safety standards. Despite low individual metal intake estimates, the combined effects, as indicated by the 95th percentile results, pose a potential risk to consumers, particularly in terms of long-term carcinogenic health risks associated with cadmium, the most influential metal in the analysis.

Keywords: *Cochin Estuary, Health Risk Assessment, Monte Carlo Simulation*

12-03

ASSESSING THE NEO-TECTONIC ACTIVITY IN THE ACHANKOVIL RIVER BASIN THROUGH MORPHOTECTONIC ANALYSIS

Anjali N*, Achu A L[1], Aju C D[2], Girish Gopinath[1]

1)Department of Climate Variability and Aquatic Ecosystems, Kerala University of Fisheries and Ocean Studies, Kochi 682506, India
2) Indian Institute of Tropical Meterology, Pune, Maharashtra 411008, India
Corresponding author email id: 681anjulakshmi@gmail.com*

Abstract: Geomorphic indices are employed to analyze the geomorphological and tectonic mechanisms contributing to the formation of drainage basins. These indices rely on factors such as tectonics and erosional processes that govern the configuration of landforms. The correlations between different geomorphic indices play a crucial role in assessing the impact of regional tectonic activity on the morphological evolution of drainage basins. In the present study, widely accepted morphotectonic and morphometric parameters such as stream length-gradient index, drainage basin asymmetry factor, hypsometric integral and curve, Drainage density, form factor, Elongation ratio, Circulatory ratio, and bifurcation ratio were used to assess the neo-tectonic activity in Achankovil River Basin (ARB), flowing through the Achankovil shear zone. The proposed study area is one among these zones, the NW–SE trending Achankovil shear zone (AKSZ). AKSZ is considered as a tectonic divide between Madhurai granulite block to the north and Kerala khondalite belt to the south. The ARB has been divided into 43 fourth-order sub-basins, and analysis was carried out at the sub-basin level. The drainage asymmetry factor for ARB ranges from 25 to 88.2 among the sub basins. While High value (SB-34) is noted towards right by sub-basins with tilt (northeast to Northwest) The variations in the tilt of adjacent segments suggest that the Achankovil River traverses' distinct structural blocks, despite the lithology being relatively consistent. The stream length gradient index revealed higher variations in tectonic activity across different sub-basin of ARB. In analysis HI varies from 0.2 to 0.5. It is noteworthy that majority of the sub-basins reached a state of geomorphic maturity, with hypsometric indices falling within the range of 0.35 < Ihyp > 0.60. Drainage density (Dd) ranges from 1.1 to 4.8. In general values represent a highly dissected terrain with relatively lower infiltration capacity. Similarly, the elongation ratio (Re) and circularity ratio and form factor imply that elongated and tectonically active basins, which are controlled primarily by geologic structures. To conclude, High values were observed in the central portion of the study area (SB 34, SB 39, SB 28, SB 29, SB 26, SB 6, SB 7, SB 23, SB 21) with higher tectonic activity. This suggests that further detailed evaluation of Quaternary chronology along with major displacements will be beneficial for future research.

Keywords: *Neo-Tectonism; Geomorphic Indices; Achankovil Shear Zone: Achankovil River; Kerala*

12-04

AN ANALYSIS OF THE DIVERSITY AND SIGNIFICANCE OF MORPHOLOGY IN THE AUTOROTATING DIASPORES OF FLOWERING PLANTS OF SOUTH INDIA

Drisya V.V.[1*], Pramod C. [1,2], Pradeep A.K. [2] & Suresh T.P. [3]

1) Department of Botany, Government Brennen College, Dharmadam P.O., Thalassery, Kerala
2) Department of Botany, University of Calicut, Calicut University P.O., Kerala
3) Department of Physics, Government Brennen College, Dharmadam P.O., Thalassery
**Corresponding author email id: drisyachandran96@gmail.com*

Background: Dispersal is a vital process in plants to overcome the boundaries of sedentary life to establish a population in distant habitats. Plants have various methods to spread their dispersal units, and one of the most effective physical mechanisms for wind dispersal is the production of autorotating or auto-gyrating dispersal units or diaspores. Based on the morphology and aerodynamics there are two types of autorotating diaspores, namely rolling autogyros and autogyros are occur in nature. Among these, the morphology of autogyros is diverse and has a wide range of practical applications for designing of wings in various systems. Therefore, the present study focuses on to analyze this morphological diversity of autorotating dispersal units (autogyros) of south India and the impact of these morphological variations on their autorotation and dispersal.

Methods: The list of autorotating diaspores in South India was prepared based on field studies, herbarium consultation, and survey of literature/floras. Documented auto-gyros were categorized based on the morphology and number of wings and selected examples from each category were used for the detailed studies. Detailed macromorphological and morphogenetic studies of selected diaspores were carried out in the laboratory and SEM analysis were performed to find the micromorphological adaptations. Still air drop tests and statistical analysis of the results were performed to determine the effect of morphological parameters on the descent rate. Cremers formula (1977) were used to estimate the mean dispersal distance of selected autogyros from each category.

Results: A total of 79 flowering plant species in South India belonging to 14 families were recorded as producing diverse autorotating dispersal units or diaspores. Among these 55 of them are single-winged autogyros and the remaining are multi-winged forms. Regression analysis of experimental results revealed that wing loading shows a significant impact on the descent rate in single-winged autogyros and wing fold angle shows a significant impact on descent rate in multi-winged autogyros. Estimating of mean dispersal distance also shows that multi-winged autogyros have more distant dispersal capacity than single-winged autogyros.

Conclusions: The factor that shows a significant effect on descent rate, direction of rotation, and dispersal potential in autogyros depends upon the geometry of wings and ultimate morphology of the diaspore. This indicates that morphological diversity among these dispersal units is an excellent example of the embodied intelligence of plants for survival according to the changing surroundings. Therefore, learning more about the diversity of these natural creations provides a wealth of notable examples of solid design and new motivating perspectives on design innovation in the future.

Keywords: *Anemochory, Autogyros, Autorotation, Dispersal Units, Morphology, South India, Wings.*

12-05

BIOELECTRICITY PRODUCTION FROM CHICKEN DROPPINGS USING MICROBIAL FUEL CELL

Deepa Irene C and Lea Mathew

Department of Civil Engineering, College of Engineering Trivandrum

Background: The energy crisis is a serious issue addressed globally. Large demand and consumption of energy causes running out of non-renewable resources which leads to energy scarcity. The microbial fuel cell is a sustainable technology to generate bioelectricity. The microbial fuel cell is a device that converts chemical energy to electrical energy with the help of microorganisms.

Method: Double chambered Microbial Fuel Cell was constructed with 5g, 10g, and 15g chicken droppings with various combinations of electrodes. The effect of methylene blue mediator is also checked in this work.

Results: The maximum voltage, current density and power density obtained were 1012 mV, 52.71 mA/m² and 49.39 mW/m² respectively in Microbial Fuel Cell with 10g chicken droppings, anode zinc electrode and cathode carbon electrode and 1ml methylene blue mediator. The generation of electricity with time shows an increasing trend up to a certain value and after that, there is a decreasing trend. As a result of the growth of microorganisms in a microbial fuel cell, the parameters such as voltage, current density and power density show a varying trend.

Conclusions: In microbial fuel cells, the voltage and current obtained vary with microbial activity of substrate, type of electrode, and the addition of mediators.

Keywords: Microbial Fuel Cell, Chicken Droppings, Bioelectricity

12-06

THE RISK ASSESSMENT OF HEAVY METAL POLLUTION IN THE SEDIMENTS OF VELLAYANI LAKE, KERALA

Geethu Susan James, Dipu Sukumaran, Jayasooryan KK, Jainet PJ, Magesh NS

Centre for Water Resources Development and Management, Kozhikode

Background: The sediment in aquatic ecosystems serves as a large pool for heavy metal storage. Most of the trace metals are considered as essential micronutrients but are also toxic at concentrations higher than the amount required for normal growth. Increase in bioavailability of these toxic metals with increasing total metals concentrations in the sediments can be a potential threat to benthic organisms and aquatic biota in the system

Methods: Thirty samples were collected from Vellayani lake using standard methods. Sediment samples were collected at selected locations to assess the textural characteristics in the Vellayani Lake area and also seven heavy metals such as Cadmium (Cd), Chromium (Cr), Coper (Cu), Manganese (Mn), Nickel (Ni), Lead (Pb) and Zinc (Zn) were analysed using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES, Thermo-iCAP™ 7000 series - Thermo Electron 40 Corporation, UK). Contamination factor (CF), Geo-accumulation index, Enrichment factor (EF)

are used predict the heavy metal pollution in soils are used to analyse the risk factor

Results

Texture Analysis: The collected samples revealed that most of the area consists of sand with a mixture of clay of 33%. 26% is found to be sand clay loam texture, 13% is of sandy loam and 10% is clay whereas the other belongs to sand, clay loam and loamy sand.

Metal content and its spatial variability in the lacustrine sediments : The mean heavy metal content shows the following descending order in the lacustrine sediments of the Vellayani Lake: Cr> Mn> Zn> Ni> Cu> Pb> Cd. The spatial variability of metals in the study area is largely due to the varied weathering rate of local lithology and their transport through local streams from the urban area.

Geochemical contamination of heavy metal in Vellayani Kayal

Enrichment factor : The average EF shows the following descending order in the sediments: Cr> Cd> Zn> Pb> Cu> Ni> Mn.Moderate enrichment of heavy metals was noticed for Cd, Cr, Cu, Pb and Zn are significant enrichment is noticed in metals such as Cd can be due to anthropogenic activities.

Contamination factor : It is observed that most of the metals show low contamination (CF < 1). The average CF shows the following descending order in the sediments: Cr> Cd> Zn> Pb> Cu> Ni> Mn. Whereas, heavy metals such as Cd, Cu, Zn, Pb, Ni and Cr show moderate contamination (CF 1 to 3). Considerable contamination is noticed for the metal Cr and very high contamination is noticed for the metal Cd especially for sample location 15 and 16.

Geoaccumulation index : The average Igeo shows the following descending order in the sediments: Cr> Cd> Zn> Cu> Pb> Ni> Mn. It is noted that most of the heavy metals fall under the 'not to weakly contaminated' category (Igeo< 0) whereas Cr shows 'moderate contamination' and a moderately to strong contamination is noticed for Cd especially in location 15 and 16 indicating anthropogenic sources.

Pollution indices such as Contamination factor (CF), Enrichment factor (EF) and Geo-accumulation index (I) are performed to assess the spatial distribution and pollution status of a study area.With these factor analysis reveals that the accumulation of the heavy metals Cd and Cr in the surface sediments off Vellayani lake.

Keywords: Vellayani Lake; Heavy Metal, Sediment, Risk Assessment

12-07

EVALUATION OF MICROPLASTIC POLLUTION AND RISK ASSESSMENT IN A TROPICAL MONSOONAL ESTUARY, WITH SPECIAL EMPHASIS ON CONTAMINATION IN JELLYFISH

Hari Praved. P[1*], Neethu. K.V[1], Bijoy Nandan. S[1], Sharma. K.V[2]

1)Department of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences, Cochin University of Science and Technology, Cochin 682016, Kerala, India.
2)National Centre for Coastal Research, NIOT Campus, Ministry of Earth Sciences, Govt. of India, Pallikaranai, Chennai 600100, India
Corresponding author email id:praved.hari07@gmail.com*

Background: Estuaries, which serve as vital links between land and coastal ecosystems, play a significant part in facilitating the transfer of plastic waste from the land to the ocean. In this research, we examined the prevalence, characteristics, and ecological risks of microplastics (MPs) in the extensively urbanized Cochin Estuarine System (CES), India. Additionally, it represents one of the initial evidence-based examinations of MPs ingestion by jellyfish in Indian waters, focusing on *Acromitus flagellatus, Blackfordia virginica*, and *Pleurobrachia pileus* species.

Method: Surface water MPs and small jellyfish were collected using a plankton net (mesh size =200 µm; mouth diameter = 50 cm). MPs were recovered from water samples and jellyfish using a combination of handpicking under a stereomicroscope and the KOH acid digestion method (Matsuguma et al., 2017). MPs were enumerated via microscopy and polymer type of MPs identified using Fourier-transform interferometer (FTIR) analysis. To evaluate the current levels of MPs and their effect on the CES, the Pollution Load Index (*PLI*), Potential Ecological Risk Index (*PERI*), and Polymeric Risk Index (*H*) were utilized.

Results: The average abundance of MPs in the surface water of the CES is 21.6 ± 11 MPs/m3. Fibers was the most prevalent type of MPs in surface waters and jellyfish, with polyethylene (PE), polypropylene (PP), and polyamide (PA) being the most common polymer varieties. The high $PLI_{estuary}$ values (20.33), high $H_{estuary}$ values (234.02), and extreme $PERI_{estuary}$ value (1646.06) indicate that the CES is facing an extreme ecological risk. Among the 280 jellyfish individuals examined, 118 (42.14%) were recognized to contain MPs with an average of 1.54 ± 2.68 MPs/individual. Pearson bivariate analysis revealed a significant correlation between the jellyfish bell size and number of plastics per individual. Comparison between jellyfish species revealed, the majority (66%) of the MPs identified in jellyfish were from *A. flagellatus* and 44 among the 50 jellyfish examined (88%) had MPs.

Conclusions: This study reveals concerning levels of MP abundance in the CES, with the ecological risk assessment showing high hazard scores indicative of potential adverse effects on estuarine ecosystem and organisms. The study suggest that mangrove jellyfish *A. flagellatus* may be a potential sink for MPs and may be utilized to be a bioindicator for monitoring MPs contamination in estuarine systems, aiding in future plastic pollution mitigation efforts.

Keywords: *Cochin Estuary, Microplastic, Pollution Load Index, Polymer Risk, Jellyfish*

12-08

METEOROLOGICAL, GEOMORPHOMETRIC, AND HYDROLOGIC SETTING OF A WET TROPICAL EVERGREEN FOREST WATERSHED OF THE WESTERN GHATS

Sachin Ramesh V V, Kabil Shah Rahman, Vivek B*, Jainet P J, Surendran U

KSCSTE-Centre for Water Resources Development and Management, Kozhikode
**- Corresponding Author*

Western Ghats (WG) is one of the eight hottest hotspots of biodiversity of the world. The present study investigates meteorological variables and geomorphological behavior of the Umayar watershed and computes the annual water yield of it. The Umayar watershed is located in the Kollam district of the Kerala state. It is one of the major hydrologic contributors of the Kallada River flowing through

the district. More than 80% of the watershed is covered by wet tropical evergreen forest, and the streamflow available is pristine. Meteorological data have been observed for past few months at a camp-shed maintained by the Department of Forest and Wildlife, Kerala, located deep inside the forest watershed. This data is compared with the available long term gridded data provided by the Indian Meteorological Department (IMD). A weighted average approach is used to estimate various meteorological variables from the available grids. Geomorphological behavior of the watershed is assessed using linear, areal, and relief parameters. Watershed hydrology is estimated using Annual Water Yield (AWY) module offered by the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) model. InVEST is a Potential Evapotranspiration (PET) based model that calculates the lumped AWY of watersheds or sub-watersheds and the model output provides combined surface water and groundwater yield. AWY of the Umayar watershed has been computed using the InVEST model for the period of 2012 to 2022. The average AWY of the study area for the period is 33.123 Mm^3. The study is an important step in the hydrologic assessment of the forest watersheds of the WG, as it is the foundation head of all the rivers that keeps the lush greenery of the state.

