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Uranium refining by solvent extraction

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The solvent extraction process to produce higher purity uranium from yellow cake was studied in laboratory scale. Yellow cake, which the uranium purity is around 70% and the main impurity is thorium, was obtained from monazite processing pilot plant of Rare Earth Research and Development Center in Thailand. For uranium re-extraction process, the extractant chosen was Tributylphosphate (TBP) in kerosene. It was found that the optimum concentration of TBP was 10% in kerosene and the optimum nitric acid concentration in uranyl nitrate feed solution was 4 N. An increase in concentrations of uranium and thorium in feed solution resulted in a decrease in the distribution of both components in the extractant. However, the distribution of uranium into the extractant was found to be more than that of thorium. The equilibration study of the extraction system, $\text{UO}_2(\text{NO}_3)_2/4\text{N HNO}_3 - 10\% \text{TBP/Kerosene}$, was also investigated. Two extraction stages were calculated graphically from 100,000 ppm uranium concentration in feed solution input with 90% extraction efficiency and the flow ratio of aqueous phase to organic phase was adjusted to 1.0. For thorium impurity scrubbing process, 10% TBP in kerosene was loaded with uranium and minor thorium from uranyl nitrate solution prepared from yellow cake and was scrubbed with different low concentration nitric acid. The results showed that at nitric acid normality was lower than 1 N, uranium distributed well to aqueous phase. As conclusion, optimum nitric acid concentration for scrubbing process should not less than 1 N and diluted nitric acid or de-ionized water should be applied to strip uranium from organic phase in the final refining process.

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