Actinide Separations Using *N* Donor Compounds

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N-donor extractants preferentially extract Am(III) over Eu(III). However, most only work from weakly acidic solutions. In contrast, BTPs (2,6-bis(5,6-dialkyl-1,2,4-triazin-3-yl)pyridines) developed at INE extract from up to 1 M nitric acid with high selectivity. However, their selectivity is not understood on a molecular level. It is commonly assumed that N-donor ligands bond more covalently to An(III) than they do to Ln(III).

EXAFS investigations of An(III) (An = U, Pu, Am, Cm) and Ln(III) (Ln = Sm, Eu, Gd, Dy, Ho, Tm, Lu) complexes in organic solution seem to confirm a bond length contraction for the lighter actinides(III). Interestingly, their extractability by BTP does not follow this trend. Rather, it roughly follows that of the lanthanides(III), with the lightest ions being the least extractable.

TRLFS titrations in aqueous solution indicate significant differences in speciation: $[Cm(BTP)_3]^{3+}$ forms at a much lower BTP concentration as does $[Eu(BTP)_3]^{3+}$. The stability constants differ by 2.5 orders of magnitude, which is in good agreement with BTP’s selectivity in extraction experiments.

The fact that BTP maintain their selectivity in aqueous solution led to the development of a water soluble BTP. While common BTP are used as lipophilic extractants for An(III), the water soluble BTP is used as selective back-extraction agent for An(III).