

TBP Resin

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TBP Resin: new resin in TrisKems catalogue

This issue of the TKI is dedicated to the TBP Resin, and the presentation of the results of its characterization.

TBP is a widely used extractant. One of its most known applications is its use in the PUREx process (Plutonium Uranium Redox Extraction) for the reprocessing of U and Pu from spent fuel. Other applications include e.g. the separation of yttrium for analytical purpose.

Extraction chromatography can be considered as a supported solvent extraction, combining the rapidity and easy handling of solid phase extraction and the selectivity of the liquid-liquid extractants. In case of the TBP resin it is the TBP extractant (fig.1) that has been impregnated onto an inert support.

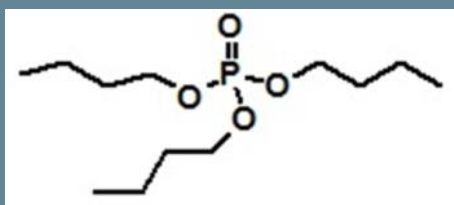


Figure 1: TriButylPhosphate (TBP)

First tests on TBP resin were performed with actinides. Figure 2 shows the D_W values of selected actinides on the TBP resin in HNO_3 and HCl ^(1,2).

In general the actinides show an increasing retention at increasing acid concentrations. However, of all actinides only Pu shows D_W values higher than 100 in HNO_3 , whereas the other actinides peak at D_W values between 60 and 80. Pu is even stronger retained at high HCl concentrations ($D_W > 1000$ on 9M HCl), retention of the other actinides, with exception of Np in 9M HCl ($D_W=140$) is rather low, especially Th(IV) shows very little affinity to the TBP resin.

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DEAR CUSTOMERS

Thank you very much to all of you !



Michaela Langer, CEO of Triskem International, received the award of the businesswomen 2014 in Brittany. We would like to use the opportunity to thank all our customers and partners.

The jury appreciated the investment of the Triskem team and honored our customers for their confidence in the quality of our products and our customer service.

Thank you very much for this confidence! Thank you very much to always help us to improve.

We wish you happy holiday and a successful and nice New Year 2015.



Aude Bombard
Technical Support

TRISKEM INFOS

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News

• New resins:

We're very glad to announce that besides **TBP Resin**, **TK100** and **TK101 Resins**, for the direct concentration and separation of **Sr** and **Pb** respectively from water samples are joining TrisKem offer. More information in the next TrisKem Infos.

For more information please contact us at contact@triskem.fr

Literature

We'd like to draw your attention to publications that may be of interest for you.

Different publications on **Lab-On-Valve technology** for automated preconcentration and/or separation systems have been released by Environmental Radioactivity Laboratory (LaboRA) led by Dr Ferrer at University of Balearic Islands and working group headed by Dr Hou in Technical University of Denmark (DTU):

- **U in environmental samples**
<http://dx.doi.org/10.1016/j.talanta.2010.12.018>
- **Sr in environmental samples**
<http://dx.doi.org/10.1016/j.talanta.2011.11.042>
- **Sr and Pb in sludges samples**
<http://dx.doi.org/10.1016/j.apradiso.2013.11.123>
- **Tc in environmental samples**
<http://dx.doi.org/10.1016/j.talanta.2014.04.093>
- **Actinides in seawater**
<http://dx.doi.org/10.1021/ac402673p>

If you would like to communicate your latest publication using our products in the next TKIs please contact either Steffen Happel (shappel@triskem.fr) or Aude Bombard (abombard@triskem.fr).

