RadChem Info

TRU Resin

Agenda

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EICHROM ENVIRONMENT

Editorial

2007 is a year of change and novelty. We are glad to announce the creation of

EICHROM ENVIRONMENT SAS

Recently resulting from a structural change between Eichrom Technologies in the United States and Eichrom Europe in France, EICHROM ENVIRONMENT goes on focusing on customers needs as well as on the environment monitoring and analysis market.

EICHROM ENVIRONMENT remains dedicated to resins sales and technology development, and produces from now on locally its own EICHROM resins range.

The Management Team of EICHROM ENVIRONMENT is fully committed to satisfy its customers' quality expectations and to develop R&D partnerships.

Your Radchem contacts in Eichrom Environment remain the same as the ones you were having in Eichrom Europe. You will find our complete team on the last page of this letter.

The technical part of this issue is dedicated to the characteristics and properties of TRU Resin. This is the last of the four main Eichrom Resins. Starting in the next RadChem Info issue, we'll go on with the Eichrom Resins that are less known as LN Resin, NI Resin,...

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TRU Resin

TRU Resin characteristics and properties are given by the synergistic combination of CMPO (octylphenyl-N,N-di-isobutyl carbamoyle phosphine oxyde) extractant diluted in TBP (fig. 1). TRU Resin is used for the extraction and separation of TRansUranian elements, including americium, contrarily to TEVA or UTEVA Resins.

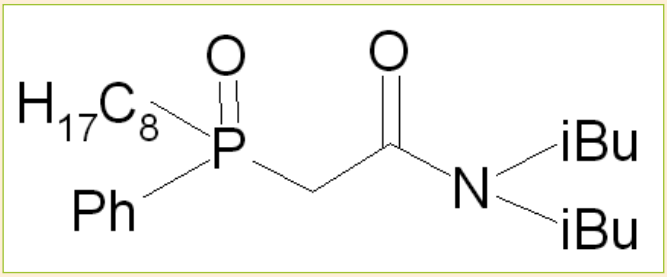

Figure 1 : CMPO.

Assumed extraction equilibria :

$$Am^{3+} + 3NO_3^- + 3\overline{E} \Leftrightarrow \overline{E_3 \cdot Am(NO_3)_3}$$

(Ln^{3+})

$$Pu^{4+} + 4NO_3^- + 2\overline{E} \Leftrightarrow \overline{E_2 \cdot Pu(NO_3)_4}$$

(Np^{4+})

$$UO_2^{2+} + 2NO_3^- + 2\overline{E} \Leftrightarrow \overline{E_2 \cdot UO_2(NO_3)_2}$$

Where E = extractant

Vm (mobile phase)	0.68 mL/mL resin
Vs (stationnary phase)	0.152 mL/mL resin
Resin density	0.37 g/mL resin
Experimental capacity	2 mg Am/ mL resin

Table 1 : Data on TRU Resin[1].

Figure 5 shows the elution profils of the different radionuclides in HNO_3 and HCl media. Transuranian elements have a high affinity for the resin for increasing HNO_3 concentration. Americium also shows a good affinity for the resin : $k'_{(Am)\ max}$ ~100 for a concentration in HNO_3 from 1 - 3M. Np(V) is not retained on the TRU Resin at high HNO_3 concentrations whereas Np(IV) is very well fixed in the same conditions. This different behaviour between the two oxydation states of Np allows the separation of this element from other actinides. Fe(III) shows no affinity for the resin for the acidity range of 0.05 - 2M HNO_3. Above 2M HNO_3, Fe(III) affinity is increasing with the HNO_3 concentration. TRU Resin properties towards Fe can be used for the separation and measurement of Fe-55 (cf Eichrom method FEW01). Fe(III) is fixed on the resin at 8M HNO_3 and eluted either with 1-2M HNO_3 solution.

