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Floral composition designed for Eichrom Europe by Aurélie, florist student on Ker Lann Campus.

Editorial

In this and subsequent issues of RadChem Info, the technical section will be dedicated to a review of our most popular products, UTEVA Resin, TEVA Resin, TRU Resin and Sr Resin. This review will allow us to communicate some of the diverse applications of these resins and perhaps broaden your knowledge of how these products can solve analytical problems. We begin with UTEVA Resin in the current issue.

In the last issue of RadChem Info we solicited suggestions for discussion topics at our Users' Meetings this year. To date we have received very few suggestions. I encourage everyone to let us know what they would like to hear about at our Users' Meetings. In the meantime we are please to announce that our workshop this year will be held in Slovakia. We are excited to have this opportunity to connect with our Central European users.

I'll end this editorial on a "floral" note. Aurélie, is a student in floral design at the Faculté des Métiers on the Ker Lann Campus, where our facilities are located. Aurélie is one of 16 students who were charged with choosing a company here on the campus and designing a floral arrangement representing companies' activities. Aurélie's creation is pictured to the left. Thanks, Aurélie !

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UTEVA Resin

UTEVA Resin (Uranium and TEtraValents Actinides), is one of the four most popular extraction chromatographic products Eichrom provides.

The extractant coated on the inert support is the DP[PP] (Dipentyl pentylphosphonate, figure 1). This extractant shows an affinity for nitrato complexes of uranium (VI), thorium (IV), neptunium (IV) and plutonium (IV). The formation of these complexes is dependent on the nitrate concentration in solution: the higher the nitrate concentration, the better the uptake of the actinides (see figure 2).

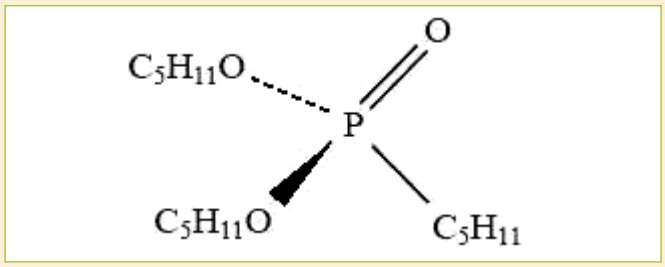

Figure 1 : Dipentyl pentylphosphate (DP[PP]) also called Diamyl amylphosphate (DAAP).

The assumed equilibrium extraction is :

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

$$Th^{4+} + 4NO_3^- + \overline{3E} \Leftrightarrow \overline{Th(NO_3)_4 \cdot E_3}$$

Where E = extractant.

Vm (mobile phase)	0,65 mL/mL of resin
Vs (stationnary phase)	0,167 mL/mL of resin
Resin density	0,39 g/mL of resin
Experimental capacity	7,5 mg U/ mL of resin

Table 1 : UTEVA resin data[1].

It can be seen that the uptake from nitric acid is very similar for each of the tetravalent actinides and uranium. All have strong retention (k'>100) above 5M nitric acid. Note that Am is not retained at any nitric acid concentration. This fact is important in developing analytical separation schemes. Plutonium can be reduced to Pu(III). At this valence state, it behaves similarly to Am(III). Figure 2 is a graph that shows the effect of HCl on the retention of Np(IV), Th(IV), and U(VI) on UTEVA Resin. The large difference in k' for uranium and thorium in the range of 4-6M HCl allows for the selective elution of Th from the resin after both thorium and uranium have been loaded. U and Np remain on the resin. Looking at the oxalic acid effects on Np and U retention, Np can be stripped with 0.05M oxalic acid solution without effect on U elution (fig. 3 and 4).

