EFFECTS OF SAMPLE MATRIX AND HEATING CONDITIONS ON VOLATILITY OF TRACE ELEMENTS

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Abstract. Trace elements, such as arsenic, selenium, mercury, cadmium, lead, are known to form volatile compounds. During sample preparation for instrumental analysis, these elements are prone to losses through evaporation as a result of heat and dissolution procedure. In this study, we have investigated the effects of sample matrix and dissolution procedures on the determination of a suite of heavy metals, including As, Cd, Co, Cu, Hg, Ni, Pb, Sb, Se, Zn. Several certified reference materials (CRM) with different matrix composition were used, which include Montana Soil (SRM 2710), Marine sediment (PACS-2), Bone Ash (SRM 1400), Freshwater Plankton (CRM 414), Lobster Hepatopancreas (TORT-2), Fish Liver (DOLT-2). Dissolutions were performed by nitric acid under heating. Three different heating schemes were used: (a) closed-vessel microwave assisted digestion, (b) open-vessel heating without drying sample, (c) open-vessel dissolution with heating to complete dryness. Samples of the CRMs were analyzed by ICP-MS and ICP-AES for elemental recoveries treated with the dissolution procedures. Mercury was lost in the latter two methods from all samples, while Method (c) caused losses for Se and Cd to extent in biological samples. In soil, sediment and bone ash samples, no significant loss was observed except for Hg which was completely lost when Method (c) was used. These results indicate that matrix components of sample affect the elemental species and their volatility in sample. Open-vessel dissolution procedures can be safely applied for accurate determinations provided that sample is not dried or heated at dryness to avoid the elemental losses. For Hg determinations, digestions must be carried out in sealed vessels due to its high volatility.

Keywords: Arsenic, mercury, selenium, cadmium, lead, volatility, closed-vessel dissolution, open-vessel dissolution, heating