Keywords: Western Ghats, Meteorology, Geomorphometry, Hydrology, InVEST

12-09

BIODIVERSITY BEYOND SPECIES AND ITS CONSERVATION A CASE STUDY FROM ANDAMAN ARCHIPELAGO

Sarath Paremmal[1], Ghosh Dasgupta M[2], Muneera Parveen A.B[2], Sreekumar V.B[1], Dev S A[1*]

1) Kerala Forest Research Institute, Thrissur, Kerala.
2) Institute for Forest Genetics and Tree Breeding, Coimbatore.
**Corresponding author email id: sumadev@kfri.res.in*

Biodiversity encompasses diversity at three fundamental levels: genetic, species, and ecosystem diversity. However, conservation studies predominantly focused on preserving species diversity, paying little attention to the massive drain in intraspecific diversity. The present study focuses on the microevolutionary and divergence aspects of insular populations of *Korthalisa laciniosa*, a lesser-known climbing palm (rattan) distributed in the Andaman and Nicobar archipelago. The fragmentation and isolation of landmasses in archipelagos make them a unique habitat. Paradoxically, it is one of the reasons why island biodiversity is readily vulnerable to threats; therefore, islands are ideal for evolutionary and conservation studies. The species is popularized for its canes, which are heavily harvested from the wild as raw materials for the rattan industry. The long-time harvesting pressure, and population decline, along with the island-specific microevolutionary processes, has the potential to trigger demographic stochasticity in these populations. This may result in loss of genetic diversity, causing adverse genetic consequences in the populations and eventually lead to the local extinction of species. Therefore, understanding the distribution and population genetic diversity of the species in the landscape, are imperative for formulating conservation strategies. A 592 Mbp draft genome of *K. laciniosa* has been developed and 2,67,240 genomewide microsatellite markers were mined out. SSR genotyping of the eight populations distributed across the Andaman archipelago was carried out, using a subset of SSR markers which showed *in-silico* polymorphism. The allelic data was analysed for the presence of null and private alleles. Population genetic diversity analysis was carried out using GenAlEx and Population genetic structure was inferred using Bayesian

algorithm STRUCTURE. Discrete genetic clustering of the spatially and geographically distinct populations revealed from the results indicated the influence of spatial distance and isolation on the microevolutionary processes. Private alleles are more prevalent in isolated islands, signifying a distinct evolutionary trajectory that the population likely followed, due to interrupted gene flow, founder effect and local adaptation. The results generated from the study provide crucial information to assist in informed decision-making and implementation of proper conservation strategies.

Keywords: Rattan, Conservation Genetics, Forest Genetic Resources.

12-10

HYDROLYTIC ENZYME POTENTIAL OF MICROBES ISOLATED FROM SELECTED WETLANDS OF KASARAGOD DISTRICT, KERALA

Anagha A. and Sebastian C. D.

Molecular Biology Division, Department of Zoology, University of Calicut, Kerala

Background: Wetlands are complex and most productive ecosystems harbouring a wide range of microbial species. These microbial communities play a pivotal role in nutrient cycling, remove hazardous contaminants from aquatic systems and produce several enzymes and pigments that have industrial, pharmaceutical and ecological applications.

Methods: The present study aims at isolating bacteria, yeast and fungi from Chemmattamvayal and Kuruvapalli wetlands of Kasaragod district and assessing the hydrolytic enzyme potential of the microbes.

Results: The pH and temperature of the sediments ranged between 6-7.2 and 29-32˚C respectively. The CFU per gram (CFU/g) of the isolates showed significant difference among the two selected wetlands in the two seasons. Monsoon season harboured more microbes than premonoon season. A total of 10 different enzymes were analysed qualitatively according to the standard protocols which also showed considerable variation between the seasons. It was noticed that all the bacterial isolates from Chammattamvayal showed 100% hydrolytic enzyme production.

Conclusion: Wetlands are unique ecosystems having the extraordinary capacity to sustain a wide range of microbes. However, the diversity and ecological functions are yet underexplored. Unveiling the microbial characteristics in these ecosystems would lead to several novel ideologies and applications in environment as well as industry.

Keywords: Wetlands, Bacteria, Fungus, Yeast, Hydrolytic Enzyme Potential

12-11

EFFECTIVENESS OF VEGETATION AS PROXIES FOR IMPROVING THE ESTIMATION OF SOIL WATER FLUXES

Aswathi V K[1,2], Amrutha S[3], Sreelash K[1] and Smitha Mohan K[3]

1) National Centre for Earth Science Studies, Akkulam, Thiruvananthapuram
2) School of Environmental Studies, Cochin University of Science and Technology, Kochi
3)Dept. of Civil Engineering, Govt. Engineering College, Trichur

Background: While estimation of surface soil moisture at a spatial scale is viable from remote sensing data, estimation of sub-surface soil moisture remains a challenge, particularly in multi-layered soil systems typically prevalent in tropical regions. Reliable estimates of soil water fluxes could enhance the accuracy of numerical weather prediction models, which is of primary importance in a state like Kerala with its large-scale climate variability and increasing incidences of natural hazards like floods, landslides, etc.

Method: Sensitivity analysis of canopy variables to soil water storage properties was carried out to determine the best choice of canopy variable for estimating soil water fluxes. The methodology has been developed for estimating sub-surface soil water fluxes. Observed values and the estimated values of variables such as surface soil moisture (SSM), leaf area index (LAI), evapotranspiration (ET), and soil temperature (ST) will be used in different weighted combinations to get the best estimates of soil water fluxes with low uncertainty.

Results: Sensitivity analysis between soil moisture, canopy variables and soil hydraulic properties (SHPs) showed strong correlation of SHPs with SSM, LAI, ST and ET indicating that these variables could provide reliable estimates of soil water fluxes. Likelihood combinations of variables with higher weights to canopy variables provided better estimates of SHPs in the deeper layers. The results showed that the methodology proposed in the present study can provide reliable estimates of sub-surface soil water fluxes in heterogeneous soil systems.

Conclusion: Since the variables used in this study are potentially accessible from the remote sensing data, the application of this methodology at large spatial scales is feasible, thereby generating spatiotemporal maps of sub-surface soil moisture at regional scales, which can aid in better prediction/forecast of hydro-climatic hazards (flood and landslide).

Keywords: *Soil Moisture Modelling, Soil Water Fluxes, Hydro-Climatic Hazard*

12-12

ELECTROSPUN MEMBRANES MODIFIED WITH CELLULOSE NANOFIBER EXTRACTED FROM WATER HYACINTH, FOR WASTEWATER PURIFICATION

Baburaj M. S, Diksha Painuly and Abi Santhosh Aprem*

Corporate Research and Development Centre (CRDC), HLL Lifecare Ltd, Akkulam,

Background : The global problem of water pollution has been imperilling aquatic as well as human life for decades. Among different water purification methods, membrane filtration is one of the most promising methods due to its versatility, cost effectiveness, superior flux and selectivity.

Method: The present study demonstrates the fabrication, characterisation and water filtration efficiency of cellulose nanofibre (CNF, extracted from water hyacinth fiber) modified electrospun nanofibrous membranes (ENMs) from biodegradable polymers namely, polycaprolactone (PCL), gelatin (GEL) and chitosan (CHI). The suitability and efficiency of CNF- modified ENMs for filtration applications was investigated using Methylene Blue (MB) based model effluent, and wastewater collected from local water bodies at Trivandrum district.

Results: CNF modified ENMs with high biopolymer content showed high efficiency for MB removal. Fabricated membranes showed their excellent efficiency for the reduction of physicochemical parameters and micro-organisms in wastewater. The fabricated ENMs also showed stable flux and superior selectivity in long-term filtration studies. Morphological and thermal studies showed that the fabricated ENMs retained its chemical and physical identity, even after 15 cycles of filtration.

Conclusion: The cost effective, biodegradable and reusable ENMs can be effectively used for the filtration of both municipal and industrial wastewater.

Keywords: *Water Pollution, Electrospun Nano-Membranes, Cellulose Nano Fibers, Water Hyacinth, Pressure Driven Filtration*

12-13

CONSERVATION EFFORTS FOR THE MALABAR RIVER LILY, THE FIRST DISTRICT FLOWER IN KERALA; INSIGHTS FROM ECOLOGICAL NICHE MODELLING AND HABITAT ASSESSMENT.

Harshid P. and Pradeep N. S.

KSCSTE- Malabar Botanical Garden and Institute for Plant Sciences, Kozhikode, India

Background: Endemic species face conservation challenges due to their limited range and rarity, with causes varying for each case. Understanding these causes is crucial for effective conservation. *Crinum malabaricum* Lekhak & S.R. Yadav (Malabar river lily), is an aquatic perennial plant found in the seasonal streams of laterite plateaus in Northern Kerala. The Kerala State Biodiversity Board has recently designated it as the District flower of Kasaragod. According to the IUCN criteria, this plant is categorized as "critically endangered". Immediate attention is needed to evaluate the status of the plant and implement conservation measures as it faces an imminent threat of extinction in its natural habitat.

Methods: The status of *C. malabaricum* in its four natural habitats was estimated through frequent surveys conducted over a three-year period from 2021 to 2023. Analyzed various ecological parameters, along with phenological data, seed germination data, and seedling viability etc. Prepared Maxent based ecological niche models to identify suitable habitats for species translocation. The study area encompasses the Malabar Plains of the Western Ghats. The accuracy of the model was assessed using the ROC curve method.Used GIS softwares to locate suitable habitats in the areas where model depicted highly suitability (HSI > 0.85) and conducted filed surveys to validate it and translocated seedling of *C. malabaricum* in suitable areas.

Result: The evaluation of *C. malabaricum* suggests that it lack an effective dispersal mechanism and its viable seedlings are considerably affected by extreme environmental conditions during

the summer season. The species faces significant risks due to habitat degradation caused by anthropogenic activities. The Maxent based ENM predicted a fundamental niche for this species with 2393 KM2 (3.6% of the study area) as a highly suitable area, which is much higher than the calculated extend of occurrence (EOO = 283 KM^2) of this species. The realized niche of this species was identified during field explorations. Ten suitable areas were selected for species translocation. The habitats that have been chosen are located in different regions of the southern Western Ghats.

Conclusion: The study shows that *C. malabaricum* is declining in its natural habitats. Translocating the species to suitable habitats, as interpreted by niche modelling, can help to resolve the threats posed by the species' inefficient dispersal mechanisms. For selecting appropriate sites for conservation translocations, this methodology will be reliable and effective, and it could be useful for other endemic species.

Keywords: Ecological Niche Modeling, Crinum Malabaricum, Endemism, Species Conservation, Maxent; Species Translocation.

12-14

A NOVEL APPROACH TO GEOMORPHIC-BASED CARBON STOCK AND SEQUESTRATION ASSESSMENT OF MANGROVES FOR CLIMATE CHANGE MITIGATION

Varghese Rani[1], Girish Gopinath[1], Jayachandran P.R[2], S. Bijoy Nandan[3]

[1]Department of Climate Variability and Aquatic Ecosystems, KUFOS, Puduvype, Kerala
[2]Applied Research Center for Environment and Marine Studies, King Fahd University of Petroleum & Minerals (KFUPM) Saudi Arabia
[3]School of Marine Sciences, CUSAT & Kannur University

Background: Assessing carbon stocks in mangroves and quantifying carbon dioxide (CO2) emissions resulting from mangrove deforestation are crucial aspects of climate change mitigation research. Due to the lack of research studies on geomorphic controls, this research focuses on the variability in carbon stocks and sequestration rates within diverse geomorphic mangrove habitats along the South-West coast of India, with a special emphasis on the Kochi region.

Methods: Carbon stock in mangroves in different pools namely were estimated by using standard methodology by Kauffman and Donato (2012). Soil carbon burial rate/sequestration rate was assessed according to Anderson et al., 1988 and applying CRS (Constant rate Supply)/CIS (Constant Initial Supply) modelling with carbon concentration (%) will provide the soil carbon sequestration rate/ burial (Rani et al., 2021 & Passos et al., 2022).

Results: The total biomass Carbon stock was high in undisturbed mangrove habitats having Riverine semi-enclosed and Estuarine semi-enclosed geomorphology (St.1 = 271.23. t C ha-1, St.3 = 473.75 t C ha-1, St.5 = 573.26 t C ha-1). Lowest was recorded at 139.65 t C ha-1 at Marine open mangrove with aquaculture practices. The soil carbon stock also was highest at undisturbed mangrove habitat (289.88 t ha-1). Riverine semi-enclosed with undisturbed mangrove habitats exhibited the highest soil carbon sequestration rates, while marine open aquaculture-converted mangrove habitat demonstrated the lowest attributed to distinct geomorphological and biological controls.

Conclusions: Geomorphology, pollution, aquaculture conversion, and biological controls emerge as major factors influencing the variation in carbon accumulation rates in mangrove sediment. Acknowledging and sustainably addressing these controlling factors can enhance carbon sequestration efforts, contributing to effective climate change mitigation.

Keywords: Carbon Stock, Sequestration, Geomorphology, Climate Change Mitigation

12-15

DEVELOPMENT OF ENVIRONMENT-FRIENDLY NIR REFLECTIVE NANO PIGMENTS FOR COOL ROOF APPLICATIONS

Aji Joseph, Ambili K.S., Jesty Thomas*

Research and PG Department of Chemistry, Kuriakose Elias College, Mannanam, Kottayam, Kerala
Corresponding author email id: jestyk@kecollege.ac.in*

Background: Global warming poses a threat to both nature's equilibrium and human health, leading to the heat island effect in urban areas. This effect raises indoor temperatures, increasing energy consumption. Utilizing NIR reflective cool pigments in paints, polymers, ceramics, and automobiles can mitigate this by reducing heat accumulation caused by concentrated sunlight energy. As traditional inorganic pigments contain toxic heavy metals, there is a pressing need for an environmentally friendly inorganic yellow pigment that not only reflects NIR light but also degrades pollutants in sunlight, emphasizing the importance of synthesizing a non-toxic, energy-efficient pigment with catalytic properties.

Method: Here we employed a highly effective solvothermal method to synthesize both bismuth oxide and Nd-doped bismuth oxide nano pigments. Diverging from conventional approaches utilizing various solvents, we exclusively utilized Ethylene glycol as the sole solvent throughout the synthesis process. The precursor material, bismuth nitrate pentahydrate, was carefully selected to ensure the successful fabrication of these compounds. The outcome of this method was the creation of a nontoxic, visually appealing cool pigment displaying exceptional NIR reflectance properties, alongside a notable catalytic capacity, showcasing its potential in diverse applications. This methodology stands out for its simplicity, effectiveness, and the multifunctional characteristics of the resulting materials, marking a significant contribution to the field of materials science.

Results: The synthesized material's characterizations via FTIR and XRD analyses highlighted its crystalline nature, phase change, and identifiable bonds. UV-DRS studies substantiated its aptitude for visible light absorption, crucial for its photocatalytic application, and indicated its band gap. UV-Visible absorption spectra revealed successful degradation of dye and antibiotic compounds. Morphological investigations using SEM and HR-TEM, coupled with XPS analysis, provided insights into surface composition. LC-MS and HPLC analyses corroborated the material's effectiveness in degrading antibiotics, particularly Ceftriaxone sodium. PL studies delved into its structural defects and catalytic properties, while colour code analysis and NIR reflectance (88-90%) assessments emphasized its potential as a cool roof pigment with practical applications.

Conclusions: In conclusion, this study systematically investigates the influence of metal substitution on diverse properties, encompassing structural, optical, and morphological aspects. The outcomes strongly advocate for the use of Nd-doped Bi2O3 as a compelling cool pigment, presenting a non-

toxic alternative with considerable potential across applications, further amplified by its impressive photocatalytic efficacy.

Keywords: Bismuth Oxide, Photocatalyst, Cool Pigment, Nd-Doped Bismuth Oxide

12-16

MICROPLASTICS FROM THE SEDIMENTS AND BIOTA OF PUZHAKKAL RIVER IN THRISSUR DISTRICT, KERALA.

Haripriya P S*, Blaise Jose K, Jayaraj .R

KSCSTE - Kerala Forest Research Institute, Peechi P.O, Thrissur, Kerala, India.

Background: Microplastics (MP) are the plastic particles of size less than 5 mm. These emerging contaminants pose a serious threat to the aquatic ecosystems especially in urbanised areas. Release of microplastic and its co-contaminants can seriously affect the biota. MP contamination is least studied in freshwater systems of Kerala. This is the first attempt to document the MP contamination in an urban river sediment and fish samples of Thrissur district, Kerala.

Method: Water, sediment and fish samples were collected from the regions of Puzhakkal River adjacent to Thrissur corporation area. Physico- chemical water quality parameters were tested in accordance with APHA methods and BIS Water quality standards. For water and sediments, microplastic extraction from samples was done by density separation using NaCl and, wet peroxide oxidation with H_2O_2. Fish tissue digestion done by incubating fish species in KOH solution at 60°C for 48 hours. Microscopic identification was done in order to visually characterize the MP and polymer identification was done using FTIR spectroscopy.