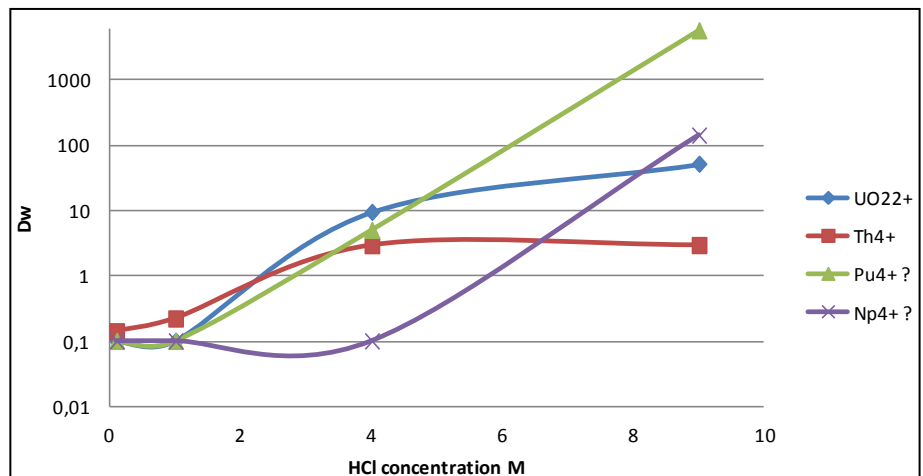
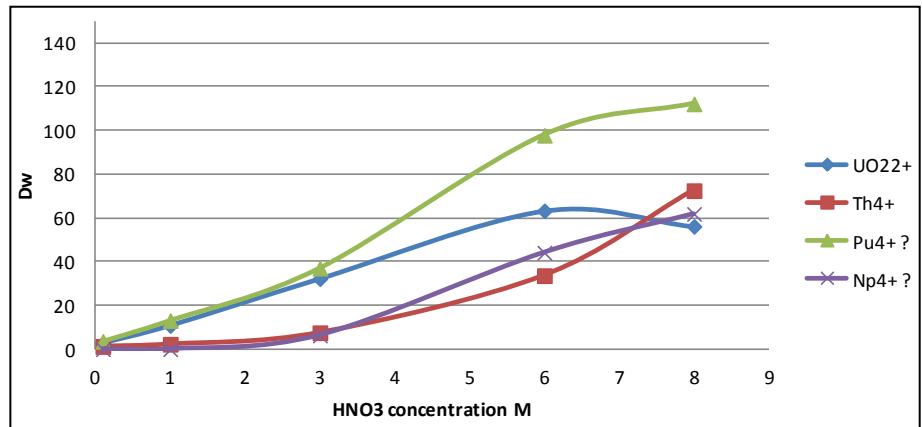
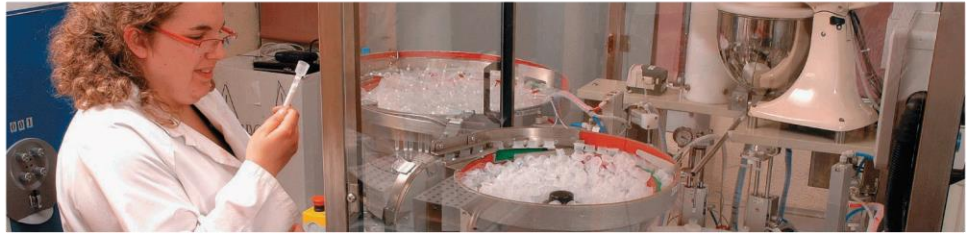


Figure 2 : D_w values of selected actinides in HNO_3 and HCl media on TBP Resin⁽¹⁾

Nora Vajda et al. could show that the TBP resin can be used for the separation of Pu from other actinides and developed a method for its use for the determination of Pu in water samples⁽²⁾.

Vajda et al. also evaluated the influence of Fe(III) and three anionic interferences (oxalic, sulfuric and phosphoric acid) on the U and Pu uptake⁽²⁾. In 8M HNO_3 a Fe concentration of 0.1M is not interfering with the uptake of U(VI) and Pu(IV), the same is true for Np(IV) and Th(IV). Contrary to that the same Fe concentration very strongly interferes with the retention of U and Pu in 9M HCl.

Figures 3 and 4 show the impact of increasing amounts of anionic interferences on the retention of U(VI) in 8M HNO_3 and of Pu(IV) in 9M HCl. Oxalates show no interference with the U uptake even at concentrations of up to 0.5M. Sulfate, and especially phosphate, interfere significantly when present in elevated amounts. The Pu(IV) extraction from 9M HCl is very robust, although the tested anions do interfere with its uptake when present in concentrations $\geq 0.1M$, the D_w values of Pu still remain greater than 500.

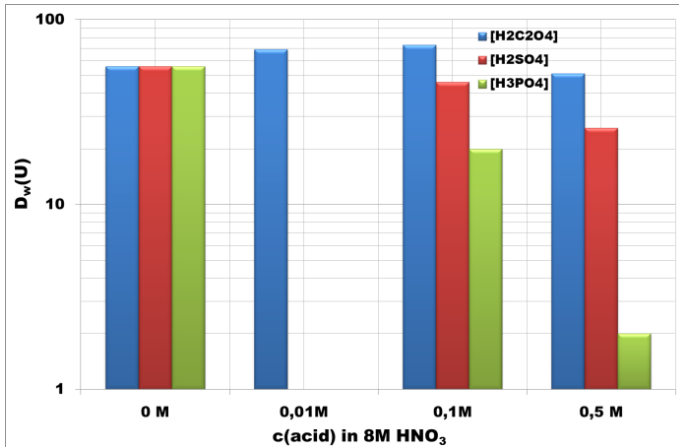


Figure 3 : D_w values for U in 8M HNO₃, increasing amounts of anionic interferences⁽²⁾.

