

## CHAPTER V

### DISCUSSION AND CONCLUSION

The principal merits of the preconcentration and chemical separation technique by reversed-phase partition chromatography, using supports impregnated with selective extracting materials insoluble in the aqueous solution are their simplicity and versatility. It retains some of the advantages and disadvantages of solvent extraction and ion exchange. Advantages are minimal sample handling and the possibility of very high concentration factors. Disadvantages are that some elements are not adsorbed under a certain set of chemical parameters, such as chelating agent, pH etc., so that several adsorbing columns have to be used. Under such circumstance, this method is much slower than solvent extraction. No chemical loss, on the other hand, is expected as in the case of solvent extraction from unclean separation of the organic and the aqueous phases. Methyl isobutyl ketone is generally recommended as a solvent for the extraction of the elements under investigation in the present study. This reagent has a bad smell and is toxic. It is therefore, not practical for routine use. Carbontetrachloride was used as the eluting agent. It can undergo only partial combustion in outer zones of the flame which renders some poisonous gases such as phosgene to be formed. By aspirating an organic solvent into an atomic absorption spectrometer causes increase in nebulization efficiency; hence resulting

in an increase of analytical sensitivity of 2-3 times compared with an aqueous solution of similar concentration. In spite of this advantage, the organic solvent was first destroyed and aqueous solution was sprayed instead. The results of the concentration ranges of Ag, Hg, Cu, Pb, Cd and Co found in the water samples from the lower part of the Chao Phya River are given in Table 5-1 in comparison to the permissible concentrations for drinking water specified by the U.S. Department of Interior and by the World Health Organization. The concentrations for mammalian acute toxicity are also reported in Table 5-2. It should be stressed once more that, the results obtained for Ag, Cd and Co were covered with high imprecision since the concentrations were too low for the present technique. The precision for Cu and Pb was, however, acceptable. In these two cases, no significant difference was observed on measurements performed on different days.

The technique for collecting water samples was not satisfactory since no automatic closer cylinder was available. The samples were stored for a long period (10 months) prior to any separation performance, so that some losses by adsorption on the container wall were not avoidable. More detailed studies must be performed before any conclusion on the heavy-metal pollution status of the Chao Phya River could be deduced.

Table 5-1 The concentration range of trace elements in the lower Chao Phya River and permissible concentrations for drinking water.

Element	conc. range in the lower Chao Phya River(ppb)	U.S. Department of Interior(7)	World Health Organization(8)	
		maximum permissible limit (ppb)	permissible limit(ppb)	excessive limit (ppb)
Ag	0-0.40	50	-	-
Hg	nondetectable	-	-	-
Cu	3.32-19.32	1,000	1,000	1,500
Pb	4.71-32.33	50	100	-
Cd	0.12- 0.97	10	-	50
Co	0- 2.21	200	-	-

- No report

Table 5-2 The concentrations for mammalian acute toxicity of some inorganic chemical (8).

Metal	Species	Dose	Effect
AgNO <sub>3</sub>	Human	10,000 mg	Lethal
Hg	Human	1,000- 2,000 mg/kg	Lethal
		Ingestion of a toxic dose	
Cu	Human	10,000 mg/kg	Lethal
		60-100 mg	Gastroenterities with nausea and intestinal irritation
		10-30 mg	no poisoning even after many days
Pb (lead acetate)	dog	30 mg/kg	Lethal
Cd	Human	150 mg/kg	Lethal in 1.5 hr.
Co	Human	-	low toxicity

## APPENDIX I

## Measurement of detection limits

Table A-I Absorbance of aqueous-and standard-solution

Note: There are 11 readings for the blank, 10 for the standard solution. Each reading for the standard is "bracketed" by a pair of blank readings.

Readings	Absorbance					
	Ag	Hg	Cu	Pb	Cd	Co
1	0.012	0.006	0.020	0.012	0.022	0.018
2	0.036	0.055	0.068	0.075	0.058	0.058
3	0.015	0.000	0.018	0.010	0.018	0.020
4	0.035	0.068	0.070	0.068	0.054	0.061
5	0.010	0.010	0.020	0.020	0.022	0.011
6	0.038	0.070	0.074	0.082	0.060	0.057
7	0.013	0.012	0.018	0.025	0.015	0.020
8	0.036	0.060	0.078	0.080	0.069	0.065
9	0.014	0.003	0.023	0.015	0.020	0.018
10	0.037	0.045	0.068	0.090	0.064	0.069
11	0.009	0.010	0.022	0.020	0.022	0.020
12	0.034	0.055	0.074	0.070	0.062	0.060
13	0.008	0.000	0.020	0.008	0.023	0.015
14	0.029	0.050	0.069	0.070	0.069	0.055
15	0.006	0.020	0.017	0.015	0.025	0.020
16	0.028	0.070	0.075	0.078	0.060	0.063
17	0.005	0.018	0.020	0.010	0.026	0.010
18	0.027	0.078	0.068	0.060	0.068	0.055
19	0.007	0.010	0.018	0.020	0.019	0.020
20	0.034	0.074	0.070	0.070	0.067	0.058
21	0.009	0.015	0.015	0.010	0.025	0.014

Calculation example (from the measurement of Ag)

Procedure:

- 1) Average the absorbances for the first two blank readings (absorbance 1 and 3)  $0.012 + 0.015 \div 2 = 0.0135$
- 2) Subtract this value from the corresponding reading for the Ag solution (absorbance 2)
- 3) Repeat for each pair of blank readings for each reading from the Ag solutions in order.
- 4) Continue as indicated above until 10 values are obtained.
- 5) Table A-II shows these value for the example.
- 6) Calculation the standard deviation (S) from

$$\begin{aligned}
 S &= \pm \sqrt{\frac{\sum d^2}{N-1}} \\
 &= \sqrt{\frac{0.00003675}{9}} \\
 &= \pm 0.0020
 \end{aligned}$$

Table A-II

	Absorbance x	deviation x - $\bar{x}$	(deviation) <sup>2</sup> (x - $\bar{x}$ ) <sup>2</sup>
1	0.0225	- 0.0015	0.00000225
2	0.0225	- 0.0015	0.00000225
3	0.0265	0.0025	0.00000625
4	0.0225	- 0.0015	0.00000225
5	0.0225	0.0015	0.00000225
6	0.0225	0.0015	0.00000225
7	0.0220	- 0.0020	0.00000400
8	0.0225	0.0015	0.00000225
9	0.0210	- 0.0030	0.00000900
10	0.0260	0.0020	0.00000400
	$\bar{x} = 0.0240$		$\sum d^2 = 0.00003675$

7 The detection limit may be now calculated by

$$\begin{aligned}
 D &= 2 \times S \times \frac{C}{\bar{x}} \\
 &= \frac{2 \times 0.2 \times 0.0020}{0.0240} \\
 &= 0.0333 \\
 &= 0.033 \mu\text{g}/\text{cm}^3
 \end{aligned}$$