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Characterization of f-element complexes with soft-donor ligands for selective Americium separation

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In recent years, much effort has been invested in recycling of minor actinides from PUREX raffinate solutions. Hydrophilic N-donor ligands such as tetrasodium-3,3',3'',3'''-([2,2'-bipyridine]-6,6'-diylbis(1,2,4-triazine-3,5,6-triyl))tetra benzenesulfonate ($\text{SO}_3\text{-Ph-BTBP}$) are used for selective separation of Am(III) from Cm(III) and other trivalent fission lanthanides by smart combination with diglycolamide ligands as extractants such as *N,N,N',N'*-tetra-*n*-octyl diglycolamide (TODGA). In this work, the extraction behavior of $\text{SO}_3\text{-Ph-BTBP}$ in combination with TODGA and its mono- and dimethylated derivatives Me-TODGA and Me₂-TODGA was investigated. All systems show a high selectivity of An(III) over Ln(III), and Am(III) over Cm(III). Separation factors decrease in the order TODGA > Me-TODGA > Me₂-TODGA. Moreover, a significant drop in distribution ratios of heavier lanthanides (Tb-Lu) was observed in all three extraction systems. This effect was further elucidated by speciation studies of the formed complexes with several lanthanides using UV/Vis spectroscopy. The formation of 1:2 complexes (metal-to-ligand ratio) with $\text{SO}_3\text{-Ph-BTBP}$ was confirmed for the studied lanthanides and stability constants $\log \beta$ of 7.7 ± 0.8 for Nd(III) at 10^{-3} mol L⁻¹ HNO₃ and 6.1 ± 0.4 for Ho(III) at 3 mol L⁻¹ HNO₃ were determined. No complexation was observed for Nd(III) at 3 mol L⁻¹ HNO₃. Therefore, the formation of complexes with a protonated form of $\text{SO}_3\text{-Ph-BTBP}$ seems to be possible with Ho(III), but not with Nd(III). The results of the extraction experiments and speciation studies will be presented and discussed in the poster.

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