PERFORMANCE CHARACTERISTICS OF HYDRIDE GENERATION FOR DETERMINATION OF HEAVY METALS BY ICP-AES

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Abstract. Heavy metals, such as arsenic, cadmium, lead, selenium and tin, are detrimental to ecosystem and human health at extremely small levels. Accurate determination necessitates the use of highly sensitive instrumentation and analytical chemistry methodologies. Inductively coupled emission atomic emission spectroscopy is a robust, multielement capable technique that takes the advantage of hot argon plasma to produce excited species. However, the sensitivity of ICP-AES for these elements is not adequate to detect these elements in environmental samples at low microgram per gram levels due to the inherent shortcoming of complexity of emission spectrum and inefficency of solution nebulization. Hydride generation is popular technique commonly used for flame atomic absorption spectroscopy for measurement of hydride forming elements. In this study, we examined the performance characteristics of hydride generation with ICP-AES for simultaneous measurement of several hydride forming elements (As, Bi, Cd, Pb, Sb, Se, Sn). Hydrochloric, nitric and sulfuric acid were examined for hydride generation efficacy. To affect the hydride generation, acid concentration of the 50 ppb multielement solutions were varied from 0 to 5% v/v. Solution were on-line reacted with 2% m/v NaBH4 solution. The gaseous hydride was analyzed by ICP-AES. Hydrochloric acid performed better than the other two acids. NaBH4 concentration had substantial effect on the hydride generation efficiency. Levels between 2 and 3% were optimum. Higher levels led to unstable plasma conditions. The effects of several mild oxidants were studied. Among them potassium ferricyanide increased lead signals substantially, while no enhancement was observed for other elements.

Key words: Hydride generation, arsenic, cadmium, lead, ICP-AES