Validation of the flow-sheet proposed for reprocessing of AHWR spent fuel: counter-current studies using TBP

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ABSTRACT

A solvent extraction based flow-sheet, for reprocessing of spent fuel arising from Advanced Heavy Water Reactor (AHWR) for separation of uranium, plutonium and thorium using 5% TBP in n-dodecane, has been tested using laboratory scale mixer-settlers. Simulated feed solution containing thorium, uranium and plutonium in the concentration levels expected in feed solutions of AHWR spent fuel reprocessing is prepared using plutonium, natural uranium and thorium nitrate. Quantitative extraction of uranium and plutonium is achieved under experimental conditions leaving bulk of thorium in the raffinate. Co-extracted thorium from the organic phase is scrubbed using 3.00 M HNO₃. Separation of plutonium from uranium is achieved by chemical reduction employing a mixture of hydroxylamine nitrate and hydrazine nitrate in nitric acid. Results show quantitative partitioning. Uranium from the plutonium lean organic phase is stripped using 0.01 M HNO₃. The results clearly established the validity of the proposed flow-sheet.

Keywords: AHWR; Uranium; Plutonium; Thorium; TBP; Solvent extraction