CHAPTER V

CONCLUSION AND RECOMMENDATION

Arsenic and its compounds have toxic properties and these arsenicals are ubiquitous in nature and living things in trace amount. The finding of arsenic in vegetables is, therefore, a result of natural presence and contamination by the uses of arsenicals and their residues.

In this study, the sample solution from a vegetable was obtained after the vegetable had been ashed without an aid of the extraneous chemical in a muffle furnace or digested with 8.0 M HNO_3. The cation exchange treatment was performed in 0.1 M HCl to eliminate interfering cations in the sample solution and the analysis of arsenic by differential pulse polarography (DPP) was performed.

The most suitable supporting electrolyte for DPP analysis of arsenic was 1.0 M HCl. Two reduction peaks of arsenite ion were obtained at the peak potentials of -0.42 and -0.71 V vs saturated calomel electrode (SCE). The first peak (at -0.42 V) was sharper and the higher peak current was yielded. This DPP technique used has rather high sensitivity, the lowest concentration that could be detected in 1.0 M HCl at the peak potential of -0.42 V vs SCE was found to be 0.10 μg As/cm^3. The method for separation of interference by cation exchanger, Amberlite IR-120 (H), in 0.1 M HCl medium was successful to remove Pb (II) ion and other cations which were reduced at nearly the same potential as that of arsenite ion.

In the study of destruction of organic matter, the dry ashing with no aid of extraneous chemical was compared with the wet digestion with 8.0 M HNO_3 by using standard arsenite solution. It was found that the dry ashing was a better method than the wet digestion in many respects. Dry ashing method needed less attention of the analyst, and larger amount of sample could be employed to increase sensitivity. The percent recovery of the standard arsenite solution with the dry ashing method was found to be 88.77 and that with the wet digestion method was 71.61.

Table 26 is a conclusion of arsenic contents in various vegetables which were collected from four sources: Hua Lum Pong market, Pak Klong market, Suan Luang garden and Sathupradit garden. The vegetables analyzed were cabbage, celery, Chinese cabbage, Chinese convolvulus, Chinese kale, Chinese white cabbage, coriander, cucumber, lettuce, multiplier onion and yard long bean. By dry ashing method, the amount of arsenic found ranged from none to 2.98 μg As/g of the vegetable on dry basis and from none to 0.24 μg As/g of the vegetable on fresh basis. The maximum values of 2.98 μg As/g of the dry vegetable and 0.24 μg As/g of the fresh vegetable were obtained from Chinese convolvulus grown at

Table 26 Ranges of arsenic contents in vegetables in µg As / g of the vegetable

Vegetable	Dry ashing		Wet digestion	
	Dry basis	Fresh basis	Dry basis	Fresh basis
Cabbage	none - 0.37	none - 0.03	none	none
Celery	0.75 - 1.90	0.06 - 0.17	0.22 - 1.60	0.02 - 0.14
Chinese cabbage	0.42 - 1.35	0.02 - 0.10	none - 0.86	none - 0.07
Chinese convolvulus	1.50 - 2.98	0.05 - 0.24	0.24 - 2.65	0.01 - 0.24
Chinese kale	0.34 - 0.75	0.03 - 0.07	0.11 - 0.49	0.01 - 0.05
Chinese white cabbage	0.66 - 0.87	0.03 - 0.13	0.19 - 0.56	0.02 - 0.08
Coriander	1.70 -2.70	0.09 - 0.21	1.20 - 1.58	0.07 - 0.12
Cucumber	none - 0.48	none - 0.02	none - 0.19	none - 0.08
Multiplier onion	none - 0.66	none - 0.07	none - 0.18	none - 0.02
Yard long bean	0.14 - 0.34	0.01 - 0.03	none - 0.35	none - 0.03
Lettuce	0.80 - 1.58	0.04 - 0.08	0.23 - 1.18	0.01 -0.06

Sathupradit garden. By wet digestion method, the amount of arsenic was found to range from none to 2.65 µg As/g of the dry vegetable and from none to 0.24 µg As/g of the fresh vegetable. The maximum values of arsenic contents were also from Chinese convolvulus. Coriander and celery contained smaller amounts of arsenic. Cucumber and yard long bean were the vegetables that contained low level of arsenic.

The maximum of arsenic contents found in Chinese convolvulus, 0.24 µg As/g sample, on fresh basis was still lower than the tolerance limits as permitted by many countries, for examples, 2.6 µg/g sample by the United States (5), 1.5 µg/g sample by Australia (66), 1.0 µg/g sample by Canada (66) and France (67), and 0.76 µg/g by Japan (67). These values were reported in µg As per gram of fresh vegetables.

From this study, it can be concluded that arsenic contents in vegetables varied from species to species, from plant parts to parts, source to source and from different methods used for destruction of organic matter.

Arsenic distributed in vegetables possibly arised from arsenical pesticides, herbicides, rat poisons and insecticides. In addition, it could come from impurities in fertilizers used and from industrial contaminations.

In Thailand, there is no report on background and tolerance levels of arsenic in environment, food and vegetables. This thesis may serve as a preliminary investigation of arsenic in vegetables. With further studies, assessment of background levels of arsenic in food and also the highest allowable limit for public health can be made. To evaluate such informations, more details have to be included, for examples, arsenic level in soil, application of fertilizers, pesticides used, clay contents and available ions in soil.

For further study, modification can be made to the methods in destroying the organic matter in vegetables. For example, ashing aids such as MgO, $Mg(NO_3)_2$ and $NaHCO_3$, can be used. However, these chemicals can retain more arsenic as reported by Tam and Conacher (18), and Reay (19).