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Abstract

In this work we present and evaluate a radiochemical procedure optimised for the analysis of ^{236}U and ^{239,240}Pu in seawater samples by Accelerator Mass Spectrometry (AMS). The method is based on $Fe(OH)_3$ co-precipitation of actinides and uses TEVA® and UTEVA® extraction chromatography resins in a simplified way for the final U and Pu purification. In order to improve the performance of the method, the radiochemical yields are analysed in 1 to 10 L seawater volumes using alpha spectrometry (AS) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Robust 80% plutonium recoveries are obtained; however, it is found that Fe(III) concentration in the precipitation solution and sample volume are the two critical and correlated parameters influencing the initial uranium extraction through $Fe(OH)_3$ co-precipitation. Therefore, we propose an expression that optimises the sample volume and Fe(III) amounts according to both the ^{236}U and ^{239,240}Pu concentrations in the samples and the performance parameters of the AMS facility. The method is validated for the current setup of the 1 MV AMS system (CNA, Sevilla, Spain), where He gas is used as a stripper, by analysing a set of intercomparison seawater samples, together with the Laboratory of Ion Beam Physics (ETH, Zürich, Switzerland).

Keywords: Accelerator Mass Spectrometry; 236U; Plutonium; Seawater; Preconcentration; Ion-exchange chromatography