Results: Microplastics was present in the fish and sediment samples collected from designated samples at Puzhakkal River. In fish, the species *Tilapia mossambica* with highest abundance and *Pseudetroplus maculatus* had the lowest abundance of MP. In sediments, MP concentration varied from 140.00 ± 6.80 particles/Kg to 48.00 ± 24.51 particles/Kg. There were 18 type of polymers were found. High density polyethylene (HDPE) and chlorinated polyethylene (CPE) dominated in sediments and, avtex fibre/ avlin (polyester) in fishes. In sediments, white colored and film shaped MP were the major type, whereas in fish it was red coloured fibres.

Conclusion: It is alarming that, the urban freshwater sources used for irrigation, contains MP and they even made entry into the biota. The high concentration of MP in the sediments is disturbing and can be transported with water flow, and flood episodes can carry them to the Kole fields adjacent to this river in the down stream, an ecologically sensitive Ramsar site. There is an urgent need of documentation of the current status of the freshwater resources and to initiate remedial measures in order to address the issue.

Keywords: Microplastics, Bioaccumulation, Environmental Pollution, FTIR Spectroscopy, Water Quality

12-17

MICROPLASTICS IN HUMAN DIET: CONTAMINATION OF MICROPLASTICS IN SUGAR SAMPLES FROM KERALA, INDIA

Anagha P. L. and Ramasamy E. V. *

School of Environmental Sciences, Mahatma Gandhi University, Kottayam, Kerala, India
**Corresponding author email id:* evramasamy@mgu.ac.in

Background: Microplastics (MPs) are plastic particles with size < 5mm distributed extensively in different realms of the environment. Their bioavailability to the organisms including human is of great concern. The dietary intake of MPs by human through seafood items, sea salt, potable water etc. have been well documented. However, studies on MPs presence in sugar is limited globally, with no reports so far from India. In this context, the present study aims to examine MPs contamination in sugar, which is one among the important consumer goods in India.

Method: The sugar samples commercially available in super markets were subjected to wet peroxidation (WPO) using 30% H_2O_2 at 50°C for 24 hours. The digested samples were filtered over Whatman GF/A filter paper (pore size: 1 µm) and oven dried (40°C). Visual characterization of MPs retained over filter paper were done using stereomicroscope fitted with digital camera. Surface morphology of MPs was determined using Scanning Electron Microscope (SEM) and Micro Raman spectrometer was utilized for the polymer identification.

Results: The MPs load in individual sugar samples varied from 123 - 493 particles kg-1 with a mean abundance of 239.86 ± 81.85 particles kg-1. Prominence of fibers (65.91%) is observed in the samples, followed by fragments (29.92%) and film (4.17%) with most of them appear in blue color. MPs in the size classes: 100 – 500 µm and 500 –1000 µm were predominant which accounts to 38.35% and 20.22% respectively of the total MPs count. Polyamide and Polypropylene were the most abundant polymer types identified.

Conclusion: The role of sugar as a pathway of microplastics (MPs) uptake by human has been observed in the present study. As per the findings of this study, due to the MPs contamination in sugar, annual percapita consumption of MPs through sugar consumption alone becomes around 2282 MPs in India. Necessary steps on proper plastic waste management to be initiated by the government and the same to be followed in the society.

Keywords: *Microplastics, Food Contamination, Sugar Intake, Raman Spectroscopy*

12-18

EXPLORING PRE-MONSOON ALGAL DIVERSITY IN THE WALAYAR RIVER OF PALAKKAD, KERALA: A COMPREHENSIVE STUDY

Anusree K V, Bibina P B, Praseetha A P, Ammini C J, Sreekumar V B

Department of Forest Botany, KSCSTE- Kerala Forest Research Institute, Peechi, Thrissur, Kerala

Background: In response to the increasing demand for sustainable ecosystems, this study focuses on documenting the algal flora of the Walayar River in the Palakkad region. Notably, algal studies in the rivers of Kerala have been relatively limited, underscoring the significance of this research

in addressing that gap. The chosen study area encompasses the Kanjikode region, Kerala's second-largest industrial hub, making it especially relevant for the investigation. This effort marks a crucial step towards comprehensively examining algal diversity in the Walayar River, shedding light on a significant knowledge deficit within the state. Additionally, the research assesses the pollution status of the river using Palmer's Index, emphasizing the importance of understanding and managing environmental health in the face of industrial influence.

Method: Collections of freshwater algae were made by random sampling method from the different sites of Walayar River during the pre-monsoon season. The collected samples were preserved immediately in 4% formalin (APHA, 2012). Photomicrographs and measurements were made with a Leica DMC 2900 digital camera and LAS (Leica Application Suite). The identification is done with the help of standard publications.

Result: The study documented 69 microalgal species from 32 genera across four classes in the Walayar River. Chlorophyceae dominated with 43 species, followed by Euglenophyceae (10), Cyanophyceae (9), and Bacillariophyceae (7). *Scenedesmus* exhibited the highest diversity with 12 species. The pollution assessment using Palmer's Index produced a score of 20 with seven pollution-tolerant species, indicating probable organic pollution and eutrophication.

Conclusion: This study on the algal diversity in the Walayar River reveals the abundance of Chlorophyceae and the impact of pollution, as indicated by Palmer's index. The absence of prior research emphasizes the importance of immediate examination of microalgal diversity, especially in industrial areas. The developed algal catalog for the Palakkad district provides crucial insights for effective river management and underscores the vital role of algal diversity research in preserving freshwater ecosystems.

Keywords: Algae, Pollution, Palmer's Index, Kanjikode, River

12-19

A SUSTAINABLE PROCESS FOR ENHANCE BIO-HYDROGEN (GREEN-H_2) PRODUCTION FROM WASTEWATER RESOURCES

Adithya Mohan[1], Sindhu Vinodan Vineetha[1], Partha Kundua [2*]

1)Environmental Technology Division, CSIR-National Institute for Interdisciplinary Science and Technology
2)Academy of Scientific and Innovative Research (AcSIR)
**Corresponding author email id: kundu@niist.res.in*

Background: The increasing global demand for sustainable energy sources has prompted extensive research into alternative and environmentally friendly methods of hydrogen production. Bio-hydrogen, generated through biological processes, emerges as a promising avenue due to its potential for utilizing renewable resources and waste streams. In this present study the feasibility of bio-hydrogen production from wastewater was studied as renewable resources.

Method: A novel Bio-Electro-Chemical (BEC) reactor was designed and developed for enhance bio-hydrogen production from wastewater by utilising hydrogen producing biocatalyst. BEC unit was utilising the hydrogen-producing microorganisms, to transform organic matter present in wastewater into hydrogen. Various process parameters like pH temperature and applied voltage were optimized for the BEC system as a part of the experimental design to maximise the production

of bio-hydrogen from wastewater.

Results: The notable increase in hydrogen production was observed from 2.25 ml/gm VSS to 17.75 ml/gm VSS. Overall hydrogen production was observed as 51.55 ml/gm VSS. A significate COD degradation of 66±10% was observed. Electrochemical properties of the BEC system were also studied through CV (CyclicVoltametry) and NQ (Nyquist plot) analysis. Gas and liquid analysis were carried out through GC- TCD and GC-FID. From VFA analysis, it was revealed the presence of specialist chemicals i.e., propanoic acid, butyric acid, valeric acid as a side product.

Conclusion: It was observed that the BEC process is capable of extracting of bio-hydrogen from wastewater. Ultimately, the study aims to contribute to the development of a viable and scalable technology for biohydrogen production, fostering a more sustainable and circular economy approach towards clean energy generation.

Keywords: *Bio-Hydrogen, Renewable Energy, Waste Utilization, Bio-Electro-Chemical (BEC) Reactor, Green Process*

POSTER PRESENTATION

12-20

COMPLEX REFRACTIVE INDEX RETRIEVAL OF AMMONIUM SULPHATE USING DUAL WAVELENGTH INTEGRATING SPHERE INTEGRATING NEPHELOMETER DATA AND PYMIESCATT

Aiswarya S[1], Issac S. I[2], Ravi Varma[3] and Nithyaja B[1*]

[1]Govt. College Madappally, Vatakara, Kozhikode, Kerala.
[2]St. Joseph's College Devagiri, Govt. medical College, Kozhikode, Kerala.
[3]National Institute of Technology Calicut, Calicut, Kerala, India.
**Corresponding author email id: nithyashajeesh@gmail.com*

Anthropogenic greenhouse gases and aerosols introduce main perturbations to the earth's radiative equilibrium. These perturbations result in changes of the regional and global climate system that are difficult to predict. Aerosols affect the climate directly by scattering and absorbing solar radiation. They also affect climate indirectly by acting as cloud condensation nuclei, thereby changing the optical properties and lifetime of clouds. Nephelometers that are designed to integrate the scattered light over the entire range of angles are termed integrating nephelometers. We report here, the retrieval of wavelength dependent refractive indices (405 & 532 nm) of white aerosol, ammonium sulphate, using PyMieScatt survey iteration method. Using this retrieval algorithm, n and k values of a non-absorbing aerosol was retrieved, using the scattering coefficients obtained from a dual wavelength integrating sphere integrating nephelometer (ISIN), assuming the absorption to be negligible and the scanning mobility particle sizer (SMPS) data. The complex RI values thus obtained were found to be in good agreement with the values reported in previous literatures. PyMieScatt survey iteration method is found to be a reliable and potential inverse algorithmic method for the retrieval of complex RI and its spectral dependencies.

Keywords: Aerosols, Nephelometer, Pymiescatt, Complex Refractive Index, SMPS

12-21

DOCUMENTATION AND MANAGEMENT OF TEAK LEAF RUST DISEASE IN FOREST NURSERIES OF KERALA

Kiran M.[1] *, Gopakumar S.[1], Reshmy V.[2], Shambhu Kumar[3], Srinivasan1 K., Anoop E.V.[1]

[1]College of Forestry, KAU, Vellanikkara, Thrissur;
[2] College of Agriculture, KAU, Vellanikkara, Thrissur;
[3]Dept. of Forest Pathology, KFRI, Peechi, Thrissur

Background: Teak (Tectona grandis L.f.) is extensively used for afforestation programs in Kerala, and the major threat to the quality of seedlings is the leaf rust disease caused by the fungus Olivea tectonae. But, in this changing climate scenario, recent studies on the status of this disease and its management from forest nurseries have yet to be made available.

Method: A purposive sampling survey and disease assessment were conducted in forest nurseries under different agroecological zones across the state in two seasons during 2021. Correlation of weather parameters and an in vivo management study was also performed against this disease.

Results: Eleven forest nurseries were detected with the disease, and a positive correlation with temperature and a negative correlation with rainfall was observed during the pre-monsoon period, irrespective of agroecological zones. The *in vivo* management study showed the superior efficacy of hexaconazole (0.1%) and the lowest performance of *Trichoderma asperellum* against the disease.

Conclusions: Hexaconazole (0.1%) is an effective fungicide against the critical teak leaf rust disease in nurseries. Long-term studies on seasonal influence and management are required.

Keywords: Teak Rust Disease, Forest Nursery, Weather, Fungicide Efficacy

12-22

PREPARATION AND CHARACTERIZATION LOW-COST ADSORBENT FROM WASTE LDPE FOR EFFICIENT REMOVAL OF TOLUENE

Anjumol K.P and Partha Kundu

Environmental Technology Division, CSIR- National Institute for Interdisciplinary Science and Technolog

Background: Pyrolysis is the fragmentation process of polymers in inert and vacuum medium, using reducing and oxidizing agents with catalyzer or without catalyzer at high temperature. During fragmentation, polymer chains are broken and new molecules are created (Oksuz, 2006). In addition to liquid and gas products, solid fraction (char) is the residue remained in the reactor after pyrolysis reaction. Heating rate, reactor's temperature and retention time are pyrolysis factors that play significant role in the structure and quantity of char (Paethonom and Yoshikawa, 2012). It is evident that AC prepared from wastes effectively compete with the commercial ones to remove contaminants such as organic compounds, dyes and heavy metals (Dias et al., 2007).

Method: Waste milk packets was collected from NIIST canteen was washed and dried. 1 g of sample was weighted in to at 300, 450 and 6000C pyrolysis in an inert gas (Nitrogen) atmosphere for different heating rate such as 5,12.5 and 20 0C/min and residence time such as 10,50 and 90 minutes.

Along with charcoal two by-products such as gas and oil were formed and after the experiments the characterization of all by-products were done. For batch biodegradation study of toluene by activated carbon, 125 g of media that consist of activated carbon, compost and sludge were prepared and from that 25 g was transferred to five conical flasks with a capacity of 250 ml. one is blank with only compost, sludge and toluene and the rest of the bottles are filled with 25 g of media (adsorbent material, compost, sludge) and toluene with different concentrations such as 1,10, 50 and 100 ppm. The experiments were done for a period of 100 hours and after every three hours the gas concentration inside the flasks were analyzed using a VOC gas analyzer and after the experiment's desorption was done using heating the flasks at 85 0C and the toluene degradation was calculated and the data were plotted as graph.

Results: Seventeen pyrolysis experiments were done at different temperature, heating rate and residence time for optimizing the suitable working conditions and the data were tabulated. From the table it is clear that maximum yield that is 98 % was obtained at three different conditions first one is temperature 600 0C, heating rate 12.5 0C/min and residence time 90 min. BET analysis of adsorbent material was done and the results such as pore radius, pore volume and surface area were tabulated and from the table it was found that the maximum pore radius i.e., 6.018 nm was obtained at three different conditions one is at temperature 450 0C, heating rate 20 0C/min and residence time 10 min. Biodegradation of 10,50 and 100 ppm toluene using activated carbon was done for a period of 100 hrs. and from the experiments it was found that the maximum removal efficiency of 100 % achieved at a concentration of 10 ppm.

Conclusions: In the present study, we explored batch biodegradation of toluene by adsorbent derived from waste milk packets were used and for that the adsorbent was prepared by pyrolyzing the waste milk packets optimize various working conditions as temperature 600 0C, heating rate 12.5 0C/min and residence time 10 min and the packing media was prepared by mixing adsorbent, compost and activated sludge and was characterized by various analytical techniques such as SEM, XRD, FTIR and BET etc. Batch biodegradation study of toluene at different concentration was done for a period of 100 hours and from the batch study it was found that at 10 ppm toluene concentration adsorbent shows a removal percentage of 100 at 100 th hour and at 50 ppm it shows a removal percentage of 80 at 100 th hour and finally at 100 ppm the removal percentage was about 95 %.

Keywords: Plastic Pyrolysis, Biodegradation, Volatile Organic Compounds, Activated Carbon

12-23

MICROPLASTICS CONTAMINATION IN BIVALVES OF ECONOMIC IMPORTANCE FROM BEYPORE ESTUARY, SOUTHERN INDIA

Magesh N.S. and Ajith K.V.

KSCSTE-Centre for Water Resources Development and Management, Kozhikode, Kerala 673 571, India

Background: Accumulation of microplastics in the aquatic environment may enhance their bioavailability to aquatic organisms such as bivalves which is susceptible to microplastic ingestion due to their prey size similarity, ecological niche and food web transfer. In this context, the study aims to ascertain the microplastic contamination and characterization of a bivalve (green mussel - *Perna viridis*) collected from the Beypore estuary, Southern India.

Method: Bivalve mollusks representing mussel (*Perna viridis*) was collected from the Beypore estuary. The digestion, extraction, and identification of microplastics from the bivalve tissue were adopted from standard protocol. Quality control measures were adopted to minimize the external contaminations.

Results: The abundance of microplastics in the bivalve (*Perna viridis*) from the study area has shown a detection rate of 80% (24 out of 30 samples). The mean microplastic concentration in the bivalve is 2.86±2.28 items/individual and 1.14±1.10 items/gram of wet weight. Morphologically, various size, color and shapes of microplastics were observed in the bivalve species (*Perna viridis*). The size of the microplastics in the studied species ranged from 100 to 3000 µm. Microplastics representing flakes, films and fibers are the dominant shape observed in the species. Transparent and white colored microplastics are the dominant one observed in the species. The dominant polymers observed in the species are polyethylene (PE) and polypropylene (PP).

