

DETERMINING DETECTION LIMITS OF AQUEOUS ANIONS USING ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY DANE

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Background: Pulsed amperometric detection is a relatively new method for detection of ions and especially nonelectrolytes such as carbohydrates in aqueous solutions. Pulsed amperometric detection relies on a redox reaction while electrochemical impedance simply measures the real and capacitive resistant of the solution. There is a correlation between the real impedance of a solution and the ionic strength of the solution.

Method: This work explores measuring real impedance of pure water as a function of temperature from 25.0 to 60.0 ° C to determine the relationship between impedance and temperature. Maintaining temperature at 25.0 °C, solutions of sodium chloride, potassium carbonate, sodium sulfate acetate and bicarbonate have been measured using impedance spectroscopy.

Results: Regression analysis shows that measuring anions using impedance spectroscopy and simple stainless steel cylinders that detection limits at the parts per trillion (ppt) level are possible. There was no statistical difference when comparing impedance values of the same concentration of acetate and chloride in solution, showing real impedance is not dependent on ion size. However, ions with higher charge do result in lower impedance measurements.

Conclusions: This work establishes the use of simple, small, robust stainless steel cylinders and impedance measurements following separation for the identification and quantification of ions in solution.

Keywords: Impedance Spectroscopy, Anions, Stainless Steel Cylinders, Detection Limit