An alternative approach to TALSPEAK chemistry using SO_3-Ph-BTP

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The TALSPEAK process was developed over 50 years ago for separating actinides(III) from lanthanides(III) by solvent extraction. Over the last decade scientific interest in this process has revived. To handle some of its disadvantages such as a narrow pH window, a largely improved process, ALSEP, has been developed in the US.

The idea behind TALSPEAK—masking actinides(III) in the aqueous phase to make them less extractable than the lanthanides(III)—has also been exploited in recent European research programmes, ACSEPT and SACSESS. However, rather than using polyaminocarboxylates, a water soluble bis-triazinyl-pyridine, SO_3-Ph-BTP, is utilised to strip actinides(III) from a TODGA solvent loaded with actinides(III) and lanthanides(III). Excellent selectivity for actinides(III) over lanthanides(III) is achieved and the stripping of actinides(III) is performed around 0.5 mol/L HNO_3.

We first tested SO_3-Ph-BTP as a stripping agent for actinides(III) about five years ago. In the meantime, two separation processes using SO_3-Ph-BTP have been developed and lab tested: an i-SANEX process, separating Am(III) and Cm(III) from PUREX raffinate, and a GANEX 2nd cycle process, separating Np(VI), Pu(IV), Am(III) and Cm(III) from a GANEX 1st cycle (equivalent to UREX) raffinate.

After confirming the good chemical stability of SO_3-Ph-BTP, a concept for separating the actinides from SO_3-Ph-BTP and recycling the latter has been devised. Unfortunately, SO_3-Ph-BTP is susceptible to radiolytic damage, challenging its recyclability under process conditions. Owing to its sulphur content, secondary waste is generated upon degradation.

This contribution is intended to give an overview of what so far has been achieved with SO_3-Ph-BTP, highlighting its advantageous properties while not denying its drawbacks, and pointing out possible future development.