CHAPTER 4

CONCLUSION

The main propose of this research is the study on the concentrations of Cd and Pb in human hair samples. For the determination of Cd and Pb in human hair samples, the hair samples were prepared by wet digestion with concentrated HNO_3, using microwave-assisted digestion. Then, the analyte was preconcentrated by cloud point extraction and followed by analysis of Cd and Pb concentrations using FAAS. The variable parameters affecting the preconcentration of Cd and Pb were optimized which included complexing time, the concentration of surfactant and chelating agent, pH, the volume of acetate buffer solution and the volume of methanol in 0.1 mol l^{-1} HNO_3. The optimum conditions in this study were obtained by the maximum analytical signals of Cd and Pb. From the results, the suitable conditions of cloud point extraction for Cd and Pb were 30 min of complexing time, $2x10^{-4}$ mol l^{-1} PAN, 0.04 %v/v Triton X-114, 0.40 ml of acetate buffer solution pH 3 and 500 µl of methanol in 0.1 mol l^{-1} HNO_3. The selected conditions will be employed in real samples.

For the determination of Cd and Pb in real samples, the proposed method was applied to determine the concentrations of Cd and Pb in human hair samples. The human hair samples including untreated hair sample (A-1), hair sample of a person worked in heavy metals laboratory (B-1), hair samples of workers who worked in electronic industry (C-1 to C-3) and dyed hair samples (D-1 to D-8) were studied. The concentration of Cd in human hair samples can be ordered as following :

D-7 > D-8 > D-4 > D-2 > D-6 > D-3 > D-5 > D-1 > C-3 > C-2, respectively. Sample A-1, B-1 and C-1 could not be detected Cd concentration by FAAS. The concentration of Pb in human hair samples can be ordered as following: B-1> C-1, D-3 > D-6, respectively. Sample A-1, C-2, C-3, D-1, D-2, D-4, D-5, D-7 and D-8 could not be detected Pb concentration by FAAS.

The accuracy expressed in term of percentage recoveries of this method was found in the range of 83.43 – 98.21% and 82.29 – 102.95% for Cd and Pb, respectively. The detection limits were 0.03 and 0.62 μg ml^{-1} for Cd and Pb, respectively. The precisions expressed in term of relative standard deviation (%RSD) were 1.10 and 1.95% for Cd and Pb, respectively. The linear range of Cd calibration curve was obtained in the range of 0.50-2.50 μg ml^{-1} and the correlation coefficient (R^2) was 0.9988. The linear range of Pb calibration curve was obtained in the range of 1.00-20.00 μg ml^{-1} and the correlation coefficient (R^2) was 0.9996. The results indicated that the proposed method was reasonable for trace analysis, resulting in good recoveries of Cd and Pb. The detection limits of the method are comparable level with the works in literature including cloud point extraction.

For the determination of Cd in all studied samples, the results have shown that the concentrations of Cd in dyed hair samples were higher than those human hair samples. The lower concentrations of Cd were found in the hair samples of workers who worked in electronic industry, and Cd concentration could not be detected in untreated hair sample and hair sample of a person worked in heavy metals laboratory. The highest concentration of Pb was found in hair sample of a person worked in heavy metals laboratory. The lower concentration of Pb was found in hair sample of a worker worked in electronic industry for 5 years and sample of dyed hair for 2 and 8

years. From the results can be concluded that the concentrations of Cd and Pb depended on the sources and exposure time of Cd and Pb to human hair or human body.

The proposed method offers a simple, safe, rapid, sensitive and inexpensive methodology for preconcentration and separation of trace metals in aqueous solutions. Triton X-114 was chosen for the formation of the surfactant-rich phase because it has excellent physicochemical characteristics, commercial availability, low cost, the lack of electro-active groups in its molecule and low toxicity. CPE is a green method that provides many advantages because it uses a very small volume of reagents and generated a few laboratory residues, including surfactants are not toxic, not volatile, and not easily flammable. The proposed method was successfully applied to the determination of trace Cd and Pb in human hair samples.