

Tert-butyl hydroquinone: A promising reductant of plutonium for process and analytical applications

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ABSTRACT

Tert-butyl hydroquinone (TBH) has been evaluated as a plutonium reductant for reprocessing and analytical applications. The effect of nitric acid concentration on plutonium reduction efficiency of TBH and its recycling are investigated under conditions prevailing in the uranium purification cycle of the PUREX process. A solvent extraction method has been developed for the separation of trace concentrations of uranium (3–30 µg/mL) from plutonium solution (10–12 mg/mL) obtained on dissolution of plutonium oxide in HNO₃ containing traces of HF. The method involves the selective extraction of U(VI) with a mixed solvent comprising 1% trialkyl phosphine oxide (TRPO) + 1.1 M tri-*n*-butyl phosphate (TBP) + 0.4 M TBH solution in *n*-dodecane from 3 M HNO₃–0.4 M N₂H₄, while reducing Pu(VI)/Pu(IV) to inextractable Pu(III) using salt-free reductants TBH (organic phase) and hydrazine (aqueous phase). A decontamination factor of ~150 with respect to Pu has been achieved. This method has been adopted for routine analysis of uranium in PuO₂ samples by Inductively Coupled Plasma–Atomic Emission Spectroscopy (ICP–AES).

Keywords: Uranium; Plutonium; TBP; *Tert*-butyl hydroquinone; Reductant

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