CHARACTERISATION OF A TBP RESIN AND ITS APPLICATION TO THE SEPARATION OF SN

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Introduction

TBP is a widely employed reagent in liquid–liquid extraction, especially in the extraction of actinides, one of the most prominent examples of its use being the Purex process. A TBP based extraction chromatographic resin has been characterized with respect to its U capacity and the weight distribution ratios (D_W) of U, Th, Pu, Np and numerous other cations in different concentrations of HNO_3 and HCl. Based on obtained data two methods for the separation of Sn have been developed: one for decommissioning samples (including a matrix removal step and special focus on Sn/Te separation - important for MS determination of Sn-126) and the other for the production of radionuclides (Sn separation from up to 1g of Cd).

Characterisation

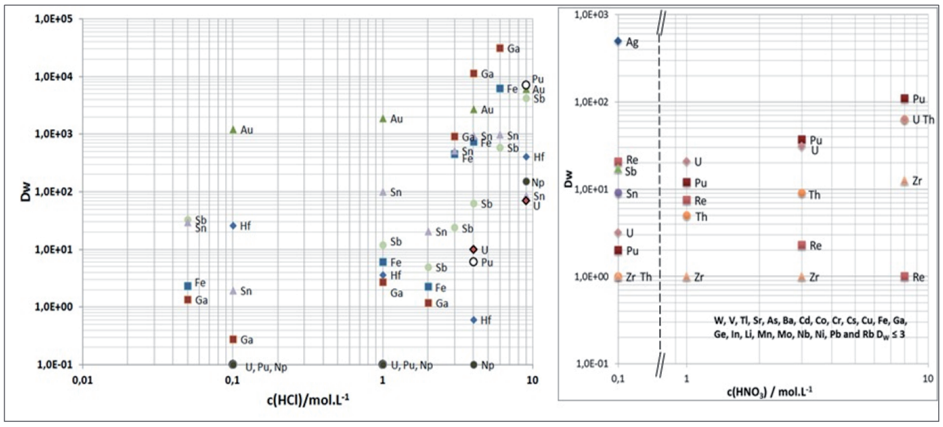

Figure 1: Weight distribution ratios D_W of actinides and selected cations on TBP resin in various HCl and HNO_3 concentrations

- Batch experiments
  - measurement via ICP-MS or LSC
- D_W values = 60-110 for tetra- and hexavalent actinides in HNO_3
- High D_W values for Pu at elevated HCl concentrations
  - Overall moderate D_W compared to TEVA/UTEVA/TRU/DGA Resins
- Easy strip of actinides at lower acid concentrations
- Interesting selectivities for Sn, Ga, Sb and noble metals in HCl
- Maximum uptake of the TBP resin was determined to be in the order of 75 mg $U.g^{-1}$ resin in 8M HNO_3

Two step procedure for decommissioning samples

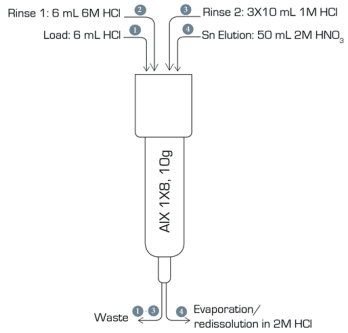

Figure 2: Elution study, matrix removal via anion exchange, 10g 1X8 Resin (Eichrom A8, 200 – 400 mesh)

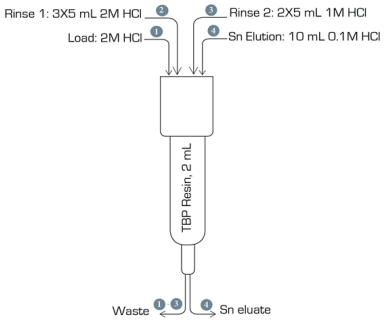

Figure 3: Elution study, Sn separation, Sn purification via 2mL TBP Resin columns

- Matrix removal via anion exchange
  - Direct or after co-precipitation for gross-matrix removal
  - Load and first rinse from 6M HCl
  - Further rinse with 1M HCl
  - Removal of great part of matrix elements
  - Sn elution in 50 mL 1 or 2M HNO_3
    - Sn yield > 90%
  - Trace Fe, Ga and Te still present, In follows Sn

- Sn purification via 2 mL TBP column
  - Evaporation of Sn fraction and redissolution in 2M HCl for direct load onto TBP
  - Rinse with 2M HCl
    - Further removes matrix and In
  - Rinse with 1M HCl
    - Removes trace Ga, Fe and In
  - Sn quantitatively eluted in 10mL 0.1M HCl
  - Overall high decon. factor for Te

Sn separation from up to 1g Cd

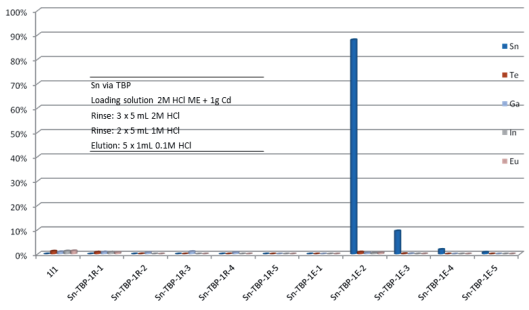

Figure 4: Elution study, Sn separation from 1g Cd, 2 mL column

- Sn separation of Sn from 1g of Cd
  - Quantification by ICP-MS
  - Separation following Fig. 3
    - Multi-element solution plus 1g of Cd (as chloride)
  - No Cd determination in Load and Rinse possible (too high content)
  - No Sn breakthrough during load
  - Sn quantitatively eluted in 5mL 0.1M HCl
  - Cd content in Sn fraction in low µg

Conclusions

- TBP resin characterized with respect to D_W values and maximum U uptake
- Good selectivity for Pu(IV), Sn, Ga and Sb in HCl
- High potential for Sn separation/purification
- Method development via elution studies
- Sn separation methods developed
  - Separation of Sn from decommissioing samples via two step procedure (AIX / TBP)
  - Separation of Sn from large amounts of Cd
- Potential application to noble metal and Sb separation/purification

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