In HCl media, Am(III) is not retained on TRU Resin. Pu(IV), Np(IV), Th(IV) and U(VI) show very high affinity for HCl concentrations higher than 3M. Affinity of

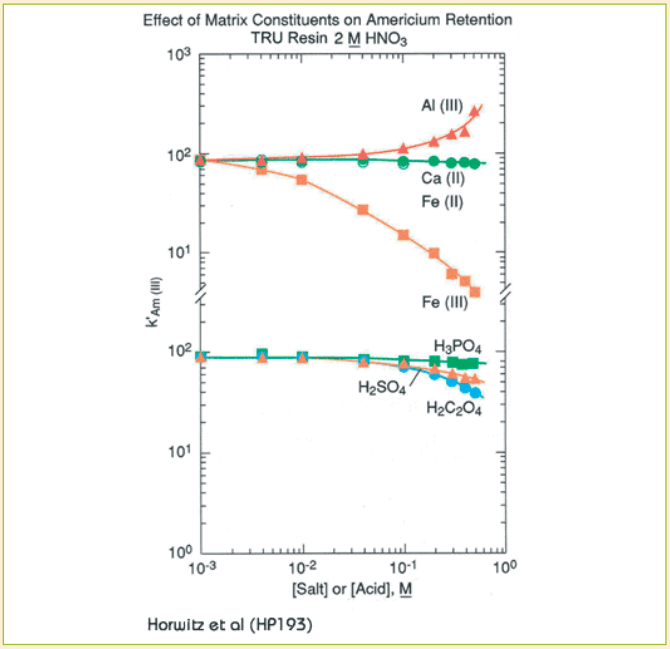

Figure 2 : Matrix effects on Am(III) retention [1].

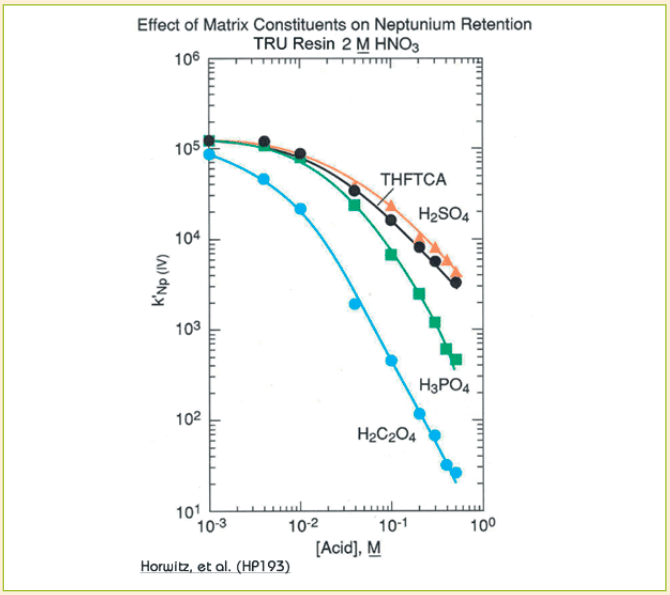

Figure 3 : Matrix effects on Np(IV) retention [1].

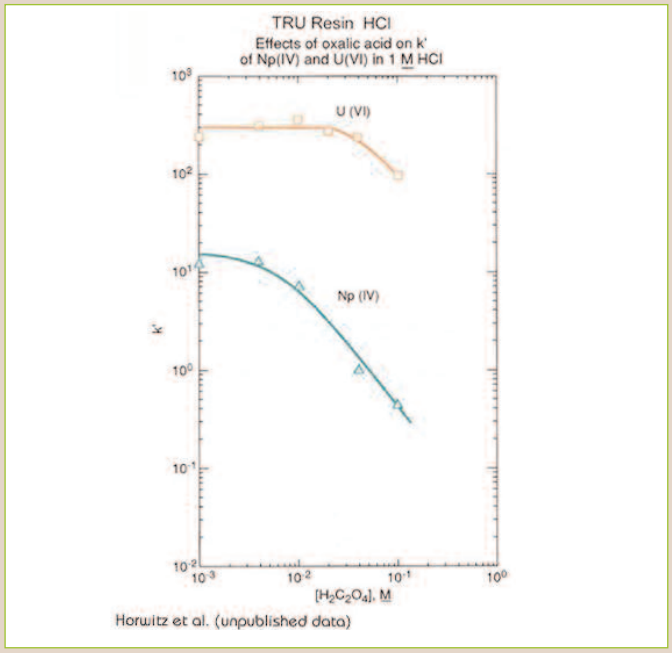

Figure 4 : *Oxalic acid interference on the uptake of Np(IV) and U(VI) [1].*

these elements for the resin is decreasing with decreasing HCl concentration.