Conclusions: The use of plastics is likely to rise in future, the abundance of microplastics in the study area is expected to increase. Moreover, adsorption of organic and inorganic compounds in the surface of microplastics acts as a vector to the bivalves. Continuous monitoring of microplastics at catchment scale followed by strict plastic disposal policies need to be implemented to curb the microplastic pollution in the study area.

Keywords: Microplastics, Perna Viridis, Accumulation, ATR-FTIR, Beypore Estuary, Kerala

12-24

EVALUATING CHILLI GERMPLASM FOR TOLERANCE AGAINST LEAF-CURL MOSAIC COMPLEX VIRUS (LCMCV) DISEASE: A COMPREHENSIVE SCREENING USING CONVENTIONAL AND MOLECULAR APPROACHES

Varsha P Vengilat, Seeja. G, Joy .M, Radhika N.S, Pratheesh P. Gopinath

Department of Genetics and Plant Breeding, College of Agriculture, Vellayani, Trivandrum

Background: Chilli (*Capsicum* spp.) is a crucial cash crop globally, contributing significantly to the agricultural economy. However, the cultivation of chilli is often hindered by viral diseases, with the Leaf-Curl Mosaic Complex Virus (LCMCV) being a prominent threat. This study aimed to identify and characterize chilli germplasm with tolerance to LCMCV, offering potential solutions for sustainable chilli production.

Method: A total of sixty four genotypes of chilli belonging to *Capsicum annuum*,*C. frutescens* and ***C. chinense*** were collected and screened under natural and artificial environmental conditions to unmask the resistance against leaf curl-mosaic complex. Natural screening was initiated during the summer season (January–March). Artificial screening was done by espousing graft transmission. The variables used for screening were disease vulnerability and disease incidence. The virus titre was estimated for the genotypes that were observed to be tolerant to leaf curl virus using virus-specific Deng primers. Genotypes were alienated into different clusters by implementing Mahalanobis D^2 statistics.

Results: Thirty genotypes were carefully chosen for their complex disease tolerance under natural conditions based on disease scoring, vulnerability index, and disease incidence. The results

demonstrated a spectrum of responses within the chilli germplasm, ranging from susceptibility to robust tolerance against LCMCV. The vulnerability index for leaf curl virus ranged from 0 to 80 while that for mosaic ranged from 0 to 19.4. Upto three genotypes showed 100 percentage disease incidence for leaf curl virus. Only one genotype showed 63 percentage disease incidence for mosaic disease. The graft transmission revealed that among the sixty-four genotypes, eight were tolerant to the leaf curl-mosaic complex virus suggesting the presence of novel resistance genes. At the molecular level virus-titre was estimated for the genotypes that showed leaf curl disease tolerance and high-yielding capacity so that these genotypes can be further utilised in breeding programmes for the development of high yielding hybrids with leaf curl-mosaic complex disease tolerance. The sixty-four genotypes were further alienated into nine clusters by implementing Mahalanobis D^2 statistics based on the quantitative data observed.

Conclusions: The high yielding genotypes confirmed for leaf curl-mosaic complex disease tolerance and belonging to different clusters can be used for the development of superior hybrids. It contributes to the ongoing efforts to enhance chilli crop resilience against viral diseases, particularly LCMCV ultimately ensuring the sustainability and productivity of chilli cultivation.

Keywords: Leaf Curl-Mosaic Complex, Vulnerability Index, Disease Incidence, Graft Transmission,Virus Titre Estimation, Mahalanobis D^2 Statistics.

12-25

IMPACT OF CLIMATE CHANGE ON THE BATS OF THE WESTERN GHATS, INDIA

Mahalakshmi Chelladurai[1], Sreehari Raman [1*], Thekke Thumbath Shameer[2]

1)Department of Wildlife Science, College of Forestry, Kerala Agricultural University, Vellanikkara, Thrissur 680656, Kerala, India

2)Tamil Nadu Forest Department, Advanced Institute of Wildlife Conservation, Vandalur, Chennai 600048, Tamil Nadu, India

Corresponding author email id:sreehari.raman@kau.in*

Abstract: Addressing the impact of climate change on the bats involves considering a broader ecosystem and its implications for both animal and human health. The Western Ghats Mountain ranges are a renowned global biodiversity hotspot of habitat heterogeneity and species endemicity and one of India's significant bat hotspots. However these mountain ranges were accessed as a region of Significant Concern by the IUCN conservation outlook with potential threats such as climate change, deforestation and habitat fragmentation. As bats are known to be a potential indicator of climate and forest changes, this study focused on its response to climate changes and vegetation patterns. Ecological niche models were generated using MaxEnt to predict the future variations for the IPCC climate scenario Shared Socioeconomic Pathway (SSP). The results for different SSP scenarios showed varied responses in different bat hotspots. Overall, the analyses predicted a potential loss in the habitats in all the scenarios with the retention of climatically suitable regions for a few of the bat species. Being aware of the species' responsiveness to climate change is crucial for policymakers in planning conservation initiatives. Moreover, understanding these connections is essential for the effective conservation of bats safeguarding their ecological roles, and implementing health management strategies to ensure long-term human and environmental well-being.

Keywords: Biodiversity Hotspot, Climate Change, Maxent Model, Conservation Planning, Health Management

12-26

AVOIDANCE TEST AS A SCREENING TOOL FOR SOIL QUALITY: A CASE STUDY

Krishna T.G, Joshy George and Kesavachandran C.

CSIR-National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram, Kerala

Background: Soil quality evaluation is an important activity in the present scenario of environmental contamination, especially in the urban areas. Most of the quality evaluation methods imply expensive instruments and time, and most of them are in numerical expressions which need to be extrapolated for empirical inferences. In this context, avoidance test is a rapid soil quality screening method used for evaluating the habitat function of the soil. Conducting an avoidance test with the earthworm *Eisenia fetida* as a test organism has several advantages such as low work expenses, high sensitivity levels and relatively short test period. Avoidance test using *Eisenia fetida* was conducted to screen and evaluate the habitat function of soil samples collected from varied conditions in Kerala.

Methods: The soil samples from varied conditions were collected from Municipal solid waste (MSW) legacy dumping yard at Ernakulam District, Kerala, India and suburban area of Thiruvananthapuram district, Kerala, India. Avoidance test was conducted as per ISO 17512-1: 2008. The test and control soil samples were analyzed for heavy metals using ICP-MS.

Results: No mortality of earthworms was observed after 48 hours avoidance test with different soil samples. The dual control test showed uniform distribution of earthworms in control soil. It was found that earthworms had an approach behavior towards control soil compared to test soils (86.6% for higher plastic fraction sample, 93.3% for biomining area and 86.72% for suburban area soil sample tests). Elemental analysis using ICP-MS shown remarkable enrichment of elements including toxic metals like Hg, As, Cd, Pb etc. Contamination Factor analysis showed biomining soil with maximum enrichment of elements compared to control soil. Cu showed 177.8 times enrichment, Cd 48.7 times and Zn showed 36.4 times. Also, Hg, Pb and As showed 16.7, 4.7 and 4.4 times enrichment respectively. V, Ni and Fe were enriched in plastic contaminated soils. Arsenic showed a high enrichment of 34.5 in suburban soils.

Conclusions: As per ISO 17512-1:2008, test soil with less than 20% of the worms denotes toxicity of soil. In the present study, all the test soils showed less than 20% of the worms. Hence the test soils can be classified as having limited habitat function for earthworm.

Keywords: Avoidance Test, Earthworm, Habitat Function, Eisenia Fetida, Heavy Metals

12-27

LONG-TERM ANALYSIS ON SHORELINE DYNAMICS AND COASTAL VULNERABILITY ASSESSMENT OF KERALA, SOUTH WEST COAST OF INDIA

Adil Samrood, Kavya Prabhakar and Sreejith Kalpuzha Ashtamoorthy

Department of Forest Ecology, KSCSTE-Kerala Forest Research Institute, Peechi

Background: The ever changing climate contributing to global sea level rise, tidal ranges and increasing population is leading to coastal disasters in the Low Elevated Coastal Zone (LECZ), particularly in the study area of Kerala's coastline which is marked by distinctive geographical features and high population density. This study underscores the urgency of employing remote sensing and GIS tools, like DSAS and CVI, to assess shoreline changes and develop effective policies for protection of the identified vulnerable hotspot regions of Kerala's coast.

Method: The Landsat 5, 7, 8, and 9 multi-temporal satellite datasets from 1993, 2003, 2013 and 2023 were obtained from USGS Earth Explorer. The shorelines were demarcated in the ArcMap 10.8 software and Shoreline change rates over the past three decades were calculated using the DSAS tool. A 20 year forecast of the 2043 shoreline was also generated using the DSAS results. Additionally, Coastal Vulnerability Index (CVI) was employed to assign vulnerability status to the coastal zone, using six parameters crucial to vulnerability. Finally, the CVI and forecast results were together analysed to point out the current vulnerable hotspots of the Kerala coastline.

Results: The Long-term analysis shows that highest erosional trend of -0.8 m/year at Thrissur district and accretional trends of 1.14 m/year at Kasaragod district The CVI results revealed that Ernakulam, Kannur and Alappuzha were the highest vulnerable regions, then came Thrissur, Kollam and Malappuram and Kasaragod, Calicut and Trivandrum. The vulnerable coastal hotspots of Kerala coastline developed using CVI results and shoreline forecast, indicates that erosion would continue to affect 42.22% of the transects highest in Kannur district, while accretion would occur in 57.37% of the transects highest in Thiruvananthapuram, with an average annual change rate of 0.31 meters, indicating 70-80% of Kerala's coast as highly susceptible.

Conclusions: This pioneering study provides valuable insights using GIS and Remote sensing technologies for coastal management, emphasizing the ongoing need for monitoring and mitigation against the impacts of coastal erosion and accretion trends particularly in the identified vulnerable hotspots of the Kerala coastline.

Keywords: Coastal Hotspots, Dsas, Sea Level Rise, Cvi, Kerala

12-28

DIVERSITY AND DISTRIBUTION OF MACROFUNGI IN TROPICAL WET EVERGREEN FORESTS OF SHOLAYAR, KERALA, INDIA

Baby Salini, Sreejith K. A, Parvathy M. R.

Kerala Forest Research Institute, Peechi, Kerala 680653

Abstract: Tropical forests, including the Indian tropics, especially the Western Ghats, have been

rigorously studied for their biological diversity. But the Macrofungi belong to one of the least explored groups in the tropics for their diversity and ecology. They serve diverse ecosystem functions, including decomposition and nutrient cycling. Kerala Forest Research Institute has established a long-term monitoring site in Sholayar Wet Evergreen Forest patch to conduct long-term research. Our study includes understanding the species diversity of various groups of organisms, including macrofungi. We did opportunistic sampling across the plot. Preliminary findings indicate the tremendous diversity of Macrofungi within the wet evergreen forest plot. We found 53 species belonging to 27 families. Polyporaceae was the dominant family, with nine species among the identified 53. *Filoboletus manipularis, Lentinus badius,* and *Xylaria culleni* are among the most abundant. Most of the species are found to be habitat-specific. Dead woods dominated among the substrate (70%) followed by soil (21%). These findings enhance our understanding of fungal ecology and emphasize the importance of protecting forest ecosystems to preserve a rich fungal biodiversity. Long-term in-depth studies are suggested to understand the impact of climate change on the diversity and distribution of Fungi.

12-29

CONSERVATION OF *LEPIRONIA ARTICULATA* (RETZ.) DOMIN. (GREY SEDGE), A LESSER KNOWN, OCCASIONALLY DISTRIBUTED FIBRE RESOURCE IN THE LOW LYING MARSHY WETLANDS OF ALAPPUZHA DISTRICT THROUGH CULTIVATION AND SUSTAINABLE UTILISATION WITH COMMUNITY PARTICIPATION

Ashi Anu Mathew, Shaju T. & Rajendraprasad M.

Jawaharlal Nehru tropical Botanic Garden & Research Institute, Palode, Thiruvananthapuram

Background: Worldwide, the demand for natural fibres and natural fibre based ecofriendly products has increased substantially in recent years. Reason for this trend is not only due to an enhanced awareness of the damages caused by synthetic materials on the environment and human health but also attributed to certain advantages of natural fibres such as renewability, biodegradability, high specific properties, lightweight and low cost,. *Lepironia articulata* (Retz.) Domin., known as Grey sedge, reported a decade ago from an open marsh near Pallana in Alappuzha district, Kerala, which formed the second record for the species in India and addition of the genus to the flora of Kerala. The sedge is cultivated in Thailand, Sumatra, Borneo, Vietnam and China for making straws, baskets, mats and artisanal products, and in recent times there is an extended global recognition of the plant as a natural fibre resource in replacing synthetic fibres. With the growing preference, the plant is attaining extensive demand for cultivation and utilisation.

Method: Exploration, relocation, habitat characterisation and mapping of the stands of *Lepironia articulata* (Retz.) Domin. in Pallana and its vicinity in particular, and along the coastal lowland areas of Alappuzha in general. Collection of propagules and conduct of *in situ* agro technological trials through community participation (extending to nearby wetland areas as well) leading to development of a standard package of practice for cultivation. Characterisation of the fibre and collection of available information on harvest, post harvest processing, product development and use.

Results: This programme will ultimately evolve a model scheme for cultivation and utilisation of a lesser known, lesser utilized plant resource of the wetland system aiding conservation and livelihood

enhancement of the local people.

Conclusion: The main goal is to ensure that the use of natural capital does benefit local people by maximizing the income they receive from sustainable use of wetland resources**.**

Keywords: Conservation, Sustainable Utilization, Natural Fibre.

12-30

COMPARISON OF STEM SPECIFIC DENSITY OF SELECTED TREE SPECIES ACROSS TWO FOREST TYPES IN KERALA

Arun Lal M, Hrudya A, Sreekumar V B and Sreejith K A

KSCSTE- Kerala Forest Research Institute, Peechi, Thrissur

Background: Stem specific density (SSD) is emerging as a core functional trait because of its importance for the stability, defence, architecture, hydraulics, C gain and growth potential of plants. It is suggested that the low stem density stem supports fast growth, because of cheap volumetric construction costs and a large hydraulic capacity, whereas a high stem density (with small vessels) resemble high survival, drought tolerance etc. This need to be tested in the forests of Kerala.

Method: For stem specific density (SSD) measurements, we used the water-displacement method (Pérez-Harguindeguy *et al.* 2013). A total of 12 species were used for this study. 6 species each from the dry deciduous forests (DDF) of Chinnar and Wet evergreen forest (WEF) of Sholayar. 2-3 cm long stem sections were used for volume measurements and these stem sections were then oven dried at 70°C for 72 h and their dry weights obtained. SSD (g cm-3) for each individual was calculated by dividing dry eight by volume.

Results: Stem specific density of WEF found ranged from 0.435 g/cm3 to 0.6 g/cm3 and that of DDF ranges from 0.4 g/cm3 to 0.67 g/cm3. The SSD values significantly varies across species in both forest types. The difference in SSD between DDF species (Mean = 0.573; SD = 0.09) and WEF species (Mean = 0.529; SD = 0.07) was significant (t (70) = 2.1257; p Value <0.05).

Conclusions: As expected, the SSD of DDF found high compared to WEF suggesting that in drier environment, Plants invest more in resistance over growth for survival. Significant species wise SSD variation found within forest type suggests that microclimate also influence a plants performance in an environment

Keywords: *Stem Specific Density, Kerala, Dry Deciduous Forest, Evergreen Forest*

12-31

COMPARATIVE STUDY OF WATER QUALITY BETWEEN UPSTREAM AND DOWNSTREAM OF KARAMANA RIVER, KERALA, INDIA

Athira, A. S[1], Dr. Partha Kundu[2], Dr. Simimole Sebastian[1] and Saharuba, P.M[2]

[1]Department of Zoology, Alphonsa College, Pala, Kottayam, PIN-686574
[2]Environmental Technology Division, CSIR-NIIST, Pappanamcode, Trivandrum

Background: The Karamana River, a key watercourse in Kerala, plays a crucial role in irrigating the city of Trivandrum. It originates from Chemmunjimotta and ultimately flows into the Arabian Sea near Panathura

Method: Fourteen locations in Karamana were strategically chosen for water sample collection. The selection of sampling stations was based on an approximate distance of 5 km from upstream to downstream. The collected water samples were then analyzed, and their physicochemical analysis was carried out using standard procedures.

