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Determination of Trace Amounts of Iodide by an Inhibition Kinetic Spectrophotometric Method

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Abstract: In this study, the reaction between Co(III)-EDTA and hypophosphite ion, catalyzed by Pd(II), was chosen as the indicator reaction. The inhibition kinetics of this catalytic reaction were investigated in the presence of iodide ion and the possibility of its analytical application was evaluated. Catalyzers other than $PdCl_2$ (Pt, Au and Ni salts) were assayed for the indicator reaction and it was observed that these catalysts have no effect on the reaction. The important variables that affected the reaction rate were investigated and the optimum conditions giving maximum sensitivity were established. The calibration graph, prepared following the inhibition kinetic method, gave a curve exhibiting a linear relationship (r = -0.9878) between the initial rate and iodide concentrations up to 35 ng.mL^{-1} I^-. Iodide was quantitatively be determined in the range 2-35 ng.mL^{-1}I^- with a detection limit of 1.2 ng.mL^{-1} I^- ($3S_b/m$ criterion). The RSDs of the method (n = 5) for 7 and 14 ng.mL^{-1} are 1.19 and 0.81%, depending on the iodide concentration, respectively. The reaction was monitored spectrophotometrically by measuring the change in absorbance over time at 540 nm. Iodide in trace amounts had a strong inhibitory effect under optimum conditions. The possibility of the estimation of trace amounts of iodide based on its inhibitory effect was investigated. The method was applied to the determination of iodide in water, urine, table salt and some drug samples, and was compared with the modified Sandell-Kolthoff method. The determination of the iodide content of biological fluids is important both in malnutrition conditions and in metabolic and epidemiological studies of thyroid diseases. The main advantage of this proposed method for the determination of iodide in urine samples is that it does not necessitate an additional pretreatment step. The quantitative method developed, based on inhibition kinetics, is practical, fast and economical. For this reason, it is a technique open to research for the development of application fields (chemistry, biochemistry, environmental, pharmaceutical chemistry etc.).

Key Words: Co(III)-EDTA, inhibition kinetic, iodide, initial rate method and spectrophotometry

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