

Chapter 4

Conclusion

The modify and optimize of an online hydride generation technique combined with an inductively coupled plasma optical emission spectrometer (HG-ICP-OES) was established for determination of inorganic As species in drinking water samples. It was found that the optimum conditions for inductively coupled plasma optical emission spectrometry in these experiments were a wavelength of 193.7 nm, integration time at a minimum of 5 up to a maximum of 10 seconds, RF power at 1.3 kW, plasma gas flow rate of 15 L min⁻¹, and auxiliary gas flow rate of 0.2 L min⁻¹.

Conventional hydride generation is a very expensive and a long time-consuming process. To overcome these disadvantages, a more economical, minimization of labor and faster continuous flow hydride generation combined with inductively coupled plasma optical emission spectrometry method has been developed.

In addition, a continuous flow hydride generation system was also developed in this experiments. Arsenic in the sample was reduced to arsine by using sodium borohydride as a reductant and hydrochloric as an acid medium. The three solutions were continuously pumped by using three-channels of a peristaltic pump of the inductively coupled plasma system into the manifold. After that the mixed solutions were transported with argon carrier gas into the mixing coil, and pass into the gas/liquid separator for separating arsine gas into the hydride connector of the inductively coupled plasma optical emission spectrometer for analysis. The hydride generation system conditions were optimized. The results showed that the optimum conditions were: a sample flow rate of 1.2 mL min⁻¹, reductant and acid of 0.4 mL min⁻¹ and argon carrier gas of 0.3 L min⁻¹, respectively. The parameters affecting the hydride efficiency were studied. Then, the conditions of total As and As(III) determination were optimized. The results showed that the conditions for

total As determination were 0.4% (w/v) NaBH₄ in 2 mol L⁻¹ of HCl with 10% (w/v) KI as a pre-reductant for 10 min and for As(III) conditions were 0.4% (w/v) NaBH₄ as a reductant in 2 mol L⁻¹ of HCl. As(V) was calculated by the difference of total As and As(III).

This method could be used to analyze the inorganic As species including total As, As(III) and As(V) with high precision with RSD of less than 3% for five replicates. The results of the three inorganic As species have a linear dynamic range of 1-100 µg L⁻¹ with correlation coefficient, R^2 are 0.9998-0.9999. This compares with 50 to 200 µg L⁻¹ and 50 to 100 µg L⁻¹, respectively (Gettar *et al*, 2000 and Wolnik *et al*, 1981). It showed this method successfully used covers the most common As concentrations found in nature also drinking water.

The limit of detection (LOD) and limit of quantification (LOQ) of total As were 0.38 and 1.28 µg L⁻¹, As(III) were 0.07 and 0.24 µg L⁻¹, and As(V) were 0.37 and 1.17 µg L⁻¹, respectively. These compared with previous values of 1 and 10 µg L⁻¹, respectively (Muller, 1998) and a limit of quantification of 36 µg L⁻¹ (Do *et al.*, 2000). LOD and LOQ are better than those obtained previous reported. It showed this method is high sensitivity. The accuracy of three As species are found in the range of 94.9-99.1% recovery. It showed this method is high accuracy. The obtained results show that this method can be successfully applied to selective these three As species determination in such as natural and also drinking water samples.

The inorganic As species in drinking water samples obtained from a supermarket, in Had Yai, Songkhla were analysed. As was not detected of all inorganic As species. Because their concentrations were lower than the detection limit of this technique, and lower than 10 µg L⁻¹ of standard value in drinking water (WHO, 2003). In addition the % recovery of inorganic As species added to drinking water at 4, 8 and 12 µg L⁻¹ were in the range of 79.3-111.6%.

In conclusion, this HG-ICP-OES technique is a suitable technique which can be used to determine three inorganic As species in drinking water samples. Because its provided high sensitivity. In addition, its simple performance, easy to operate and rapid technique, with less than 30 seconds per sample.