Results: The results indicated that, apart from pH and alkalinity, all other water quality parameters exceeded the recommended levels of BIS and WHO at downstream sampling stations.

Conclusion: The water quality showed a decreasing trend from upstream to downstream, primarily attribute to organic pollutants from households and sewage water. This involves providing sewage water treatment facilities for nearby villages and ensuring adequate treatment of small-scale industrial effluents before discharging into natural water bodies.

Keywords: River Pollution, Physicochemical Characteristics, Karamana River

12-32

EVALUATION OF ACUTE TOXICITY OF FLUBENDIAMIDE (39.35%) BY *IN VIVO* AND *IN SILICO* APPROACH

Sreelakshmi. KJ[1], Angel Benny[1], Sujith. S[2], Suresh N Nair [2], Nisha R[1]

[1]Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science, Mannuthy.

[2]Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science, Pookode

Flubendiamide is a synthetic insecticide that belongs to the class of chemicals known as diamides. The major advantage of flubendiamide is its selectivity against certain pests with minimal impact on non-target organisms, including beneficial insects like pollinators and predatory insects. It is used to control a variety of pests, particularly lepidopteran insects. Indiscriminate use of these can lead to accidental poisoning also presence of residues in the produce that can be harmful. Hence this study was undertaken to estimate the toxicity of flubendamide in brine shrimp model and the possible targets using molecular docking studies

Method: Commercially available flubendiamide (39.35%) was purchased from local market. Ascending concentration of 5µg/ml, 10 µg/ml, 25 µg/ml, 50 µg/ml, 100 µg/ml, 500 µg/ml of flubendiamide were prepared by serial dilution in salt water. The experiment was conducted under uniform condition as the stock culture that was kept in laboratory. The experimental Brine shrimp group consisted of four replicate contain with each replicate contain ten Brine shrimp from healthy stocks. In the current study 10 Brine shrimp were treated with above mentioned flubendiamide and after 24 hours after exposure the number of live mobile and dead Brine shrimp were recorded. Complete mortality was observed at 500 µg/ml.

An *Insilico* study was conducted to explore the possible binding sites of compound Flubendiamide with certain receptors Caspase 8, Bax, BCl2, TNF alpha, Caspase 3, and Bad proteins of humans.

Molecular docking experiments were performed using docking program AutoDock Tools- 1.5.7.Ink .

Results: No mortality was observed at the concentration of 5 µg/mL, while 100 % mortality was recorded at concetration of 500 µg/mL. Based on the percentage of mortality, the concentration that lead 50% lethality (LC50) to the shrimp was determined by the graph of mean percentage mortality versus the log of concentration. After docking studies, the binding energies of the ligand flubendiamide for the receptors were found as -390 for Caspase 8, +502.30 for Bax, + 560.71 for Bcl2 , +748.05 for TNF alpha , + 767.71 for Caspase 3, + 834.90 for Bad. From the study it could be concluded that high concentration of flubendiamide can causes highly toxic to insects and it may causes apoptosis by activating extrinsic pathway.

Keywords: Flubendiamide, Bad, Caspase 3, Caspase 8, Bax, TNF Alpha

12-33

AIR QUALITY VARIATIONS IN THE CORPORATIONS OF KERALA

Gayathry Rajan[1], Aiswarya Kunnath Poovakka[2], Farhana Fathima[3] and Jainet P. J[1,4]

[1]KSCSTE- Centre for Water Resources Development & Management (CWRDM), Kozhikode
[2]SCSTE- Institute for Climate Change Studies (ICCS), Kottayam
[3]Kerala State Council for Science, Technology and Environment, Thiruvananthapuram
[4]Department of Civil Engineering, Indian Institute of Technology, Palakkad

Introduction: The COVID-19 pandemic and subsequent lockdowns presented an unexpected opportunity to study the impact of human activity on air quality. In Kerala, India, with its major corporations and bustling industrial zones, this phenomenon was particularly evident. This research paper proposes a comprehensive analysis of the alterations in air quality observed in the major corporations of Kerala before and after the lockdown, with a specific emphasis on key pollutants and their potential health implications.

Methodology: The study area includes five corporations in Kerala, namely Thiruvananthapuram, Ernakulam, Kollam, Thrissur, and Kannur. The data sourced from the Kerala State Pollution Control Board's (KSPCB) Water and Air Quality Directory for the years 2019, 2020, 2021, and 2022 serves as a robust foundation for analyzing changes in air quality in Kerala's major corporations. In this study, the Mann-Kendall test is employed to determine whether any trends exist in the air quality parameters from 2019 to 2022. ArcGIS Software is utilized to pinpoint various air monitoring stations in the major corporations of Kerala.

Results: After analyzing the concentration of air pollutants, such as Nitrogen Dioxide, Sulphur Dioxide, and RSPM, for the study period from 2019 to 2022 in the selected study areas, it was found that pollutant concentrations tend to be higher during the winter months compared to the summer season. The data indicates a substantial decrease in the concentrations of NO2 and SO2 in 2022 compared to 2019. In 2022, the RSPM concentration showed a minimal deviation from the levels observed in 2019.

Conclusions: A key factor contributing to the overall decrease in NO2 and SO2 levels, especially in corporations of Kerala, can be associated with the remarkable surge in the demand for electric vehicles (EVs). RSPM levels didn't change much from 2019 to 2022. The persistent high levels

of RSPM may be attributed to ongoing construction activities, a consequence of the increasing population in urban areas and concurrent road construction projects.

Keywords: Nitrogen Dioxide, Sulphur Dioxide, Respirable Suspended Particulate Matter, Air Quality Index

12-34

ETHNOBOTANICAL EXPLORATION ON WILD EBILES, PROMOTION AND CONSERVATION

Anu Theresa Antony, Roshni S., Maria Mary Gigi, Anish N.P. and Manoj P.

DBT-Rajiv Gandhi Centre for Biotechnology, Thycaud, Thiruvananthapuram - 695014, Kerala

Background: The tribal populations of Kerala have been leading a life depending on wild edibles in their daily diet for their nutritional and medicinal values. A number of little known crops and edible species found in the wild are not getting recognition, though they play a crucial role in the food security of tribal families. Due to several changes in social and environmental factors, many of these food recipes and associated knowledge of raw materials are on the verge of extinction. The documentation of tribal ethnic foods and their promotion are imperative for preserving their culture, and also for the overall health benefit of the society.

Methods: In order to document the wild edibles and their utilization among tribal people, field trips were carried out in 32 tribal settlements of Mala Arayan,Mannan, Urali, Ulladan, Kurichya, Kuruma,Paniya, and Kani communities in Idukki, Wayanad and Thiruvananthapuram districts and collected information from 95 informants. The information was collected through interviews among tribal people using structured questionnaires. Different strategies were adopted for popularization and conservation activities.

Results: A total of 144 species of plants distributed in 60 species belonging to 29 families were identified as wild edibles used by tribal communities in Idukki Wayanad and Thiruvananthapuram districts. Among these plants, 19 species are used for fruits, 15 leafy vegetables, 13 tubers, 4 for seeds, 1 for shoots and 8 species used for more than one parts. To promote and conserve wild edibles, conducted activities like establishment of nurseries, conservation plots in targeted districts, conduct awareness classes and demonstration of tribal cuisines among the tribal communities.

Conclusions: tribal communities of Kerala still possess an intricate knowledge of wild edibles, skillfully incorporating them into their culinary practices and traditional medicine. But, the modernization and changes in living conditions among tribal communities bring challenges to their ethnic food habits. By adopting a community-centered approach, it is possible to preserve the ethnic food culture among tribes in Kerala and ensuring its continuity for future generations.

Keywords: Wild Edibles, Ethnic Food, Tribes, Kerala

12-35

EVALUATION OF ACUTE TOXICITY OF DIMETHOATE IN BRINE SHRIMP (*ARTEMIA*)-*IN VIVO* APPROACH

Aiswaria Das D

Introduction: Dimethoate is an organophosphorus insecticide and acaricide and known for its broad-spectrum activity against a range of insects, including aphids, mites, thrips, and leafhoppers. It acts as a cholinesterase inhibitor and disruption leads to the accumulation of acetylcholine, causing overstimulation of the nervous system and eventually leading to the death of the insect. Even though considered safe at recommended doses, there is a chance that it can cause accidental poisoning by oral route, dermal exposures and environmental contamination over agricultural practices. Commercial formulations of pesticides are having better penetrability and hence pose more risk for poisoning and also may contain contaminants that can be synergistic.

Brine shrimp (*Artemia*) are small, aquatic crustaceans that inhabit saltwater environments, particularly salt pans, salt lakes, and coastal lagoons. They are important in aquaculture and as a food source for various marine organisms. Brine shrimp are commonly used in laboratory settings and in the aquarium industry due to their ease of cultivation and their ability to survive in a dormant state known as cysts. he brine shrimp lethality bioassay is widely used in the evaluation of toxicity of heavy metals, pesticides, medicines especially natural plant extracts and etc. It's a preliminary toxicity screen for further experiments on mammalian animal models. Hence this study was undertaken to find out the toxicity of commercial formulation of dimethoate in brine shrimp.

Materials And Method: Commercially available Dimethoate was purchased from local market. Stock solution Dimethoate was prepared using 150µl in 100 ml of salt water with concentration 50mg/ml. From this stock solution 50mg/ml, 10mg/ml, 1mg/ml, 0.01mg/ml, 0.001mg/ml, 0.0001mg/ml concentrations were prepared by serial dilution using salt water.

The experiment was conducted under uniform condition as the stock culture was kept in the lab. Small quantities of dry cysts of Artemia were sprinkled into the dark, larger chamber. Yeast solution 0.06% was added to the hatching chamber for every liter of salt water to feed the larvae after 24 hours, The experimental group comprised four replicates, with each replicate containing 10 healthy Brine Shrimp from established stocks. In this experiment, 10 Brine Shrimp were exposed to varying concentration of Dimethoate, for 24 hours. After the treatment, the number of live, mobile and deceased shrimp were recorded.

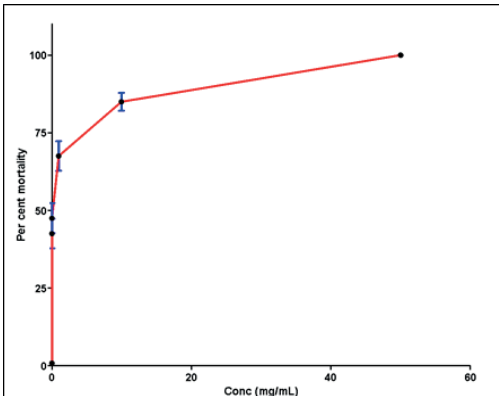
Result and Discussions: *In vivo* toxicity in brine shrimp

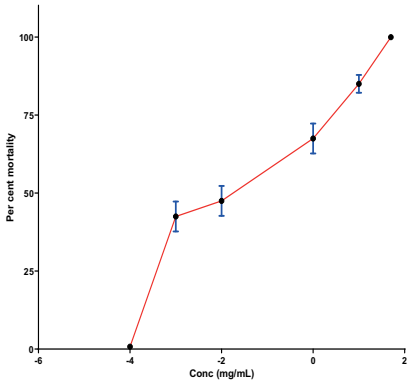
No mortality was observed at the concentration of 0.0001mg or 0.1 µg/ml, while 100% mortality was recorded at the concentration of 50mg or 50000µg/ml. The EC50 is 0.0064 and log EC50 is 0.1702.

<u>95% Confidence interval</u>

EC50 = 0.0028 to 0.0145

Correlation coefficient R2 = 0.6128





12-36

EVALUATION OF ACUTE TOXICITY OF DIAFENTHIURON ON *DAPHNIA MAGNA*

Gouri krishna C., Nimisha M. A., Sherin Thomas, Angel Benny, Archana Raj, Suresh N. Nair, and Nisha A. R.

Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Science Mannuthy.

Background: Diafenthiuron, an insecticide and acaricide widely utilized in agricultural crop protection, exhibits high toxicity towards non-target organisms. Despite its prevalent use, there is limited understanding of the developmental toxicity of diafenthiuron and its underlying mechanisms. This study aimed to investigate the developmental toxicity of diafenthiuron in *Daphnia magna*, a common aquatic model organism. Diafenthiuron, classified as a pesticide and specifically an insecticide, belongs to the thiourea group.

Method: The experiment was conducted under controlled conditions with two replicates, each containing ten *D. magna* neonates sourced from healthy stocks. Serial dilutions from the stock solution produced concentrations of 3 µl/ml, 9 µl/ml, 30 µl/ml, 60 µl/ml, 100 µl/ml, 400 µl/ml, and 1 µl/ml using distilled water. Following exposure, 10 *D. magna* were treated with various concentrations of diafenthiuron, and after 24 hours, the number of live, mobile, and dead daphnia were recorded.

Result and conclusion: A Kaplan-Meier Survival curves graph revealed 100% mortality at both the highest (1000 µg/ml) and lowest (3 µg/ml) concentrations, indicating a concentration-dependent increase in mortality rate. This analysis underscores the high toxicity of diafenthiuron to *D. magna*.

12-37

DIVERSITY AND VERTICAL STRATIFICATION OF HERPETOFAUNA IN A TROPICAL WET EVERGREEN FOREST OF SOUTHERN WESTERN GHATS, KERALA

Akshara Madhu [1], Sreejith Sivaraman [1*], Prejith M P [1], Sandeep Das[1,2], Peroth Balakrishnan[1] and Sreejith K Ashtamoorthy

[1]Department of Forest Ecology, KSCSTE-Kerala Forest Research Institute, Peechi, Thrissur, Kerala
[2]Centre for Emerging Tropical Disease, Department of Zoology, University of Calicut, Thenhipalam, Kerala
**Corresponding author email id: sreejithsivaraman296@gmail.com*

Background: Tropical forests are characterized by vertical distribution of plant biomass that includes wood, leaves, fruits and flowers, leading to stratification of microhabitats and resources for various organisms. In general, forests with greater vertical heterogeneity are expected to host more diverse faunal communities. The aim of our work is to study the diversity and vertical stratification of herpetofauna community in a tropical wet evergreen forest.

Method: The study looked at the vertical stratification of herpetofauna in a 10-hectare permanent plot of tropical wet evergreen forest in the Southern Western Ghats, Kerala from the ground up to the canopy layer. Samples from the ground, understorey, subcanopy, and canopy strata were taken from January 2022 to June 2023. We have used a combination of methods including Visual Encounter Survey (VES), scan searches and night surveys for both reptiles and amphibians, and call survey for amphibians. VES and scan searches involve for amphibians and reptiles in each of the micro-habitat, including the underside of rocks, stones, leaf litter and fallen branches or wood for finding species that take refuge under them.

Results: The different strata of forest community - from the ground, understorey, subcanopy, and canopy were observed for herpetofauna. The study revealed presence 81 species belongs to twenty-five families. Ground had the highest species richness with 47species, which subsequently declined in the canopy. Overlapping stratification was observed in several species which is an interesting topic for further study.

Conclusion: These findings show that distinct species are hosted by the understorey and the canopy, which means that sampling the understorey alone—a frequently used technique in biodiversity surveys—may underestimate the amount of species richness in a given region. Further detailed species-specific studies are required on the occurrence of each species at different strata for an in-depth knowledge of particular species role, interactions and function in the ecosystem.