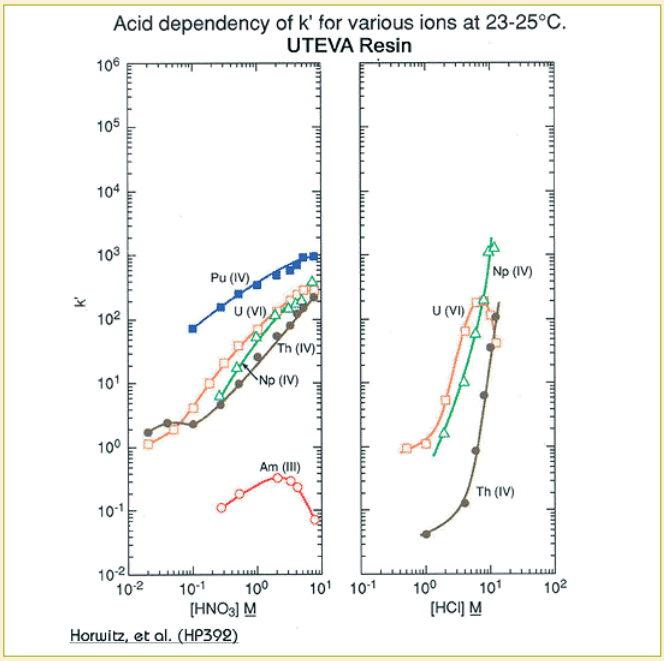

Figure 2 : Capacity factors for different actinides on UTEVA resin with respect to the acid concentration.

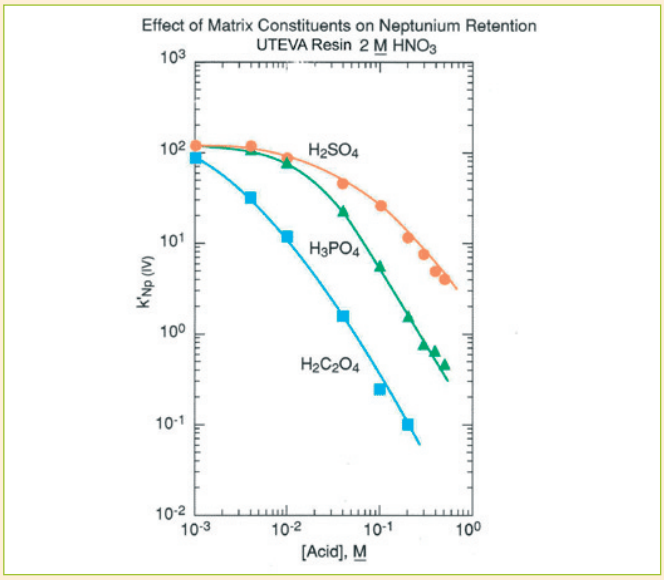

Figure 3 : Matrix effect on Np(IV) retention in 2M HNO_3.

Phosphate occurs quite commonly in a variety of biological and environmental samples, its effect is most relevant. Fortunately the addition of aluminum to the sample matrix can significantly reduce this issue.

Phosphate anions readily complex tetravalent actinides. This phosphato complex is not extracted by the DP[PP]. Added aluminum can effectively tie up the phosphate preventing its interference with neptunium (or thorium) uptake by the resin. In some methods, as much as 1M $Al(NO_3)_3$ might be added to counteract the effects of phosphate. (Cf. figures 3 et 4).

