PRODUCT SHEET

UTEVA resin

Main Applications

- Separation of Uranium
- Separation of actinides(IV)
- Separation of Zirconium

Packing

Order N°.	Form	Particle size
UT-B25-A, UT-B50-A, UT-B-100-A, UT-B200-A	25g, 50g, 100g and 200g bottles UTEVA resin	100-150 µm
UT-C20-A, UT-C50-A	20, 50 and 200 2 mL UTEVA resin columns	100-150 µm
UT5-C20-A, UT8-C20-A , UT10-C20-A	20 5, 8 and 10 mL UTEVA resin columns	100-150 µm
UT-B10-S, UT-B25-S, UT-B50-S, UT-B100-S, UT-B200-S	10g, 25g, 50g, 100g and 200g bottles UTEVA resin	50-100 µm
UT-R10-S	10 2ml cartridges UTEVA resin	50-100 µm
UT-B10-F	10 g bottle UTEVA resin	20-50 µm

Physical and chemical properties

Density : 0,39 g/ml
Capacity : 100 mg U/g resin UTEVA

Conversion factor D_W/k' : 1,67

Conditions of utilization

Recommended T of utilization : /
Flow rate: A grade: 0.6 – 0.8 mL/min, utilization with vacuum or with pressure for s grade resin
Storage: Dry and dark, T<30°C

For additional information see enclosed literature study

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SAS au capital de 40.000 euros – SIRET 493 848 972 00029 – APE 2059Z – TVA intra communautaire FR65 493 848 972 10/12/2015

PRODUCT SHEET

Methods*

Reference	Description	Matrix	Analytes	Support
ACS07	Uranium in soil (2 g samples)	soil	U	columns
ACU02	Americium, Plutonium and Uran in urine	urine	Am, Pu and U	columns
ACU02 VBS	Americium, Plutonium und Uran in urine (Vakuum Box System)	urine	Am, Pu and U	cartridges
ACW03	Americium, Plutonium, und Uran in water	water	Am, Pu and U	columns
ACW03 VBS	Americium, Plutonium und Uran in water (Vakuum Box System)	water	Am, Pu and U	cartridges
ACW13 VBS	Thorium, Plutonium und Uran in water (VBS)	water	Pu, Th and U	cartridges
Application Note: 603	Metal Impurities in Uranium, Plutonium and Mixed Oxides	U, Pu, mixed oxides	Metal impurities, Np-237	cartridges, columns

*developped by Eichrom Technologies Inc.

UTEVA RESIN

UTEVA Resin (Uranium und TEtraValents Actinides), is mainly used for the separation of Uranium and tetravalent actinides like Np, Th and Pu.

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

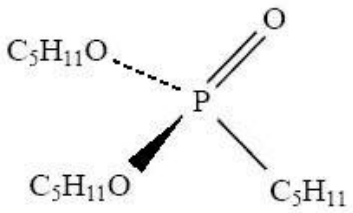

Figure 1 : *Dipentyl pentylphosphate (DP[PP]) also called Diamyl amylphosphate (DAAP).*

The assumed equilibrium extraction is :

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

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

With E = extractant

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 similar to Am(III). Figure 2 also shows the retention of Np(IV), Th(IV), and U(VI) on UTEVA Resin in HCl. 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. The large difference in the effect of oxalic acid on Np and U retention (fig. 3 and 4) can be used to separate both: Np can be stripped with HCl solutions containing 0.05M oxalic acid solution whereas U retention is not affected.

