Determination of plutonium isotopes (238Pu, 239Pu, 240Pu, 241Pu) in environmental samples using radiochemical separation combined with radiometric and mass spectrometric measurements - DTU Orbit (01/01/2019)

Determination of plutonium isotopes (238Pu, 239Pu, 240Pu, 241Pu) in environmental samples using radiochemical separation combined with radiometric and mass spectrometric measurements

This paper reports an analytical method for the determination of plutonium isotopes (238Pu, 239Pu, 240Pu, 241Pu) in environmental samples using anion exchange chromatography in combination with extraction chromatography for chemical separation of Pu. Both radiometric methods (liquid scintillation counting and alpha spectrometry) and inductively coupled plasma mass spectrometry (ICP-MS) were applied for the measurement of plutonium isotopes. The decontamination factors for uranium were significantly improved up to 7.5×10^5 for 20 g soil compared to the level reported in the literature, this is critical for the measurement of plutonium isotopes using mass spectrometric technique. Although the chemical yield of Pu in the entire procedure is about 55%, the analytical results of IAEA soil 6 and IAEA-367 in this work are in a good agreement with the values reported in the literature or reference values, revealing that the developed method for plutonium determination in environmental samples is reliable. The measurement results of 239+240Pu by alpha spectrometry agreed very well with the sum of 239Pu and 240Pu measured by ICP-MS. ICP-MS can not only measure 239Pu and 240Pu separately but also 241Pu. However, it is impossible to measure 238Pu using ICP-MS in environmental samples even a decontamination factor as high as 106 for uranium was obtained by chemical separation.

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