OP 4.6

Inorganic arsenic speciation in various water samples with GF-AAS using coprecipitation

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Inorganic arsenic species, i.e. arsenite As(III) and arsenate As(V), are generally found in natural waters, while the organic arsenic species, such as monomethylarsonic acid (MMA) and dimethylarsinic acid (DMA) are present in marine and other biological samples. Inorganic arsenics are known to be more toxic than organic ones, and As(III) is is appreciably more toxic than As(V). Inorganic arsenic is a multi-site human carcinogen matter. Arsenic in direct skin contact may cause redness and swelling. Therefore, the determination and speciation of arsenic species are very important and necessary for natural water samples such as drinking water, stream water and hot spring water samples.

In this presentation, a simple, economic, selective and sensitive method for distinguishing between As (III) and As(V) is discussed. It is based on selective coprecipitation with cerium (IV) hydroxide of As(III) in presence of an ammonia/ammonium buffer for pH 9. The coprecipitate containing As(III) is collected successively on a 0.45-μm membrane filter, the membrane loaded with the coprecipitate is dissolved with 0.5 mL of concentrated nitric acid and the solution is completed to 2 or 5 mL with ultra-pure water (resistivity > 18 MΩ cm^{-1}). Arsenic(III) in the final solutions is determined by graphite furnace atomic absorption spectrometry (GFAAS). Under the working condition, As(V) is not coprecipitated.Total inorganic arsenic is determined after the reduction of As(V) to As(III) with NaI. The concentration of As(V) is calculated by the difference of the concentrations obtained by the above determinations.

In this work, both the determination of As with GFAAS in presence of cerium (IV) and the coprecipitation of As with cerium (IV) hydroxide were optimized. The preconcentration factor was found to be 75 with quantitative recovery (≥95 %). The rsds for the replicate analysis (n=6) of 2-160 μg L^{-1} arsenik solutions were lower than 10 %. The limit of detection (3σ) for both As(III) and As(V) were 0.05 μg L^{-1}. The proposed method produced satisfactory results on the application to the direct analysis of inorganic arsenic species in drinking water, stream water and hot spring water samples. The suitability of the method for determining inorganic arsenic species in the water samples was checked by analysis of the water samples spiked with 4-10 μg L^{-1} each of As(III) and As(V). Also it was controlled with a reference method based on TXRF. The relative error was under 5 %.