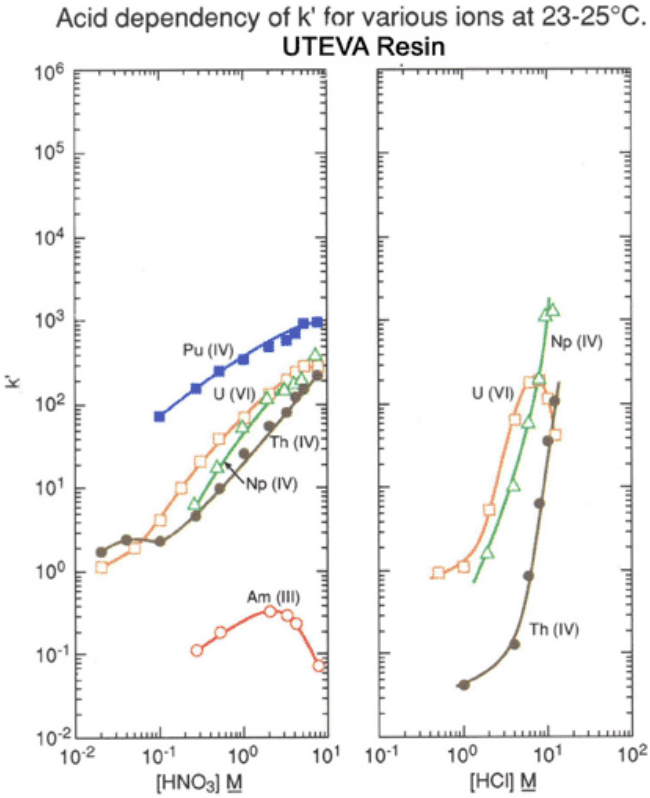

Figure 2 : *Capacity factors k' for different actinides on UTEVA resin with respect to the acid concentration.*

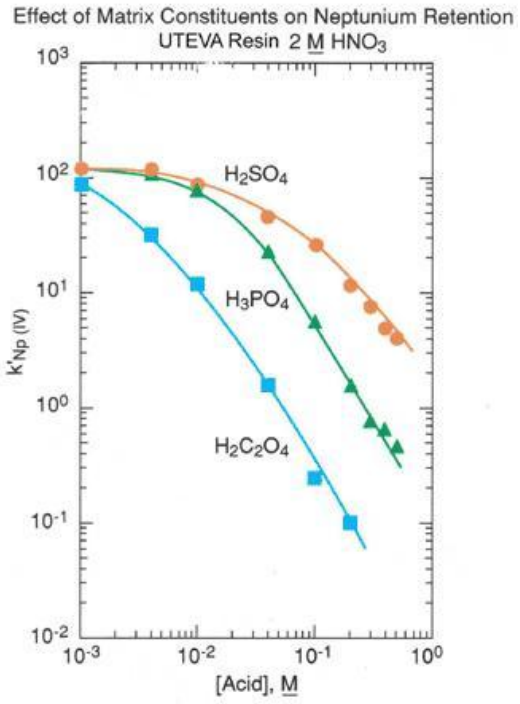

Figure 3 : *Matrix effect on Np(IV) retention in 2M HNO_3.*

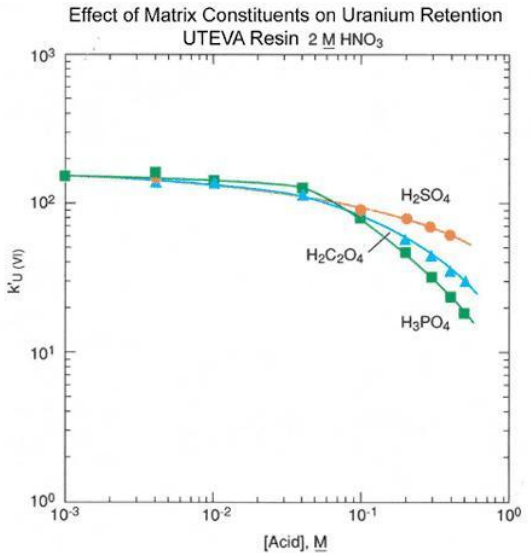

Figure 4 : Matrix effect on U(VI) retention in 2M HNO_3.

Phosphate occurs quite commonly in a variety of biological and environmental samples; its effect is most relevant. Fortunately the addition of aluminium to the sample can significantly reduce this issue. Phosphate anions readily complex tetravalent actinides, this phosphato complex is not extracted by the DP[PP]. Added aluminium 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. (*see* figures 3 and 4).

Depending on the radionuclides to be determined, 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].

Combined with TRU resin, UTEVA resin is commonly used to sequentially separate U, Pu and Am.
UTEVA is also used for the separation of Zr from various matrices, including radioactive waste (4).

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.
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(4) Sz. Osváth, N. Vajda, Zs. Molnár, É. Széles, Zs. Stefánka: Determination of 237Np, 93Zr and other long-lived radionuclides in medium and low-level radioactive waste samples. Journal of Radioanalytical and Nuclear Chemistry, 286, 3 (2010) 675-680