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Separation of tin from tellurium: Effects of chloride and sulfate interferences

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Quantification of tin isotopes in environmental samples, especially the radioactive 126Sn, is important for processes such as the biomonitoring of organotin species, long-term nuclear waste storage and treatment planning. However, the detection of 126Sn by mass spectrometric methods, like Accelerator Mass Spectrometry (AMS), is hampered by the presence of the stable 126Te. Therefore, separation of tin from tellurium is crucial to minimize isobaric interferences. In the present study, the determination of distribution coefficients (KD, metal adsorbed in solid phase over metal retained in liquid phase) of Sn and Te onto TRU chromatographic resin in presence of Cl^- and SO_4^{2-} solutions were evaluated using ICP-MS technique. The KD values of Sn and Te with real field water (surface and groundwater) samples, and the adsorption-desorption study of Sn and Te with field water spikes were also discussed. Results reveal that the average KD for tin in aqueous hydrochloric acid (HCl) with the Cl^--spike produced an increase of 11%, whereas the mixed-spiked (both Cl^- and SO_4^{2-}) sample faced a reduction by 7% compared to that of the unspiked sample. The KD values of tellurium in the presence of tested anionic species remained unchanged. This observation demonstrates that the distribution coefficients of tin and tellurium onto the solid phase is barely affected by the presence of Cl^- and SO_4^{2-} contaminants (each present at concentrations of 70.0 mg L–1). Moreover, the adsorption of metal in the presence of Cl^- and SSO_4^{2-} spikes on the resin is favored at pH values from 4.0 to 5.0, and the optimum time for the best metal-resin interaction is around 90 minutes. A thorough adsorption-desorption study for tin and tellurium with spiked field water samples (surface and groundwater) show that at least 99% tin is adsorbed, while the adsorption of tellurium can be maintained at a level as low as 60%. Aqueous hydrofluoric acid (HF) can then selectively elute 85% of tin (with a single wash of 100 mg of resin) with tellurium release of less than 10%. Our proposed methodology can be applied successfully for the selective separation of tin from tellurium from surface and groundwater samples contaminated with Cl^- and SO_4^{2-} ions.

Speaker Biography

Mohammad Majibur Rahman has completed his MSc (in Chemistry) from Jahangirnagar University, Bangladesh, and an MSc (in Environmental Science) from Memorial University of Newfoundland, Canada. He has just submitted his PhD thesis in the Department of Earth and Environmental Sciences, University of Ottawa, Canada. He is a professor at the Department of Environmental Sciences at Jahangirnagar University. His research interest focuses on the measurement of radioisotopes, especially 126Sn, using Accelerator Mass Spectrometry (AMS).

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