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ACCEPTED MANUSCRIPT

Isolation of ²³⁶U and ^{239,240}Pu from seawater samples and its determination by Accelerator Mass Spectrometry

Mercedes López-Lora^{1,2*}, Elena Chamizo¹, María Villa-Alfageme³, Santiago Hurtado-Bermúdez⁴, Núria Casacuberta^{5,6}, Manuel García-León⁷

- ¹ Centro Nacional de Aceleradores (Universidad de Sevilla, Consejo Superior de Investigaciones Científicas, Junta de Andalucía), Thomas Alva Edison 7, 41092 Sevilla, Spain
- ² Departamento de Física Aplicada I, Escuela Politécnica Superior, Universidad de Sevilla, Virgen de África 7, 41011 Sevilla, Spain
- ³ Dpto. de Física Aplicada II, Universidad de Sevilla, Av. Reina Mercedes 4A, 41012 Sevilla, Spain
- ⁴ Servicio de Radioisótopos, Centro de Investigación, Tecnología e Innovación, Universidad de Sevilla, Av. Reina Mercedes 4B, 41012 Sevilla, Spain
- ⁵ Laboratory of Ion Beam Physics, ETH Zürich, Otto-Stern-Weg 5, CH-8093 Zürich, Switzerland
- ⁶ Environmental Physics, Universitätstrasse 16. CH-8092 Zürich, Switzerland
- ⁷ Dpto. de Física Atómica Molecular y Nuclear, Universidad de Sevilla, Reina Mercedes s/n, 41012 Sevilla, Spain

*Corresponding author:

E-mail address: mlopezlora@us.es

Abstract

In this work we present and evaluate a radiochemical procedure optimised for the analysis of ²³⁶U 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 ²³⁶U 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; Ionexchange chromatography

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