

CHAPTER 4

CONCLUSIONS

4.1 Conclusions

In this research work, consists of two parts. The first was development of rFI-spectrophotometric methods for aluminum. It has been possible to construct simple flow injection systems for the determination of trace aluminum at the $\mu\text{g mL}^{-1}$ level. Flow Injection analysis (FIA) systems were developed and constructed from easily available materials and instruments. The second was development of SI-spectrophotometric method. SIA was methods in analytical techniques and instrumentation tend to require small portable, fast and easy-to-use devices with cost effectiveness and low waste production.

4.1.1 Determination of aluminum in water samples by rFI-spectrophotometric

A reverse flow injection spectrophotometric procedure for aluminum determination based on complexation with BPR and CTAB has been developed in which a small volume of BPR as the reagent solution was injected into the sample stream and the resulting of Al : BPR : CTAB was 1 : 3 : 6. The complex was formed at pH 5.0-5.5 which was then measured at 480 nm. Optimum conditions for determining Al(III) were investigated. Various factors influencing the sensitivity of the method were optimized using the univariate method and the optimum conditions are summarized in Table 3.12. The two linear calibration graphs over the ranges of

0.05-0.11 mg L⁻¹ and 0.13-0.40 mg L⁻¹ with different slopes could be established with a regression equation: $y = 617.86x - 20.629$ for 0.05-0.11 mg L⁻¹ Al(III) with the correlation coefficient of 0.9992 and $y = 208.69x + 29.745$ for 0.15-0.40 mg L⁻¹ Al(III) with the correlation coefficient of 0.9986 respectively. The method was very sensitive as little as 0.002 mg L⁻¹ Al(III) could be determined. The relative standard deviation of 0.33% (n=11) for 0.1 mg L⁻¹ Al(III) and the sample throughput of 43 h⁻¹ were obtained. The proposed method has been applied to the determination of water samples. It was seen that results obtained by the recommended method were in good agreement with those obtained by ICP-OES verified by t-test. The method is simple, inexpensive, accurate and reproducible which is suitable for the monitoring of aluminum (III) in the water samples.

4.1.2 Determination of aluminum in water samples by SI-spectrophotometric

The SIA spectrophotometric instrumentation was adapted and used as the basis for the development of a simple, rapid and low waste. Sequential injection procedure for determination of Aluminum using BPR and CTAB as colorimetric reagent. The SIA instrumentation set up and the SIA signals were shown in Figs. 2.2, 2.3 and 3.28, respectively. Conditions necessary for aluminum determination by SIA method were established by univariate method (see Table 3.32). The two linear calibration plots were obtained over the concentration range of 0.02-0.30 mg L⁻¹ (Fig. 3.29 a) and 0.30-1.00 mg L⁻¹ (Fig. 3.29 b) with the regression equation $Y = 0.6588X - 0.0134$ ($r^2=0.9997$) and $Y = 0.2367X + 0.1413$ ($r^2=0.9997$) respectively. The method was found to be very sensitive with the LOD and LOQ of 0.007 and 0.023 mg L⁻¹ for

linear range 0.02-0.30 mg L⁻¹ and LOD and LOQ of 0.209 and 0.698 mg L⁻¹ for linear range 0.30-1.00 mg L⁻¹. The repeatability obtainable for determining 0.08, 0.20, 0.40 and 1.00 mg L⁻¹ of aluminum standard by the proposed method (n=11) were 0.83%, 0.56%, 0.59% and 0.88% respectively. The methods have been applied to the assay of aluminum in water samples with the sample throughput of 31 h⁻¹. Validation of the proposed method for aluminum determination was also performed by comparison of the results obtained by both the proposed and the standard method (ICP-OES). It was found that results obtained by both methods were in good agreement. With suitable modification the SIA instrumentation can be used as a basis to the development of greener analytical methods for analyzing a wide range of environmental samples.