Keywords: Sholayar, Herpetofauna, Vertical Stratification, Biodiversity

12-38

SITE SELECTION FOR RAINWATER HARVESTING STRUCTURES IN ECO-RESTORATION SITE AT CHEMBIKUNNU, THRISSUR

Megha K. B[1], Soorya S[2*], Pawan S. Wable[2], Aswathi K. Vijayan[2] and Sandeep. S[2]

[1]Sree Sankara College, Kalady, Ernakulam, India - 683 574
[2]KSCSTE-Kerala Forest Research Institute, Peechi, Thrissur
Corresponding author email id:sooryas@kfri.res.in*

Background: Human activities and climate change have a negative impact on the structure and function of forests, leading to their degradation. This poses a threat to millions of people who rely on forests for goods and services, affecting both ecosystems and society. To address this issue, Kerala Forest Department is moving towards eco restoration, and several rainwater harvesting (RWH) structures will be made in the forested area associated with the restoration works. This study focuses on identification of potential zones for RWH structures using Remote Sesning and GIS in two micro watersheds at the eco-restoration site in Chembikunnu, Wadakkancherry forest range, Thrissur.

Method: A site specific desirable criteria is prepared based on literature reviews. Ideal locations for RWH and recharge structures for the study area were determined using the developed desirable criteria and the Boolean logic method. Further these locations were again prioritized and the number of structures to be made were finalized based on cost-effectiveness and socio-hydrological conditions.

Results: The location identified using the geospatial techniques indicate that approximately 33.07 Ha and 6.81 Ha of the Basin 1 and Basin 2 are suitable for staggered trench, and 53.12 Ha and 13.00 Ha are suitable for terracing. Additionally, 2.51 km and 0.46 km, as well as 0.62 km and 0.48 km, are prioritized for brushwood check dams and check dams, respectively in Watershed 1 and 2. Furthermore, 0.12 km and 0.66 km of Basin 1 and Basin 2 are prioritized for gully plugs, and 0.64 km and 0.41 km are suitable for percolation tanks. Lastly, 0.86 km and 0.05 km of stream length are identified as ideal for ponds along the stream.

Conclusions: Manually selecting suitable regions for RWH structures through field visits, especially in larger forest areas, poses challenges. This study employs geospatial techniques to overcome this difficulty and identify RWH sites/zones using a reliable methodology. The major findings indicate that the study area is suitable for constructing various RWH structures, such as brushwood check dams, gully plugs, check dams, percolation tanks along streams, and ponds along streams in the eco-restoration area of Chembikunnu, Wadakkancherry Forest Range, Thrissur. Construction of RWH structures at identified locations avoids further increases in erosion and damage due to unscientific practices of RWH construction at unstable sites.

Keywords: *GIS, Kerala Forest, RWH Structures, Site Selection Watershed*

12-39

EVALUATION OF WATER QUALITY STATUS NEAR AN INDUSTRIAL SITE AND ITS IMPLICATIONS – A CASE STUDY FROM POOVATTUPARAMBA, KOZHIKODE DISTRICT, KERALA

Sruthi K.V [1] and Akash Raj[2]

[1]KSCSTE - Centre for Water Resources Development and Management, Subcenter, Neyyattinkara, Trivandrum
[2]Department of Civil Engineering, Manipal Institute of Technology

Abstract: The present study was designed to assess the quality of groundwater in relation with Heavy metal contamination and its implication to human health. The groundwater quality in and around a Battery manufacturing unit in Poovattuparamba in Kozhikode district was evaluated using water samples collected from 17 sites during January, February and May. 17 Water quality parameters including pH, Electrical conductivity (EC), Total dissolved solids (TDS), Total hardness (TH), Total alkalinity (TA), Calcium hardness (CaH), Calcium, Magnesium, Sulphate (SO_4^{2-}), Turbidity, Chloride (Cl^-), Sodium (Na), Potassium(K), Iron (Fe), Nitrate, Phosphate, Acidity and the Bacteriological parameters Total colliform and E coli and Heavy metals including Lead(Pb), Copper(Cu), Manganese(Mn) and Zinc(Zn) were analyzed and recorded. 2 soil samples collected were analyzed and physicochemical parameters including pH, EC, Chloride, Alkalinity, Calcium, Magnesium, Sulphate, Sodium, Potassium and Heavy metals Lead (Pb) and Copper(Cu) were recorded. The results of the analysis were compared with the standard guidelines proposed by Bureau of Indian Standards (BIS) of water quality. pH values for all the water samples are found deviating from drinking water standard by BIS and 75 % of water samples deviated from accepted Turbidity value. Other Physico-chemical parameters such as EC, TDS, Total Hardness, Ca, Mg, Sulphate, Cl^-, falls within the permissible limit, and Heavy metal such as Pb concentration found in 2 well water samples and Mn concentration found exceeding in one well water sample. From the results of Surface soil analysis of the two samples detected a high concentration of SO_4^{2-} and Lead (Pb). The Study revealed that the Ground water quality around the industrial area cannot consider as good quality as it is highly Turbid and a high variation in pH. Spatial interpretation maps of the water quality parameters were created using the ArcGIS software served as an important information to understand the groundwater quality along the area and for identifying the high potential zones.

12-40

LASER-ASSISTED ESTIMATION AND REMOVAL OF POLLUTANT IRON IN WATER

Anju Abraham P [*1], Swapna M S [2], and Sankararaman S [1]

[1]Department of Optoelectronics, University of Kerala, Trivandrum 695581, India
[2]Laboratory for Environmental and Life Sciences, University of Nova Gorica, Vipavska 13,Nova Gorica, SI-5000, Slovenia
**Corresponding author email id:* sranju.opto@gmail.com

Background: The research addresses heightened iron levels in bore wells near Trivandrum, Kerala, impacting groundwater quality in the Kazhakoottam region. Dissolved iron, originating from the

Earth's crust, introduces aesthetic and health concerns, including metallic taste, discoloration, and plumbing issues. Traditional detection methods like colorimetry and atomic absorption spectroscopy face limitations, prompting the exploration of the thermal lens technique for its cost-effectiveness and sensitivity. The study focuses on a two-stage oxidation and filtration process in Meenamkullam Panchayath, aligning with the World Health Organization's iron level guidelines for drinking water. This research bridges scientific understanding with practical water purification solutions, particularly beneficial for rural areas facing iron contamination challenges.

Materials and Methods: This study investigates elevated iron levels in bore wells near Trivandrum, Kerala, employing a comprehensive analytical approach. The combustion method is used to synthesize iron oxide nanoparticles, which serve as a reference for calibrating the iron content in bore well water samples. X-ray diffraction and UV-visible spectrophotometry analyze the structure and optical properties of both the synthesized iron oxide and bore well water samples. A calibration curve is then plotted for accurate quantification and estimation of unknown contaminants in the water samples, utilizing a highly sensitive thermal lens setup. Additionally, a two-stage oxidation and filtration process are implemented for purification, and pH measurements are recorded before and after the purification process to assess its effectiveness.

Result and discussions: Results from XRD and UV-visible spectra demonstrate a close match between the nanoparticles and borewell water samples, confirming the presence of iron oxide. The thermal lens setup measures signal intensity using iron oxide nanofluids at different concentrations, producing a calibration curve with excellent linearity. The limit of detection for iron in water samples is established at 0.1 ppm, and the estimated concentration of iron oxide is 38 ppm. Implementation of a two-stage oxidation and filtration process, using potassium permanganate and hydrogen peroxide, leads to a significant reduction in iron content from 43.44 ppm to 0.43 ppm. This process also correlates with a decrease in TDS, conductivity, and turbidity, signifying an enhancement in water quality.

Conclusion: This study emphasizes the implementation of a low-cost and simple water purification system near Trivandrum, Kerala. It uses a highly sensitive thermal lens setup for iron detection and quantification, complemented by a two-stage oxidation and filtration process for purification. The successful calibration, detection, and purification processes highlight the study's comprehensive approach, offering a practical solution for addressing elevated iron levels in water sources.

Keywords: Iron, Water Purification, Thermal Lens, Limit Of Detection

12-41

ENDOCRINE DISRUPTING CHEMICALS IN VEMBANAD ESTUARINE AQUATIC FAUNA: A COMPREHENSIVE BIOMONITORING STUDY AND HUMAN HEALTH RISK ASSESSMENT USING UNTARGETED METABOLOMICS

Nasreen Nazar [1,2], Niladri Sekhar Chatterjee[1]

1)National Referral Laboratory, ICAR – Central Institute of Fisheries Technology, W. Island, Kerala
2)School of Marine Sciences, Cochin University of Science and Technology, Kochi, Kerala

Background: Endocrine Disrupting Chemicals (EDCs), classified as Emerging Contaminants (ECs), raise global concerns due to their detection and hormonal effects, leading to bans in various

countries. This study marks the first assessment of EDC presence in Vembanad Estuary (VE) aquatic animals, utilizing a validated multiresidue method. Human Health Risk Assessment (HHRA) employed an untargeted metabolomic approach to evaluate the metabolomic effects and identify biomarkers. The study explored the cocktail effect of contaminants under environmentally relevant concentrations (ERC) for an extended duration.

Method: A validated multiresidue method in GC-MS/MS and LC-MS/MS detected EDCs in VE samples. HHRA, based on Hazard Index (HI) values, assessed non-carcinogenic risks for VE dwellers. Untargeted metabolomics, utilizing HPLC-Q-Orbitrap MS, investigated metabolomic changes in Wistar albino rats exposed to an EDC mix (ERC) over 60 days. Chemometric and multivariate statistical analyses detected altered metabolites, with Metaboanalyst software evaluating biomarkers and altered metabolomic pathways.

Results: Fish, crustacean, and clam samples (N=608) revealed around 81 contaminants, with 2-Phenylphenol, Metalaxyl, and PAH dominating at mean values of 12 ng/g, 25 ng/g, and 15 ng/g, respectively. HHRA, based on HI values below 1, indicated low to moderate non-carcinogenic risks from consuming contaminated species. Untargeted metabolomics identified altered phospholipids, amino acids, and more, suggesting chronic exposure's impact on energy, lipid, and hormonal metabolisms.

Conclusions: This study, measuring EDC levels in VE aquatic species, conducted detailed HHRA and unveiled contamination levels. The untargeted metabolomics approach demonstrated chronic EDC exposure's effects on crucial metabolic pathways, indicating potential long-term adverse outcomes. These findings offer essential insights for policymakers and coastal communities, facilitating informed intervention planning.

Keywords: Vembanad Estuary, Endocrine Disrupting Chemicals, Risk Assessment, Untargeted Metabolomics, Biomarkers, Metabolomic Pathway Analysis

12-42

CLIMATE RESILIENT ADAPTATIONS IN *GLUTA TRAVANCORICA* BEDD. : A MODEL STUDY OF CLIMATE CHANGE IMPACT ON ENDEMIC AND THREATENED TREES OF THE WESTERN GHATS

Jose P.A. and Anuraj. K

KSCSTE- Kerala Forest Research Institute, Peechi, Thrissur- 680 653

Background: The functional dynamics viz. phenology, reproductive biology and biotic interactions of *Gluta travancorica* Bedd. (Anacardiaceae), an endemic and threatened tree of the southern Western Ghats was reinvestigated after twenty-five years to understand the implications of climate change and micro habitat changes on natural dynamics along with resilience strategies evolved by the species.

Method: Populations of target species were identified in the shola forests in Western Ghats, Kerala. The phenological events along with anthesis, stigma receptivity period and insect interactions were studied and analyzed with the temporal data of the species in conjunction with climate change and habitat changes.

Results: A delayed and extended flowering, with subsequent fruit aging aligning with the onset of the southwest monsoon, was found to be an ecological adaptation to facilitate natural regeneration. The rare occurrence of vivipary recorded is considered a genetic adaptive strategy reflecting environmental challenges in the degraded Shola ecosystems to ensure the seedlings as the phenomenon is an adaptation of its allied species habituated in peat swamps and tidal rivers of Malayan peninsula. The shift in anthesis timing from night to daytime, extended stigma receptivity period and new insect incidence recorded were treated as a biological adaptation to increase the insect interactions for enhancing the reproductive efficiency of the species.

Conclusions: The findings of the study highlight the adaptations developed by *G. travancorica* as part of resilience to changing climate and microhabitat conditions in the shola forest ecosystems of Southern Western Ghats.

Keywords: Phenology, Reproductive Biology, Biotic Interactions, Climate Change, Adaptations

12-43

ASSESMENT OF ENVIRONMENTAL QUALITY STATUS OF A TROPICAL URBAN CANAL AND EVALUATION OF THE SCOPE OF ADSORPTION-BASED HEAVY METAL BIOREMEDIATION USING MICROALGAE

Khadeeja Badarudheen Theparambil[1], Anchitha M.P[2], Riyara K. Renjith[1], Digilarani .M[2], Er. Ihjas. K[2]

1) School of Environmental Studies, Cochin University Of Science & Technology, Kochi, Kerala
2) Ecology & Enviroment Research Group, Kscste-Centre For Water Resources Development And Management, Kozhikode, Kerala

Background: Developmental activities in urban areas lead to water quality degradation through eutrophication and pollution, with canals being waste receivers stressed with nutrient and metal loads. The study evaluates the water quality of a polluted canal in Kerala and explores bioremediation as a solution. It identifies a local microalgae species for heavy metal bioremediation, which effectively removes nutrient enrichment from wastewater due to human activities.

Method: This work is to evaluate the optimum range of pH & contact time for adsorption of heavy metals using marine algae *Chlorella Vulgaris. Chlorella Vulgaris* were grown in Tap media and incubated at 25°C under continuous illumination provided by a daylight fluorescent tube. Heavy Metals such as Nickel, Cadmium & Lead at 10ppm were used with pH maintained at 2, 4, 6, & 8 using 1N NaOH & 1N HCL. The heavy metal solutions are kept in rotary shaker for 60, 90 and 120 minutes for adsorption. The HM concentration was then analysed using ICP-OES.

Result: The results of present study showed that at an optimum contact time of 60min for metal, Nickel and contact time of 90min for metals cadmium and lead have an optimum contact time of 90min with equilibrium pH of 8 via *Chlorella vulgaris*.

Conclusion: This work suggested that the biomass of *Chlorella vulgaris* is an extremely efficient and environmentally friendly biosorbent for the removal of nickel, cadmium and lead from aqueous solutions, which may be applied on a natural environment.

Keywords: *Heavy Metal, Water Pollution, Bioremediation, Microalgae Chlorella vulgaris*

12-44

COMPREHENSIVE ASSESSMENT OF TRIFLURALIN TOXICITY: *IN VIVO* EVALUATION ON *ARTEMIA SALINA* AND *IN SILICO* EXPLORATION OF CYTOTOXIC, GENOTOXIC, AND CARCINOGENIC TARGETS

Gopika R, Bibu John Kariyil, Archana Raj, Suresh N. Nair

Department of Veterinary Pharmacology and Toxicology, College of Veterinary and Animal Sciences, Mannuthy - 680651, Thrissur, Kerala Veterinary and Animal Sciences University

Background: *Artemia salina*, commonly referred to as brine shrimp, exhibits high tolerance to salinity variations, a remarkable resistance to extreme environmental conditions, and possesses the unique ability to generate dormant cysts that can hatch under favorable conditions. The unique attributes of *Artemia salina* render it indispensable in various domains, contributing significantly to aquaculture, research, and education. Trifluralin, a pre-emergence herbicide extensively employed in agriculture to manage the proliferation of grasses and broadleaf weeds in crops such as soybeans, corn, and cotton, operates by impeding weed seed germination. Previous *in vitro* studies proved trifluralin to be cytotoxic, genotoxic and carcingenic in mammalian cell lines. Hence the present study was done to assess the in vivo impact of trifluralin on *Artemia salina* and to explore the cytotoxic, genotoxic and carcinogenic targets of trifluralin using computational methods.

Methods: In assessing the toxicity of trifluralin on *Artemia salina*, concentrations ranging from 650 µg/ml to 0.0065 µg/ml were employed to determine mortality rates after 24 hours of administration of trifluralin, thereby establishing its acute LC_{50}. *In silico* studies were conducted using various proteins of cytotoxicity, genotoxicity and carcinogenecity to explore the molecular targets of trifluralin.

Results: The calculated LC50 value for trifluralin against *Artemia* was determined to be 1.039 µg/mL. Complete mortality occurred at the highest concentration of 650 µg/mL, while no mortality was observed at the lowest concentration of 0.0065 µg/mL. Furthermore, *in silico* studies unveiled that trifluralin selectively targeted various proteins, eliciting cytotoxic, genotoxic, and carcinogenic effects.