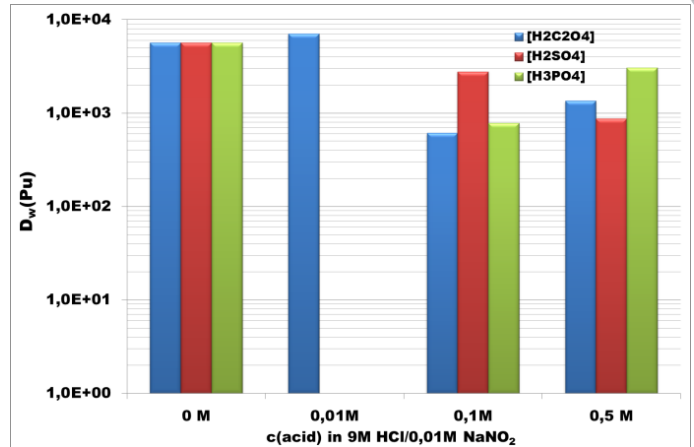
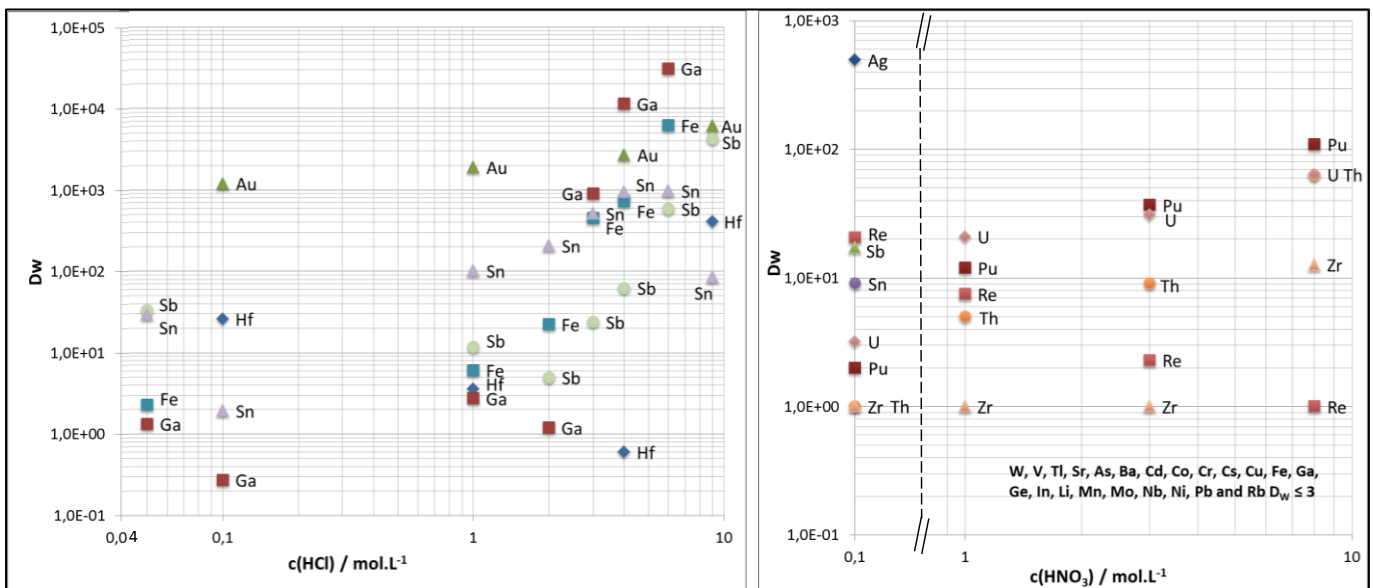


Figure 4 : D_w values for Pu in 9M HCl, increasing amounts of anionic interferences⁽²⁾.

The TBP resin has further been characterized with respect to the uptake of various elements in HNO₃ and HCl, the results are summarized in figures 5 - 6.



Figures 5 and 6 : D_w values of selected elements on TBP resin in HCl and HNO₃⁽¹⁾.

Beside Pu(IV) and Np(IV) several other elements such as Au, Hf, Fe, Sn and Ga also show high affinity for the TBP resin in HCl (figure 5).

The TBP resin generally shows very good selectivity for Sn over Te (Te-126 is an isobaric interferences for the mass spectrometric determination of Sn-126, a long-lived beta emitter frequently determined in decommissioning and radioactive waste samples) and Cd which is frequently used as target material for the production of Sn-117m, a conversion electron emitter used in nuclear medicine. The resin also shows interesting selectivity for Sb, however its oxidation state needs to be carefully controlled.

Based on the obtained data, Dirks et al. developed a procedure for the separation of Sn from various elements, Figure 7 shows a scheme of the proposed method using a 2 mL TBP column. Figure 8 shows the results of an elution study performed using this procedure⁽¹⁾.

For more information contact or visit our website
<http://www.triskem-international.com/>



AGENDA

We'll be participating to the following upcoming conferences and are very much looking forward to meeting and discussing with you there!

