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.

General information
State: Published
Organisations: Radioecology and Tracer Studies, Center for Nuclear Technologies, Nanjing University
Contributors: Xu, Y., Qiao, J., Hou, X., Pan, S., Roos, P.
Pages: 590–595
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Talanta
Volume: 119
ISSN (Print): 0039-9140
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.26 SJR 1.186 SNIP 1.163
Web of Science (2017): Impact factor 4.244
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.19 SJR 1.168 SNIP 1.276
Web of Science (2016): Impact factor 4.162
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.99 SJR 1.173 SNIP 1.316
Web of Science (2015): Impact factor 4.035
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.71 SJR 1.192 SNIP 1.284
Web of Science (2014): Impact factor 3.545
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 3.74 SJR 1.2 SNIP 1.385
Web of Science (2013): Impact factor 3.511
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.74 SJR 1.417 SNIP 1.451
Web of Science (2012): Impact factor 3.498
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes