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Sequential anion-exchange separation of ultra-trace actinides and lanthanides with an automatic system

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Plutonium and americium belong to anthropogenic elements, and these ultra-trace elements are detected from environmental samples. Origin of these elements comes from the nuclear bomb tests and the accidental release from nuclear power plants. Isotope ratio and elemental abundance of these actinides provide information on the source term and the elapsed time [1][2]. Uranium and thorium in environmental samples also play a key role to investigate origin of the sample, dating of mineral formation, and history on mineralization. In most environmental samples, trace actinides are contained with major elements including Na, K, and Fe. The ultra-trace elements of interest have to be separated from these major elements to measure accurate isotope ratio and abundance. It is essential to separate ultra-trace Am from large amounts of lanthanides in a sample to accurately measure the Am isotope ratio. An automatic system for sequential separation of Pu, U, Th, Pb, and lanthanides for ultra-trace analysis in environmental samples was developed in our previous works [3][4]. In this work, automatic and sequential separation of actinides including Am, Th, U, Pu, and lanthanides from other elements was achieved by using a small anion-exchange column. Americium was completely separated from lanthanides by eluting the Am with a mixture of highly pure acids including acetic acid, hydrochloric acid, and nitric acid without any special chelate reagents. This simple technique has excellent ability to separate actinides from the matrix elements including lanthanides. The detailed experimental results and optimized separation conditions will be shown in this presentation.

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