CHAPTER 4

CONCLUSIONS AND SUGGESTION FOR FURTHER WORK

4.1 Conclusions

This research work consists of two parts. The fist part, a low cost rFI spectrophotometric method for the determination of aluminium (III) has been proposed. It has been possible to construct simple flow injection systems for the determination of trace aluminium (III) at the μgmL^{-1} level. Reverse Flow Injection analysis (rFIA) systems were developed and constructed from easily available materials and instruments. The method presented good reproducibility, high sensitivity, and sample through put. The method was also simple, inexpensive and reliable. This method was successfully applied to the analysis of tap water samples from various districts in Chiang Mai Province. The second part, SIA with spectrophotometric detection procedure was developed for aluminium (III) determination. SIA offers precise automatic control of reaction conditions and microfluidic manipulation of samples and reagents. It also operated at microlitre scale, saving reagents while generating small volumes of waste.

4.1.1 rFIA spectrophotometric Determination of Aluminium (III) Using Quercetin and Cetyltrimethyl Ammonium Bromide as A Complexing Agent

A reverse flow injection spectrophotometric procedure for aluminium (III) determination based on complexation of Al (III) with Quercetin and CTAB has been developed in which a reagent solution or standard solution was injected into the sample or standard solution stream, The complex was formed at pH 5.5. The absorption of which was then measured at 428 nm. Optimum conditions for determining Al(III) were investigated. Several factors influencing the sensitivity of the method were optimized using the univariate method and the optimum conditions are summarized in Table 3.12. A linear calibration graph over the ranges of 0.02-0.50 mg L^{-1} with a slope could be established with a regression equation: $y = 61.363x - 0.0246$ with the correlation coefficient of 0.9998. The method was very sensitive as little as 0.007 mg L^{-1} Al(III) could be determined. The Relative standard deviation of 1.10% (n=11) for 0.2 mg L^{-1} Al(III) and the sample throughput of 60 h^{-1} were obtained. The proposed method has been applied to the determination of tab water samples. It was seen that results obtained by the recommended method were good agreement with those obtained by ICP-MS verified by *t*-test. The proposed method is sample inexpensive and fast which is suitable for the monitoring of Al(III) in water.

4.1.2 SIA spectrophotometric Determination of Aluminium (III) Using Quercetin and Cetyltrimethyl Ammonium Bromide as A Complexing Agent

The sequential injection analysis procedure for Al (III) determination base on complex with Quercetin and CTAB has been developed, the resulting of complex Al(III)-Quercetin-CTAB was measured at 428 nm. Optimum conditions for determining Al(III) were investigated by univariate method and the optimum conditions are summarized in Table 3.33. A linear calibration graph was over the ranges of 0.02-0.60 mg L^{-1} with a regression equation: $y = 0.4828x + 0.0023$ with the correlation coefficient of 0.9996. The method was sensitive as little as 0.013 mg L^{-1} Al(III) could be determined. The relative standard deviation of 1.76, 1.14, 0.67 and

0.76 % (n=11) for 0.05, 0.1, 0.4 and 0.6 mg L^{-1} Al(III) respectively and the sample throughput of 40 h^{-1} were obtained. The proposed method has been applied to the determination of Al(III) in tap water samples as mentioned above. It was seen that results obtained by the recommended method were in good agreement with those obtained by ICP-MS method verified by *t*-test. The proposed SIA method is simple and reliable for the determination of Al(III) in tap water samples.

4.1.3 Comparison of the analytical characteristics between rFIA and SIA method for aluminium (III) determination

A comparison of the analytical characteristics between reverse flow injection analysis and sequential injection analysis summarized in Table 4.1. The results obtained by reverse flow injection method offers a better analytical performance in terms of sensitivity and sample throughput (60 h^{-1}). The rFIA system is more sensitive with a lower detection limit (0.007 mg L^{-1}) than the SIA system which has a detection limit of 0.013 mg L^{-1}. The reproducibility (R.S.D.) of both methods is of almost the same level. Nevertheless, the SIA method is the lower consumption of a reagent than the rFIA system; it uses microlitres of the reagent and solution per analytical cycle, with minimum waste production.

Table 4.1 Comparison of the analytical characteristics between rFIA and SIA method.

Parameters	**rFIA**	**SIA**
Linear range	0.02-0.50 mg L^{-1}	0.02-0.60 mg L^{-1}
Correlation coefficient	$R^2 = 0.9998$	$R^2 = 0.9996$
Relative standard deviation	1.10 %	1.08 %
Limit of detection	0.007 mg L^{-1}	0.013 mg L^{-1}
Limit of quantification	0.024 mg L^{-1}	0.044 mg L^{-1}
Sampling rate	60 h^{-1}	40 h^{-1}

4.2 Suggestion for further work

4.2.1 This developed system could be used for routine determination of aluminium (III) in many samples with various matrices such as alcoholic beverages, foods which cooking in utensils like aluminium skillets, pressure cookers, roasting pans, pots, saucepans, frozen dinner trays, foils and wrappers especially in the case of acidic dishes that can provide an important amount of aluminium (III).

4.2.2 In order to improve the sensitivity, the effect of other cationic surfactants such as cetylpyridinium bromide, cetylpyridinium chloride, polyethoxylated and benzyldimethyltetradecylammonium chloride should be investigated for determination of aluminium (III).