



Simultaneous recovery of yttrium and uranium using D2EHPA–TBP and DNPPA–TOPO from phosphoric acid

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ABSTRACT

A method to simultaneously recover yttrium and uranium from phosphoric acid using DNPPA + TOPO and D2EHPA + TBP solvent systems has been developed. The solvent mixture DNPPA + TOPO is employed for merchant grade phosphoric acid, while the D2EHPA + TBP solvent system is employed for wet process phosphoric acid to recover uranium and yttrium. In the method, four steps are involved for the yttrium recovery: (1) yttrium is co-extracted with uranium using the two organic systems; (2) yttrium is selectively stripped from the loaded organic solutions; (3) yttrium is recovered from the strip liquor by double sulphate salt precipitation; (4) yttrium double sulphate salt is dissolved and precipitated with oxalic acid to generate pure yttrium product. Selective stripping of yttrium from the loaded organic solutions with various strip solutions was tested. It was found that 10% (w/v) Na_2SO_4 + 30% H_2SO_4 and H_2SO_4 (30 to 40%) are the most preferable conditions with more than 95% of yttrium recovered and less than 0.2% of uranium lost in the yttrium strip liquor. From the resultant strip liquor, more than 98% of yttrium was precipitated in the form of sodium yttrium double sulphate salt under the optimized conditions of 10% (w/v) Na_2SO_4 , $60 \pm 1^\circ\text{C}$ and aging time of 45 min. Pure yttrium oxide with more than 99% was obtained after dissolution of the resultant double sulphate salt, precipitation with oxalic acid and calcination at a high temperature. Sodium contained in the yttrium oxide product was removed by washing steps using distilled water and it could be completely removed under the conditions of liquid to solid ratio of 50, $80 \pm 5^\circ\text{C}$ and washing for 30 min. A conceptual process flowsheet has been proposed to recover yttrium as a by-product of uranium from phosphoric acid.

Keywords: Yttrium; DNPPA; TOPO; D2EHPA; TBP; Rare earths double sulphate; Strip solution; Yttrium oxide

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