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A novel path in partitioning: Water-soluble BTP ligands for the innovative SANEX process

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With regard to an efficient partitioning process the separation of the trivalent minor actinides from the chemically similar fission lanthanides is one of the key issues. This separation process requires highly effective extracting agents. Alkylated bis(1,2,4-triazin-3-yl)pyridines (BTP) and alkylated bis([1,2,4]triazin-3-yl)-[2,2'']bipyridines (BTBP) are among the most promising SANEX extracting agents, selectively extracting trivalent actinides from nitric acid solutions. Based on the conventional SANEX process an innovative SANEX (i-SANEX) process has been developed, combining the SANEX with the previous DIAMEX step. Hydrophilic aq-BTP is used as aqueous complexing agent for selective back extraction of actinides from organic phases loaded with trivalent actinides and lanthanides. Our studies focus on the complexation of trivalent actinides and lanthanides with aq-BTP (a) to gain fundamental knowledge on the unique properties of BTP, (b) to compare BTP with aq-BTP, and (c) to determine complex formation constants for trivalent actinides and lanthanides required for future process development. In the present work complexation studies are performed with Cm(III)/Eu(III) using time-resolved laser fluorescence spectroscopy (TRLFS). With increasing ligand concentration the following complexes are identified and spectroscopically characterised: [M(aq-BTP)], [M(aq-BTP)2], and [M(aq-BTP)3] (M: Cm(III), Eu(III)). From our spectroscopic results the stability constants and thermodynamic data of the stepwise complex formation are derived. A comparison of the log K values of the [M(aq-BTP)3]-complexes (M = Eu(III), Cm(III)) shows a significantly higher stability constant for trivalent actinides, which is in perfect agreement with the selectivity observed in liquid-liquid extraction tests.

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