Conclusion: These findings contribute to a comprehensive understanding of the multifaceted impact of trifluralin on *Artemia salina*, bridging the gap between experimental observations and computational predictions in the assessment of its potential ecological implications.

Keywords: Artemia Salina, Trifluralin, Herbicide, Toxicity Assessment, In Silico Studies

12-45

ENVIRONMENTAL FACTORS DETERMINING HOUSE SPARROW (PASSER DOMESTICUS) HABITATS: STUDY BASED ON URBAN AREAS OF TIRUR, MALAPPURAM

Rahina K. [1], Sumith Satheendran S. [2], Dhanya R. [1]

[1]*Thunchath Ezhuthachan Malayalam University, Tirur, Kerala*
[2]*Amrita-Natural Resource Monitoring Laboratory (Amrita-NRML), Earth Observation Group Department of Chemistry, AmritaVishwa Vidyapeetham, Amritapuri Campus, Kerala*

Background: The house sparrow (Passer domesticus) is one of the most abundant birds in the world. They originated in the Middle East and are distributed around the globe. After urbanization, the House sparrow population has declined tremendously all over the country. Sudden changes in the habitat due to urbanization, radiation from mobile towers, lack of roosting trees, usage of plastic packs instead of conventional package measures, monoculture, pesticide use, and the resulting air and water pollution are considered the causes of population decline of House sparrows.

Methods: The study was conducted in the suburban center of Tirur (10.9028° N, 75.9695° E), Malappuram district, during pre and post-monsoon seasons. The point Count method was used, where random points were chosen. Biotic and Abiotic factors that influence the House sparrow population were collected from these points. They were compared for used and unused points. Also, habitat modeling was done using GIS technology.

Results: The average population of House sparrows during the two seasons was 44.5. The used points were found inside or near the market area. The number of buildings, shops that can provide food for sparrows, shutter hoods, and old buildings was high at used points. Tree count was less, and artificial nests were found at these points. Using IDW analysis, it was clear that sparrows chose points with more shops that can provide food for them and shutter hoods with lesser heights. The GIS analysis also provided evidence that sparrows in this area had to compete with pigeons as their feeding niche overlaps.

Conclusions: This study concluded that the House sparrow population in this area has decreased from 2017. The effects of urbanization on their population decline are visible from the collected data.

Keywords: House Sparrow, Population Decline, Niche, Remote Sensing And GIS, IDW

12-46

ASSESSMENT OF IRRIGATIONAL SUITABILITY OF ABANDONED QUARRY POND WATERS OF PATHANAMTHITTA DISTRICT, KERALA

Mridul K, Dipu Sukumaran

Centre for Water Resources Development and Management, Kozhikode

Background: The water resource scenario of Kerala is an alarming concern. The ever-increasing demand for the resource makes us look for sources of water which was previously overlooked. Most of the crystalline quarries of Kerala after their extraction is abandoned as such. The rain water run-off is collected in these quarries and the study aims to find the suitability of these waters for agriculture.

Methods: 40 quarries were identified from which 28 were selected and sampled. Samples collected during pre-monsoon and post-monsoon and were analysed for major cations and anions according to standard methods. Piper diagram, Gibbs diagram was utilized to determine the Hydrochemical characteristics of water and derived ratios like Sodium Absorption Ratio, Soluble Sodium Percent, Kelly's Ratio were used to assess the suitability of water for irrigation.

Results: Out of 28 samples analyses, majority of the water samples were found to be of mixed type, followed by Sodium-chloride type and Magnesium-Bicarbonate type. The order of abundance of

cations and anions are as follows respectively:Na>Ca>Mg>K, HCO3>Cl>SO4.The Gibbs diagram reveals that the waters are of precipitation dominance category. Agricultural suitability of the samples is found to be suitable regarding Sodium Absorption Ratio and Kelley's Ratio. But Soluble Sodium Percent of the samples are found to be of different classes: Permissible good and excellent in that order of abundance.

Conclusions: The study undertaken can be concluded as the water collected in the abandoned quarries of Pathanamthitta are majorly of mixed type water with precipitation dominance. As far as the suitability for irrigation is concerned, except for 2 quarries the water samples were found to be suitable.

Keywords: Abandoned Quarry, Water Quality, Irrigation Suitability, Agriculture

12-47

ANALYSIS OF GEO –ENVIRONMENTAL FRAGILITY OF THE MINING AFFECTED AREA IN AND AROUND MADAYIPARA CLAYMINE, KANNUR, KERALA, INDIA

Dr.Lalitha M[1] and Mohammed Aslam M A[2]

[1]GHSS Kottyam Malabar, Kannur, Kerala, India
[2]Department of Geology, Central University of Karnataka, Kalaburagi, Karnataka, India.

Abstract: Rigorous mining activities may destroy the hilly areas, fertility of agricultural lands, pollution of groundwater, deforestation, etc. which in turn affect the entire ecosystem. Higher rates of erosion and leaching processes cause considerable effects to the running water and drainage network. Mining processes beyond a suitable depth also severely affects soil fertility, geomorphologic units, groundwater and land use of area around it.

The geo-environmental impact of clay mining in Madayippara (Madayipara) area of Kannur District, Kerala State, India has been attempted in this study. Intensive field studies have been carried out in this study.

Keywords: *Madayipara; Clay Mining; Geo-Envieonmental Effects*

12-48

RELEASE OF POTASSIUM FROM WASTE MICA UNDER ACIDIC CONDITIONS

Navya. M and Sandeep. S

KSCSTE- Kerala Forest Research Institute, Peechi, Thrissur, 680653

Background: Potassium (K) is the third major essential macro-nutrient required for plant growth and development, and it is frequently used as a fertilizer to increase crop yields. Intensively managed agriculture has led to a greater removal of K from the soil, and as a result, many Indian regions today have soils that are K-deficient, which is one of the factors limiting agricultural productivity. Mica especially waste mica can effectively be used as a source of K, if modified or altered by some suitable chemical or biological means.

Method: The mica used in this study was purchased from Sri Ramamaruthi vermiculite mines. They were crushed and ground to pass a 0.2 mm sieve before acid activation. To determine the rate of K release 10 g of the mica added to 100 ml of sulphuric acid (H2SO4) solution of 1 M concentration under continuous shaking for 24 h, 48 h, and 72 h at room temperature. The acid treated mica samples were characterized by X-ray diffraction (XRD) and X-ray fluorescence spectroscopy (XRF). All treatment solutions were collected and analysed using flame photometer for analysing the release of potassium.

Results: Raw mica shows well-defined reflections at 2θ values of 8.86◦ and 26.67◦ (corresponding to the d values of 1nm and 0.33 nm), which are typical characteristic peaks of mica. The results indicate that when the raw mica was treated with 1M H2SO4 for 24h, 48h and 72h the release of potassium was 1.43%, 1.58% and 2.08% respectively. As the contact time increases, K+ ions are more easily removed.

Conclusions: The release of potassium from waste mica was very high under acidic conditions. Thus, this work establishes the use of waste mica as an alternative source of K-fertilizer for crop production in acidic soils.

Keywords: Mica, K Release, K Fertilizer, VESTA

12-49

PATHOLOGICAL INVESTIGATIONS AND MOLECULAR DETECTION OF LITTLE LEAF AND WHICHES' BROOM DISEASES ASSOCIATED WITH JACKAL JUJUBE (*ZIZIPHUS OENOPLIA* L.) CAUSED BY PHYTOPLASMA 16SRVF STRAIN IN KERALA

Murali R., Shambhu Kumar, Jithu U. Krishnan, Donald James and Jain Mary Jose

KSCSTE-Kerala Forest Research Institute, Peechi, Thrissur, Kerala.
Corresponding author email id: rmurali@kfri.res.in

Background: Jackal jujube (*Ziziphus oenoplia* L.) belongs to the family Rhamnaceae is a perennial, flowering and thorny shrub distributed in Kerala, Karnataka, Andra Pradesh, Telangana and Maharashtra particularly in the Western Ghats, widely used in different kinds of herbal medicines. The plant produces alkaloids known as ziziphines has a long history of using them as herbal medicine. Despite its great medicinal importance, this species is highly susceptible to little leaf and witches' broom diseases caused by phytoplasma. This host is suspected to have a possible role in the epidemics of sandal spike disease as an alternate host.

Methods: The healthy and infected samples of Jackal jujube plants showing typical little leaf and witches' broom symptoms were collected from different locations of Wadakkanchery forest (10.71232° N latitude, 76.26483° E longitude) and Kerala Forest Research Institute campus, Kerala India for proper pathological investigation. The detailed symptomatological and scanning electron microscopic characteristics were observed. Finally, to confirm the identity of pathogens, PCR based detection and identification were done using universal phytoplasma primers, and nested PCR with R16F2n/R16R2 primers followed by molecular sequence phylogenetic analysis.

Results: The clear symptoms of phytoplasma infection were observed in the form of severe reduction in leaf size and length, yellowing, huge number of small leaves appeared in cluster which resembling whiches' broom compared to healthy plants. The scanning electron microscopic analysis revealed the presence of phytoplasma pleomorphic bodies (400-1600 nm) lacking cell wall were observed in the phloem sieve tubes of stem sections from diseased plant and not in healthy plants. Direct PCR of amplification phytoplasma 16S rRNA gene yields 1.8 Kb products and in nested PCR amplification 1.3kb product was obtained from the diseased plants but not from the healthy. Cloning and molecular sequence analysis showed the highest nucleotide identity (100%) with *Candidatus Phytoplasma balanitae* isolate JWB_K15 (MN902087) which belongs to 16srv-f group. Where, the sandal spike phytoplasma strain belongs to 16SrI-B. Hence the two phytoplasma strains infecting Ziziphus and Sandalwood are different at molecular level.

Conclusion: Jackal jujube is a perennial, flowering shrub has medicinal benefits is highly susceptible to little leaf and witches' broom disease. The witches' broom phytoplasma associated with Jackal jujube was identified as a member of *Ca. P. balanitae* which belongs to the 16SrV-F group. Hence, based on literature survey, this is first report of witches' broom phytoplasma diseases on Jackal jujube from Kerala.

Keywords: Plant Diseases, Phytopathogens, Ziziphus, Phytoplasma, Candidatus

12-50

FACTORS DETERMINING THE CURRENT DISTRIBUTION OF SACRED GROVES OF KERALA, AND THE NEED FOR CONSERVATION

Kavya Jeevan[1], Sreehari Raman[2], Manjusha K[1], Anbazhaghi S[1]. and Muthukumar Muthuchamy[1*]

[1]Department of Environmental science, Central University of Kerala, Periye, Kasaragode

[2]Department of Wildlife Science,College of Forestry, Kewrala Agricultural University, Vellanikkara, Thrissur-680656, Kerala, India

Corresponding author email id:mmuthukumar@cukerala.ac.in*

Abstract: Sacred groves are community-based management of natural resources enveloped with cultural beliefs. The study attempts to determine the factors affecting the distribution of sacred groves of Kerala using the Maximum entropy (MaxEnt). Locations of sacred groves across Kerala were collected through field surveys. Here, we selected five non-correlated bioclimatic variables and five variables representing human dimensions for building the final model. The results showed that road density and land use modifications in that region strongly influenced sacred groves existence. The study reveals the importance of considering the landscape for implementing developmental activities. The study's results can be utilized to effectively implement the sacred grove conservation programs (*Kavum kulavum padhathi and Devanghanam charuharitham padhathi*) and planning conservation strategies

Keywords: Biodiversity Conservation, Community Based-Management, Cultural Ecology, Maximum Entropy Model, Preservation Practices

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ESTIMATION OF PRIMARY PRODUCTIVITY AND PHYTOPLANKTON DIVERSITY IN FRESHWATER PONDS

Asha C V [*1], Rajesh N [2], Ashwini G [1], Keerthana T A[1], Dinesh K[1]

[1]Kerala University of Fisheries and Ocean Studies (KUFOS), Panangad, Kochi, Kerala, India, 682506
[2]St. Mary's Girls High School, Payyanur, Kannur, Kerala, 670307
Corresponding author email id: ashakankol@gmail.com*

Background: Primary productivity, which forms the basis of the metabolic cycle in natural aquatic ecosystems, emerges from the manipulation of biological production within a water body. Ponds, whether natural or artificial, typically small, are characterized by shallow, confined bodies of standing water, often with a muddy or silty bottom, providing habitat and nourishment for various species. Even though freshwater phytoplankton were widely studied in Kerala, there are many pond ecosystem in Kannur district are not investigated yet. In this regard, a survey was conducted to understand the primary productivity and phytoplankton diversity of freshwater ponds.

Method: A survey was conducted along five ponds of Payyanur Municipality area during October 4 2023. Pond 1, 2, 3, 4, and 5 are Payyanur Subrahmanyaswami temple pond, Mudayad pond, Alakatt pond, Ramankulam, and Muthiyalam pond, respectively. Water samples were collected and physico-chemical parameters were analyzed by standard methods. The primary productivity (gross and net production) was determined through the light and dark bottle method. Phytoplankton samples were obtained by filtering pond water through a plankton net and fixed with Lugol's iodine solution. Samples were concentrated, observed under a microscope, and identified up to the genera level using standard keys.

Results: Dissolved oxygen varied from 5.5 mg/L to 10 mg/L. The maximum value of GPP was found in pond 3 (0.31 mgC/ m3/day) followed by pond 2. The maximum value of NPP also showed the same trend. Among the stations, pond 1 having highest number of phytoplankton density (2.4*107 no./l) and lowest in pond 4 (4.5*104 no./l). Shannon diversity was maximum in pond 1 (2.9) and minimum in pond 5 (1.3). Twenty one genera belonging to four groups of phytoplankton were recorded from the five freshwater ponds. The main phytoplanktons were classified in class Chlorophyceae, Cyanophyceae, and Bacillariophyceae. In Pond 1, *Microcystis sp.* emerged as the primary contributor to algal abundance. In Muthiyalam pond, *Synura sp*. exhibited higher abundance, constituting 75% of the total phytoplankton abundance.

Conclusion: Phytoplankton analysis gives an overall idea of the environmental condition of the water body. The present study revealed that all ponds is of a better quality, although there is need to continuous monitoring for its better conservation**.**

Keywords: Primary Productivity, Phytoplankton

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AN ASSESSMENT OF QUALITY ASPECTS OF WATER FROM VELLAYANI LAKE AND SURROUNDINGS, KERALA

Divya E. B, Ranjith R*, Anamika S, Smitha V.S, and Jayasooryan K. K*

KSCSTE-Centre for Water Resources Development and Management, Kunnamangalam, Kozhikode,
Corresponding authors email id:ranjithravi7025@gmail.com, jkk@cwrdm.org*

Background: Freshwater ecosystems are the mirrors of nation's ecological wealth, playing important roles in the hydrological, biological, and biogeochemical aspects of the environment. Freshwater habitats, particularly lakes, play a critical role in climate change mitigation and adaptation. Lake water quality depends not only on natural processes such as precipitation inputs, erosion, and weathering of crustal material, etc. but also on anthropogenic influences like urban, industrial, and agricultural activities. Nowadays, Most of the freshwater resources, especially lakes are threatened due to developmental activities, over exploitation, pollution, agriculture etc. The nutrients enter the lake water through disposal of sewerages and agricultural wastes which are rich in nitrogen, phosphorous, potassium and phosphorous leads to eutrophication in lake. Lakes and their surrounding groundwater systems exhibit a strong hydrological interconnection. Groundwater can contribute to lake through seepage and underground flow or deplete the lake, thus affecting its volume and quality. Similarly, lakes can recharge groundwater aquifers by allowing water to infiltrate the surrounding soil and percolate downward, replenishing underground water sources. Changes in one system due to pollution, extraction, or natural processes can consequently impact the other, influencing their quality and sustainability. So, maintaining quality of freshwater resources is necessary for the sustainability of the society. Different water quality guidelines (WQGs) are being used worldwide to evaluate water contamination and associated risk assessment to formulate sustainable environment management strategies.