Phosphates, sulfates and oxalic acid start slightly interfering Am uptake when their concentration is greater than 0.1M (figure 2). The same salts do interfere strongly the uptake of Np(IV), especially oxalate salt.

However, $k'_{Np(IV)}$ remains greater than 1000 for salt concentrations less than 0.05M for oxalates and 0.3M for sulfates (figure 3).

Figure 2 shows that calcium and Fe(II) do not interfere Am retention. However, a concentration of Fe(III) greater than 10^{-3}M in 2M HNO_3 prevents any uptake of Am. On the contrary, the presence of more than 0.1M aluminum enhances Am(III) uptake.

In 1M HCl medium, Np(IV) shows no affinity for TRU Resin. The use of oxalic acid in concentration higher than 10^{-2}M in 1M HCl, makes the Np(IV) elution faster. In the same acidic medium, U(VI) remains on the resin up until the oxalic acid concentration reaches 0.05M (figure 4).

Eichrom methods using TRU Resin are ACU02, ACW03, ACW04, ACW03VBS, ACW16 VBS and FEW01. Associated bibliography is available on the http://www.eichrom.com/ website (follow "Radiochemistry" then "Bibliography").

Bibliography

(1) Horwitz P., Chiarizia R. Dietz M., Diamond H., Nelson, D. ; *Analytica Chimica Acta*, **281**, pp. 361-372 (1993); Eichrom reference HP193.

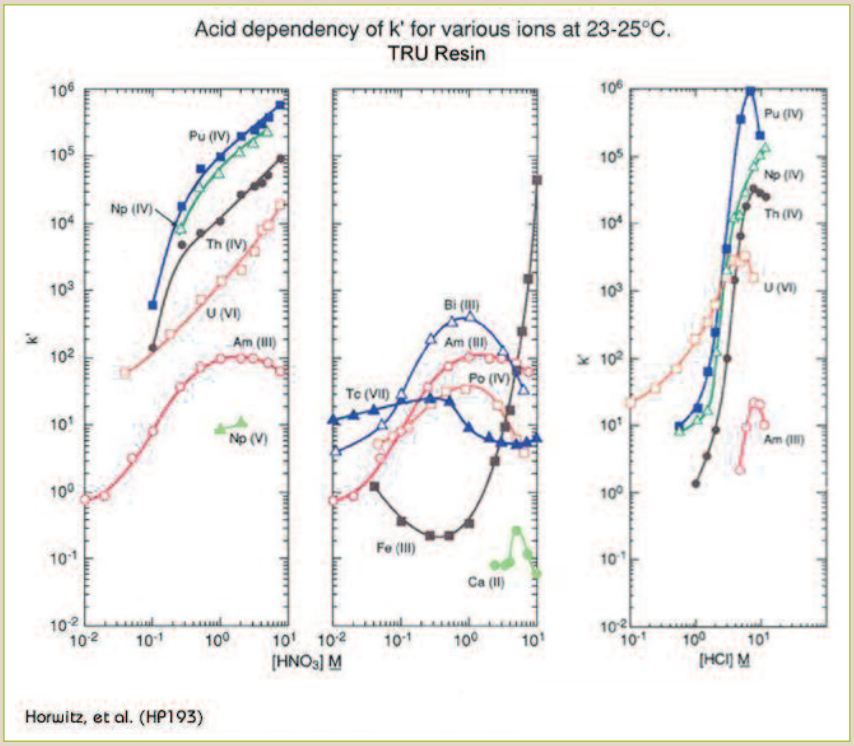

Figure 5 : *Elution profils of different elements in HNO_3 and HCl media on TRU Resin [1].*

Do not hesitate to contact us for more details

Agenda

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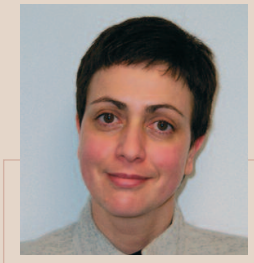

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