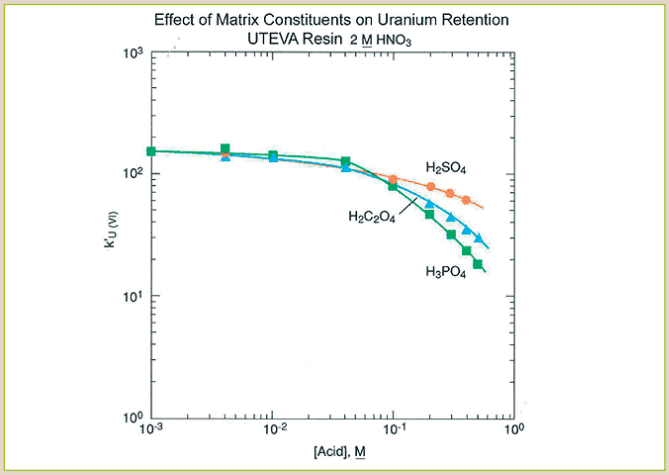

Figure 4 : *Matrix effect on U(VI) retention in 2M HNO_3.*

Depending on the radionuclides to be measured, UTEVA Resin may be used alone or in combination with other resins. UTEVA Resin has been used for the determination of U and Th concentration in soil by ID-TIMS and ID-SIMS[2]. Another interesting application of UTEVA Resin is in the analysis of trace metal impurities in uranium and plutonium metals and oxides. In nuclear fuel production and recycling operations, it is necessary to measure the purity of the uranium and/or plutonium used in fuel fabrication. UTEVA Resin has been applied to sample preparation schemes to remove the U or Pu matrix allowing for analysis of the trace metal impurities by AAS, ICP-AES or ICP-MS. This approach has been employed at Savannah River and Oak Ridge in the US[3]. A Standard Practice based on the method used at Savannah River is currently being balloted by the Nuclear Fuel Cycle Committee (C26) of ASTM International.

Combined with TRU resin, UTEVA resin is commonly used to sequentially elute U /Pu/Am (Eichrom methods ACW03 and ACW03VBS). These methods and extensive bibliography of published articles on the use of UTEVA Resin are available on our web site. (*www.eichrom.com.* Click on "radiochemistry" and choose "bibliography".)

Bibliography

(1) Horwitz P., Dietz M., Chiarizia R., Diamond H., *Analytica Chimica Acta*, **266**, pp. 25-37 (1992); Eichrom Reference HP392.
(2) Adriens A G., Fassett J. D., Kelly W. R., Simons D.S., Adams F. C., *Analytical Chemistry*, **64**, pp. 2945-2950 (1992) ; Eichrom Reference AA192.
(3) Maxwell S. L., Eichrom Western Users' Group Workshop, Albuquerque, NM - USA, (2000).

Do not hesitate to contact us for more details

In Brief

Workshop

Following the comments received from participants in the Workshops we organized in 2005, we envision future workshops being organized around actual laboratory experience of our users. As requested in the last issue of RadChem Info, we're again calling for your suggestions on interesting discussion topics for our future Users' Meetings. Let us know if you have some information to share about the use of our products in your laboratory.

In the meantime, we are pleased to announce that our 2006 workshop will be held in Slovakia this fall. Location and date will be provided latter on, but if you are interested, please contact us. This will be the first opportunity to connect with our users in Central Europe in an Eichrom sponsored forum. We are happy to have this chance to meet old and new colleagues in that region and we encourage our Western European users to join us.

Agenda

2006 Conferences

> **International Workshop on Frontiers and Interfaces of Ion Exchange :** 11 - 15 June 2006, Antalya - Turkey *(http://www.dalyatur.com/iew2006/)*

> **Procorad :** 20 - 23 June 2006, Constanza - Romania *(http://www.procorad.org/fr/avenir-reunion/)*

> **International Congress on Analytical Sciences :** 25 - 30 June 2006, Moscow - Russia *(http://www.icas2006.ru/)*

> **Euroscience Open Forum 2006 :** 15 - 19 July, Munich - Germany *(http://www.esof2006.org/programme.php4)*

> **1st European Chemistry Congress :** 27 - 31 August 2006, Budapest - Hungary *(http://www.euchems-budapest2006.hu/)*

> **Environmental Radiochemical Analysis, 10th International Symposium :** 13 - 15 September 2006, Oxford - United Kingdom *(http://www.rsc.org/ConferencesAndEvents/MemberEvents/ERA/Accommodation.asp)*

> **2nd Topical Workshop in Low Radioactivity Techniques (LRT 2006) :** 30 September - 3 October 2006, Aussois - France *(http://lrt2006.in2p3.fr/index.html)*

> **52nd Radiobioassay and Radiochemical Measurements Conference :** 23 - 27 October 2006, Chicago - USA *(www.rrmc2006.org.)*

Page-In - Imprimerie IPO