Methodology: The investigation specifically centred on evaluating the water quality of the lake and the adjacent groundwater, both facing challenges due to encroachment, over-exploitation, and agricultural activities. Parameters including physicochemical attributes (pH, EC, temperature, alkalinity, acidity, chloride, sulphate, sodium, potassium, and hardness) and nutrient levels (nitrogen and phosphorus) were analysed using standard methodologies and stringent quality protocols. An analysis of the irrigation water quality index was conducted using various quality indices, including SAR, SSP, KR, PI and KH. Vellayani Lake was sampled in February 2023 and six samples from the first segment (S1), five from the second segment (S2), and three from the third segment (S3) were collected. Groundwater samples were collected from 30 wells from the catchment area from a 2 km square grid. The observed physiochemical parameter values were compared with the standards of drinking water quality recommended by Bureau of Indian Standard irrigation water quality standard.

Results: The permissible limit of pH in freshwater is 6.5- 8.5 according to the Bureau of Indian Standard and same for the Class D type of water for the designated best use by CPCB. The pH of surface water samples ranged from 6.6 and 8.3 with a mean value of 7.5 ± 0.49 that of ground water samples were 4 to 7.1 with mean value 5.5 ±0.98. When compared to surface water, groundwater showed more acidic nature. This may be due poor management of wells and lack of proper aeration.

Irrigation suitability water from Vellayani lake was also assessed using indices such as SAR (Sodium Absorption Ratio), SSP (Soluble Sodium Percentage), KR (Kelly Ratio), Na % (Sodium

Percentage), MH (Magnesium Hazard) and PI (Permeability Index). The SAR value of surface water is 0.08 indicates that the water is excellent. The soluble sodium percentage value is 55.08, which is suitable. The value of Kelly's ratio was 1.27 which indicate that the water is marginal level. The value of magnesium hazard is 33.5. It is indicated that the water is good for irrigation. The average value of PI was 78.79. It indicate that the water is moderate level. There are significant positive correlation between EC with sodium as well as chloride and between sodium and chloride. There is no significant correlation between surface water. So, the overall result showed that the water of lake suitable for irrigation purpose. This aggressive index is determined using pH, total alkalinity and calcium hardness concentration in a given water sample. Around 18% of ground water samples and 79 % of surface water samples are moderately aggressive. 72% of groundwater samples and 21% of surface water samples shows extremely corrosive nature.

Conclusions: Vellayani Lake's environmental quality and the groundwater from its catchment region were evaluated, and the results indicated that the majority of the water's physical and chemical characteristics fell within the parameters allowed by various water quality regulations. The chemical properties of the lake water showed an increasing trend when compared to earlier research, indicating a deteriorating environmental quality that can be attributed to anthropogenic interventions. The ground water quality of catchment area was within the drinking water quality standards except for few samples. Vellayani lake is the drinking water source for 5 major panchayaths and Thiruvananthapuram corporation; and its surface and groundwater sources supports large areas of agriculture. The study indicates possible risk for such ecosystem services in the absence of management interventions.

Keywords: Vellayani Lake, Water Quality, Irrigation Water Quality Index

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NEED AND PROSPECT OF SUSTAINABLE AND INCLUSIVE LAND USE PLANNING: A CASE STUDY OF KHUGA DAM CATCHMENT, CHURACHANDPUR DISTRICT, MANIPUR.

Gegen Haokip, Dr. Prasad T.K, Rajeev S

Department of Geography, Kannur University

Abstract: This article explores the role of dams and reservoirs, acknowledging their benefits in flood control, water supply and energy generation while highlighting the significant negative impacts on the environment and communities. The primary objective is to establish a comprehensive methodology for assessing, predicting and preventing the adverse consequences of reservoirs and dams focusing on environmental preservation and providing alternative sustainability for affected communities.

Negative consequences include environmental degradation, habitat destruction, altered ecosystems, and displacement of communities, leading to social upheaval and loss of livelihoods. Reservoir construction often results in a substantial loss of cultivable lands and crucial irrigation infrastructure, impacting local economies heavily dependent on agriculture. The forced relocation of farmers exacerbates social challenges contributing to increased poverty and a ripple effect on regional development.

The article emphasizes the need for sustainable and inclusive planning in reservoir projects striking a delicate balance between development and environmental preservation. Beyond immediate impacts, reservoirs pose multifaceted challenges that require careful consideration in future water resource management. Loss of paddy land and forest cover triggers environmental consequences, including increase in shifting cultivation, deforestation and soil erosion, with displaced farmers resorting to unsustainable practices. Addressing these repercussions necessitates a comprehensive approach integrating sustainable land use practices, afforestation initiatives and community-centric development strategies.

The present study aims to guide future planning efforts, minimizing adverse effects on the environment and communities through accurate consideration of presented data.

Keywords: *Dams, Reservoirs, Environment, Displaced, Shifting Cultivation, Communities.*

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RELATIVE CALCIUM AND MAGNESIUM AVAILABILITY UNDER CONTINUOUS TEAK PLANTATIONS IN THE WESTERN GHATS

Athira Saleevan, Sandeep S.

KSCSTE-Kerala Forest Research Institute, Peechi

Teak is raised as a long duration crop in Kerala with an average period of 50-60 years. Both large plantations of forest department and teak grown by farmers teak constitute the principal plantation in Kerala. Teak is a highly calciphillic species which can extract large amount calcium from the soil. Plants grow in soil solution which is a continuous phase in the soil - water - air system. Ions essential and non-essential for plant growth in the soil solution are in a dynamic equilibrium with the soil solid phase. The uptake of nutrient ions by plants is primarily governed by the nature of the nutrient and its concentration in soil solution. The nutrient concentration in soil solution in turn is controlled by their respective exchangeable fractions on solid phase and weatherable soil minerals. This ionic equilibrium will not change, with a change in concentration of ions, following the Ratio Law enunciated by Schofield. It implies that the level of an ion, in each phase of the above equilibrium is influenced by the level of other ions in these phases. This study analysed the ionic interactions in teak soils, which will provide inputs to develop a soil fertility management software to cater to the needs of large-scale plantations as well as agroforestry systems in Kerala state. Surface soil samples (0-20 cm) were collected from 20 teak plantations of different age group from Chalakkudy Forest Division and analysed for their cation nutrient concentrations. A computer programme was developed to compute the ion activities. Teak grown in older plantations had higher concentrations and activities of both calcium and magnesium. Activities of the ions showed that major secondary nutrient cations such as calcium and magnesium had relatively lower activity coefficients with age and would not be readily available to the plants. The study suggests that concentration of an ion per se may not be suitable for predicting their availability.

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ASSESSING THE SPATIAL AND TEMPORAL CHANGES IN WATER QUALITY OF THREE RAMSAR SITES OF KERALA, USING PHYSICO-CHEMICAL QUALITY INDICES

Rose Maria Sebastian, Aswathy M S, Manjusha V., Asha M S and Renjith .K R

KSCSTE- Centre for Water Resources Development and Management, Kozhikode-673571

Background: Water quality is one of the most crucial elements of a healthy ecosystem. Assessing the water quality is important for ensuring the quality of water and for the sustenance of life on earth. The WQI provides a useful tool for aggregating water quality information into a single, understandable value that can be used to make decisions about water resource management, resource conservation and land use practices.

Method: The present study is focused on the spatio-temporal trends of 12 physicochemical parameters of the surface water for all the three Ramsar sites of Kerala. The samples were collected during 2021 from 41 stations in Ashtamudi, 17 stations in Sasthamkotta and 39 stations in Vembanad Lake for the pre-monsoon, monsoon and post-monsoon periods. The water quality of these wetlands is evaluated using the Canadian Council of Ministers of the Environment (CCME) water quality index and the Weighted Arithmetic Water Quality Index (WAWQI). The WQI is calculated by combining several water quality parameters into a single index value.

Result: The CCME water quality index of Vembanad Lake revealed that 84.62% of the stations were of poor quality, whereas rest of the stations fall into the marginal class only. Ashtamudi Lake showed even worser scenario with all the stations falling within the poor class. Even though no samples fall into the poor class in the case of Sasthamkotta Lake, it is noteworthy that none of the stations were in the good category. Weighted Arithmetic water quality index for Sasthamkotta revealed that 82%, 17% and 23% stations fall into the 'good water quality' class during the pre-monsoon, monsoon and post-monsoon seasons, respectively.

Conclusion: The results of the two computed indices indicate that anthropogenic activities have a significant negative impact on the surface water quality of all three Ramsar sites, emphasising the need for conservation and wise use by proper implementation of the management plans with the support all stakeholders.

Keywords: Water Quality Index, Vembanad Lake, Ashtamudi Lake, Sasthamkotta Lake, Ccme Wqi, Wawqi.

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EXPLORATION OF *CYCAS* L. SPECIES OF KANNUR DISTRICT, KERALA, USING QUANTITATIVE MORPHOLOGICAL FEATURE ANALYSIS

Manjusha K[1], Ramesh Chandra Srivastava[2], Kavya Jeevan[1], Anbazhagi S[1], Muthukumar Muthuchamy[1]

1)Department of Environmental Science, School of Earth Science Systems, Central University of Kerala, Kasaragod,
2)Retired Scientist, Botanical Survey of India, HQ, Kolkata, India

Background: *Cycas* L. is an economically important threatened genus that is at the risk of extinction due to natural population degradation. Hence, the study points to the conservation of this threatened genus by highlighting the population exploration of this genus and the demarcation of quantitative morphological characters in the Kannur district, Kerala, India, as found to be unexplored.

Method: The researchers observed populations in the Kannur district, Kerala, India, including Kannavam Forest range (KF) between 2021 - 2023 and recorded eight vegetative and nine reproductive characteristics of 42 mature female individuals. The normality of the datasets had checked using the Anderson-Darling test in R using the "nortest" package. "corr" and "ggcorrplot" packages of RStudio plotted the Pearson's correlation matrix. Hierarchical clustering on principal components utilised Euclidean distance matrix and Ward linkage method from "FactoMineR" and "factoextra" packages in RStudio.

Results: Pearson's correlation matrix revealed a high positive correlation of LPS with TLP (0.74) and PSP (0.71), between LAS and LIR (0.84), and LFR with NO (0.70). Clustering analysis suggested two clusters; *Cycas circinalis* L. and *Cycas nathorstii* J. Schust. based on the recorded morphological features and expertise.

Conclusions: The study shed light on the distribution of *Cycas* L. species in the Kannur district and reported the existence of *C. nathorstii* J. Schust. for the first time in the Kannur district as well as in KF.

Keywords: Cycadaceae, Cycas L., Hierarchical Clustering, Kannur District

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ECO-RESTORATION EFFECT ON SOIL PHYSICAL PROPERTIES AT CHEMBIKUNNU - WADAKKANCHERRY FOREST RANGE, THRISSUR

Nandana V.J[1], Pawan S. Wable[2*], Sandeep S.[2], Shrikant P. Badole[2], Amrutha N. S [2]

[1]Sree Sankara College, Kalady, Ernakulam
[2]Kerala Forest Research Institute, Peechi, Thrissur
Corresponding author email id:pawan.wable@kfri.res.in*

Background: Forest restoration is regarded as one of the most cost-effective and efficient methods of addressing ecosystem degradation and biodiversity loss. With increasing forest degradation in the world in general and India in particular, the present study has been undertaken to monitor soil physical properties in the 500-ha eco-restoration sites at Chembikunnu in Wadakkanchery Range of Thrissur Forest Division, Kerala. The eco-restoration work is expected to enhance water flow to the river, protect this area from forest fires, and restore near-natural biodiversity. The study's objective is to analyse the physical properties of the eco-restored soil and compare it with acacia plantation and natural forest soils.

Method: Soil physical properties such as texture, bulk density, porosity, uniformity coefficient and hydraulic conductivity were analysed using standard methods. Soil horizons were defined based on the soil texture, soil colour, and soil's organic carbon content. Soil texture analysis was carried out using the hydrometer method. Particle size analysis was carried out through the dry sieve method to determine the hydraulic conductivity and uniformity coefficient.

Results: The soil texture analysis results show that the texture found in the study area is of sandy clay loam type. The bulk density obtained is a maximum (1.59 g/cc) for the eco-restored site and a minimum (1.21 g/cc) for the natural forest. Acacia plantation shows more variation in bulk density as compared to other eco-restored sites and natural forest. The porosity is higher (54.33%) for natural forests and lower (39.9%) for restored sites. Uniformity coefficient indicates that the soil is mainly well-graded at all sites. The estimated hydraulic conductivity value is higher for natural forests (0.293 cm/s) and lower (0.046 cm/s) for eco- restored sites.

Conclusions: This ongoing soil monitoring can help manage eco-restored site more efficiently to reach physical properties near natural forest soils.

Keywords: Soil Texture, Bulk Density, Soil Profiles, Hydraulic Conductivity, Eco-Restoration

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IN THE MIDST OF CHALLENGES: A COMPREHENSIVE ANALYSIS OF HARITHA KARMA SENA'S MICRO-ENTERPRISE JOURNEY IN KERALA

Jafer Shereef, Febin Rehman, Jayakumar K B

Haritha Sahaya Sthapanam, Integrated Rural Technology Centre, Palakkad.

Background: Kerala, India pioneers sustainable waste management through a decentralized model, led by Haritha Karma Sena (HKS). This approach maximizes resource recovery, ensures economic sustainability, and addresses ethical dimensions. HKS, operating as a micro-enterprise, aligns with the state's vision for sustainable solid waste management. However, challenges persist, prompting the Integrated Rural Technology Centre (IRTC) to analyze constraints at various levels. This study aims to inform policy modifications, enhancing the effectiveness of waste management initiatives in the state.

Method: This research employs a qualitative case study approach, driven by its exploratory nature and the limited existing research on Haritha Karma Sena (HKS). Primary data sources include a comprehensive review of academic literature, government and non-government agency reports related to HKS operations, government orders, policy documents, and data extracted from various government websites. Focus group discussions (FGDs) with experienced Haritha Sahaya Sthapanam coordinators and subsequent in-depth interviews with key stakeholders, such as HKS coordinators, members, political representatives in Local Self-Government Institutions (LSGIs), and officials from Suchithwa Mission, Haritha Keralam Mission, and LSGIs, were conducted to delve deeper into the research questions and gather valuable insights.

Results: The study reveals significant challenges impeding the self-sustainability of Harita Karma Sena (HKS). Governance hurdles, including clarity issues, financial constraints, and political interests, hinder HKS's journey to self-sufficiency.

Conclusions: These challenges collectively obstruct the establishment of HKS as a self-sustaining micro-enterprise. Governance issues, financial constraints, and exploitation by private entities pose formidable barriers. Addressing these challenges requires a multifaceted approach, including clear governance structures, enhanced financial support for HSS, and effective communication strategies. enterprise, providing valuable insights for policymakers and stakeholders to refine governance mechanisms and allocate sufficient resources.

Keywords: Haritha Karma Sena, Sustainability, Solid Waste Managemnt, Micro-Enterprise.

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AVIAN DIVERSITY OF ESTUARINE WETLAND OF EZHIMALA, KERALA

Geethu Gopinathan V. V. [1,2] and Vinod K.[3]

1)Central Marine Fisheries Research Institute, Ernakulam North P.O, Kochi
2)Cochin University of Science and Technology, South Kalamassery, Kochi
3)ICAR- Central Marine Fisheries Research Institute, Mandapam Regional Centre, Mandapam

Background: Kerala is a state which is blessed with many biodiversity-rich wetlands. Ezhimala estuarine wetland is a famous wetland located in the foothills of the Ezhimala mountains of Kannur district, Northern Kerala.

Method: The study was conducted by line transect method over 6 months from July 2023 to December 2023. An average of 20 days were spent in the study area from 6.00 am to 11.00 am. Identification of the birds was done with the help of binoculars and field guides.

Result: The study results in the documentation of 54 species of birds which belong to 11 orders, 32 families, and 47 genera. Order Passeriformes form the major percentage (34 %) of observed bird species followed by Pelecaniformes (27%). Out of 54 species reported, 2 species come under the Near Threatened category of IUCN status, remaining come in the Least Concern category of the same.

Conclusion: The study reveals the importance of the Ezhimala wetlands.

Keywords: Avian Species, Diversity, Ezhimala, Wetland, Estuary

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KERALA STATE FOR SCIENCE, TECHNOLOGY AND ENVIRONMENT

SASTHRA BHAVAN, PATTOM, THIRUVANANTHAPURAM