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Sequential separation of trace Pu, U and other elements in environmental samples

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Abundance and isotopic ratios of trace uranium (U), thorium (Th), lead (Pb) and lanthanides in environmental samples play a key role to investigate features of the samples. Plutonium (Pu) is an artificial element which originates from nuclear bomb tests and accidental releases from nuclear power plants. The analytical data may give information on origin of the sample, dating of mineral formation, history on mineralization, and age determination of nuclear materials. Abundance and isotopic ratios of an element of interest are generally measured with high resolution inductively-coupled plasma mass spectrometers (HR ICP-MS). In most environmental samples such as rocks, soils, and airborne dusts, trace Pu, U, Th, Pb, and lanthanides are contained with major elements including Na, K and Fe. These major elements and the polyatomic ions including oxides and hydrides of the co-existing elements affect accuracy of analytical results measured by ICP-MS. The analytes, therefore, should be separated from the interfering elements. Chemical separations are good solution for accurate analyses, but the procedures are generally complicated and time-consuming. The authors developed the technique for sequential separation of Pu, U, Th, Pb, and the lanthanides using a single anion-exchange column and mixed media consisting of hydrochloric acid, nitric acid, acetic acid, and hydrofluoric acid. The target elements were completely separated and fully recovered by using our sequential separation technique.
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Primary author: Dr MIYAMOTO, Yutaka (Japan Atomic Energy Agency (JAEA))

Co-authors: Dr YASUDA, Kenichiro (JAEA); Dr MAGARA, Masaaki (JAEA)

Presenter: Dr MIYAMOTO, Yutaka (Japan Atomic Energy Agency (JAEA))

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