Solvent extraction of trivalent actinides with di(2-ethylhexyl) phosphoric acid

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The differences in chemical properties between trivalent actinides heavier than Am and trivalent lanthanides depend largely on their ionic radius. However, extraction behavior of the trivalent actinides was reported to bedifferent from that of the lanthanides which cannot be explained only in terms of the radii [1]. It is, therefore, interesting to study chemical properties of Am^{3+} through Lr^{3+} with comparing with those of the lanthanides.In this work, the extraction behavior of the trivalent actinides with atomic numbers Z≤100 into di(2-ethylhexyl)phosphoric acid (HDEHP) has been studied together with trivalent lanthanides.

The extraction of Ac, Am, Cm, Cf, and lanthanides (excluding Pm) from 0.01-5 M nitric acid into 0.01-1 M HDEHP in benzene was performed. Equal volume aliquots of the aqueous and the organic solutions were mixed in a polypropylene tube and then shaken in an incubator (31±1°C) for 10 min. After centrifugation and phase separation, the pH value of the equilibrated aqueous phase was measured. The distribution ratios of nonradioactive lanthanide isotopes were determined with ICP-MS by measuring the concentrations of metals in the aqueous phases. The concentrations of nonradioactive lanthanide isotopes were determined by ICP-MS measurement, while those of the radioactive isotopes were determined by γ-ray spectrometry with Ge detectors and α-particle spectrometry with Si PIN diodes detectors.

^{250}Fm ($T_{1/2}$ = 30 min) was produced in the ^{238}U(^{16}O,4n) reaction by using the AVF cyclotron at at Research Center for Nuclear Physics, Osaka University. The extraction of Fm from 0.1 M nitric acid into 0.1-0.3 M HDEHP in benzene was performed. The extraction procedures were almost the same as those of the extraction for the Ac, Am, Cm, Cf, and lanthanides.

Extraction constants of those elements were determined by a fit of the extraction reactions to the variation of the distribution ratios. From the results, extraction constants of those elements were determined (Fig.1).

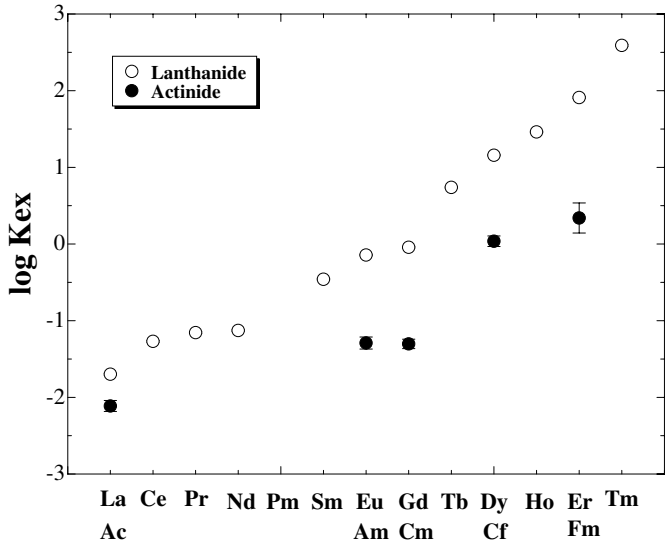

Figure 1: The logarithmic extraction constant log K_{ex} of lanthanides and actinides for extractions into HDEHP-benzene.

References

[1] K. A.Gavrilov *et al.*, Talanta **13**, 471 (1966).