



Solvent extraction studies of protactinium for its recovery from short-cooled spent fuel and high-level waste solutions in thorium fuel cycle using diisobutyl carbinol (DIBC) as extractant

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ABSTRACT

Conditions have been optimized for selective removal of protactinium by solvent extraction from short-cooled spent fuel dissolver solution and from high-level waste solution under simulated conditions employing diisobutyl carbinol (DIBC) as extractant. These studies include: effect of acidity, extractant and thorium concentration on the extraction behavior of protactinium. Selectivity of the extractant for protactinium has been investigated with respect to U, Pu, Th, and the fission/activation products. These studies suggest that 40% DIBC (~2.02 M) solution in *n*-dodecane can be employed for the recovery of protactinium from short-cooled spent fuel dissolver solution and from high-level waste solutions. Extraction of Pa increased with aqueous phase acidity due to the formation of protonated species of DIBC, $[H(DIBC)_{1-2}]^+$ and anionic $Pa(OH)_2(NO_3)_4^-$ species. There was an enhancement in Pa extraction at lower acidities (≤ 4 M HNO_3) with increased Th concentration (up to 200 g/l) beyond which a decrease was observed. At 200 g/l Th in 4 M HNO_3 , the separation factor (SF) values of Pa over U and Th are ~ 100 , $>10^5$, respectively. DIBC displays good fission/activation product decontamination under the conditions of these studies.

Keywords: Protactinium; Thorium; AHWR; Reprocessing; High-Level waste; Diisobutyl carbinol

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