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Separation technique using single column chromatography for safeguards verification analysis of uranium and plutonium in highly active liquid waste by isotope dilution mass spectrometry

Verification of uranium (U) and plutonium (Pu) is a vital task for safeguards inspection activities of IAEA in nuclear fuel reprocessing facilities. As part of this task, U and Pu are accurately analyzed even if only small quantities are present in radioactive waste such as highly active liquid waste (HALW). For determining U and Pu contents in HALW, isotope dilution mass spectrometry (IDMS) with ^{233}U and ^{242}Pu spike is generally the most reliable and widely applied analytical technique. However, IDMS requires U and Pu isolates of sample for achieving the highest level of accuracy. Also, the removal of fission products (FPs) is required to minimize the radiation dose in advance to the operation inside the glove box. Therefore, it causes tedious chemical process by manipulator operation inside the shielded cell with several separation steps such as ion-exchange or solid phase extraction.

In this study, the separation method based on single-column extraction chromatography has been developed for safeguards verification analysis of U and Pu in HALW by IDMS. The commercially available TEVA® resin is selected as an extraction chromatography for sequential separation of U and Pu. The U is chromatographically separated from FPs by nitric acid while Pu(IV) is adsorbed on the resin. After that, Pu is eluted by being reduced to Pu(III). The method has successfully achieved the separation of U and Pu from FPs with yielding the enough recovery and sufficient decontamination factors that allow subsequent analysis by IDMS. The column dose rate after the removal of FPs is decreased to the background level. The analytical results obtained by the developed method is in a good agreement with that of the conventional method. It provides simple and rapid separation compared to the conventional method. Subsequently, it is expected that the method can be applied to joint IAEA/Japan on-site analytical laboratory.

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Which ”Key Question” does your Abstract address?

TEC1.1

Which alternative ”Key Question” does your Abstract address? (if any)

TEC1.3

Topics

TEC1

Primary author: Mr YAMAMOTO, Masahiko (Japan Atomic Energy Agency)

Co-authors: Mr HORIGOME, Kazushi (Japan Atomic Energy Agency); Dr TAGUCHI, Shigeo (Japan Atomic Energy Agency); Mr KUNO, Takehiko (Japan Atomic Energy Agency)

Presenter: Mr YAMAMOTO, Masahiko (Japan Atomic Energy Agency)

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