° **European Winter Conference on Plasma Spectrochemistry - EWPCS 2015**, Münster (DE) 22-26/02/2015,
<http://www.ewcps2015.org/>

° **The 3rd Nuclear Technologies for Health Symposium - NTHS 2015**, Nantes (FR), 10-11/03/2015,
<http://www.nths2015.com/>

° **COGER 2015 (Co-ordinating Group for Environmental Radioactivity)**, Nottingham (UK), 7-9/04/2015,
<http://www.coger.org.uk/>

° **LSC Anwendertreffen 2015**, Villingen (Switzerland), 23-24/04/2015

° **ISRS 2015**, University of Missouri Columbia (MO-USA) 26-30/05/2015,
<http://muconf.missouri.edu/ISRS2015/In dex.html>

° **PROCORAD**, Toledo (ES), 17-19/06/2015, www.procorad.org

° **28th Annual Congress of the European Association of Nuclear Medicine - EANM'15**, Hambourg (DE) 10-14/10/2015,
http://www.eanm.org/congresses_event s/future_congresses.php?navId=28

You will find an update on our participations to conferences on our website
www.triskem-international.com

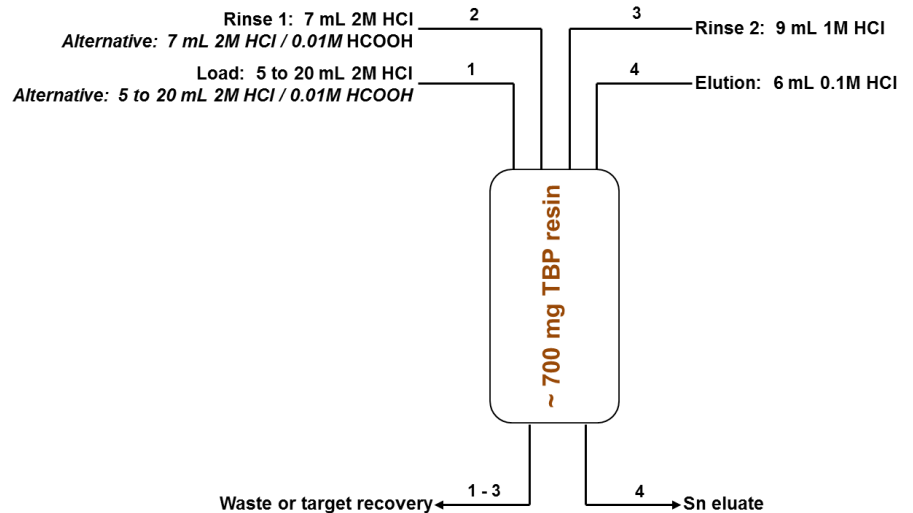


Figure 7 : Separation scheme Sn separation on TBP resin ⁽¹⁾.

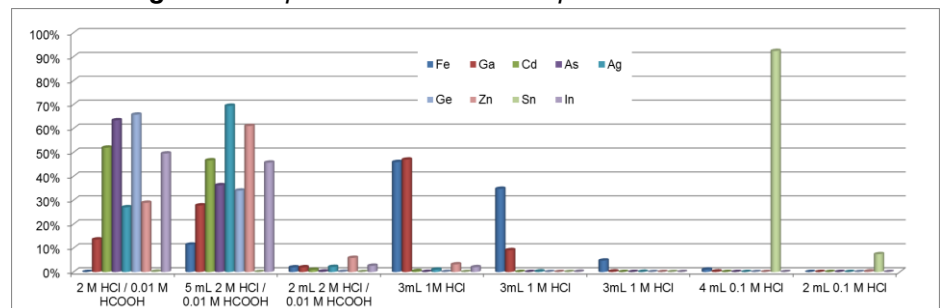


Figure 8: Elution study Sn separation on TBP resin ⁽¹⁾.

Most of the tested elements are not retained during load and first rinse. Sn and part of the Ga and Fe are retained. The latter two are first removed with 1M HCl, Sn is then quantitatively eluted with 6mL 0.1M HCl in high purity. For samples containing elevated amounts of Fe it will be necessary to either remove Fe before loading (e.g. by anion exchange) or to assure complete reduction of Fe to Fe(II).

Bibliography

- [1] Dirks C, Vajda N., Kovács-Széles E., Bombard A., Happel S.: "Characterization of a TBP Resin and development of methods for the separation of actinides and the purification of Sn" Poster presented at the 17th Radiochemistry conference, Mariánské Lázně (Czech Republic), 11 - 16 May 2014
- [2] Dirks C et al. "Characterization of a TBP Resin and development of methods for the separation of actinides and the purification of Sn", presentation at the Triskem International Users Group Meeting in Bath (UK), 16.09.14: http://www.triskem-international.com/iso_album/tbp_resin_separation_of_actinides_and_the_purification_of_sn.pdf

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