IN THE NAME OF GOD

APPLICATION OF A PARTIAL LEAST-SQUARES MULTIVARIATE CALIBRATION METHOD FOR SIMULTANEOUS DETERMINATION OF Fe(III), Al(III) AND Cu(II) AND APPLICATION OF A CATALYTIC-KINETIC METHOD FOR DETERMINATION OF TRACES OF Ag(I)
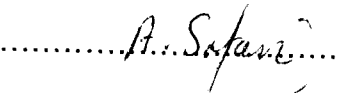
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THESIS

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DEDICATION

To my parents

To my dear Nasrin

ACKNOLEDGMENT

I thank the almighty God who helped me to accomplish my goal.

I heartily wish to discharge a pleasant duty and to acknowledge the benefit constructive suggestions from and valuable discussion with my major superviser A. Safavi that I received.

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ABSTRACT

Application of a Partial Least-Squares Multivariate Calibration Method for Simultaneous Determination of Fe(III), Al(III) and Cu(II) and Application of a Catalytic-Kinetic Method for Determination of Traces of Ag(I).

By

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A visible specrtophotometric method is used for simultaneous determination of Fe(III), Al(III) and Cu(II) using partial least-squares multivariate calibration method. The method is based on the reaction between Fe(III), Al(III) and Cu (II) and Alizarin Red S as a complexing agent. Assay conditions such as pH, ionic strength and mole ratio for all complexes were investigated and optimized. Individual calibration was constructed with several points for Fe(III), Al(III) and Cu(II). This method was used for the analysis of ternary mixtures of Fe(III), Al(III) and Cu(II) over the range of 450-6000 ng.ml^{-1}, 140-4000 ng.ml^{-1} and 450-15000 ng.ml^{-1}, respectively. The total relative standard error for applying the method on 10 synthetic samples was 5.1%. The proposed method was also successfully applied to the determination of Fe(III), Al(III) and Cu(II) in several synthetic alloy solution.

A kinetic-catalytic method was applied for determination of silver using its catalytic effect on the oxidation of Janus Green by peroxodisulphate in the presence of o-phenanthroline as an activator. The change in the rate of oxidation could be measured at wavelength of maximum absorbance of

Janus Green (λ =615). In order to find the optimum conditions for the reaction, the influence of some variables involving the concentration of all reagents, pH, temperature and ionic strength on the reaction rate using fixed time method at the first 300s of the reaction was investigated. The calibration graphs were constructed by plotting (-ΔA) against Ag(I) concentration. The percent relative standard error (RSD) was in the range of 1.8-3%. The detection limit was also obtained. To investigate the selectivity of the proposed method, the influence of foreign ions were studied on the determination of Ag(I). The orders of uncatalyzed and catalyzed reactions for overall process with respect to all reactant were measured. By drawing Arrhenius plots and Eyring plots for both uncatalyzed and catalyzed reactions the activation energy of reactions and $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$ were calculated.

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