TRISKEM
Expertise in Separation Chemistry

PRODUCT SHEET

TK102 Resin

Main Applications:

- Sr separation
- Pb separation
- Ba/Ra separation

Packing

Order N°.	Form	Particle size
TK102-B25-B, TK102-B50-B, TK102-B100-B, TK102-B200-B	25g, 50g, 100g and 200g bottles TK102 Resin	100-200 µm
TK102-C20-B, TK102-C50-B	20 or 50 2mL TK102 Resin columns Columns with larger volumes are available upon request	100-200 µm
TK102-B25-T, TK102-B50-T, TK102-B100-T, TK102-B200-T	25g, 50g, 100g and 200g bottles TK102 Resin	50-100 µm
TK102-R10-T	10 2mL TK102 Resin cartridges Cartridges with larger volumes are available upon request	50-100 µm

Physical and chemical properties

Density: 0.36 g/mL TK102 Resin

Conditions of utilization

Recommended T of utilization: room temperature
Flow rate: B grade: ≥0.6 mL/min
Storage: Dry and dark, at room temperature

PRODUCT SHEET

TK102 RESIN

The TK102 Resin is based on the same crown-ether that is also used in the SR and PB Resin (fig 1).

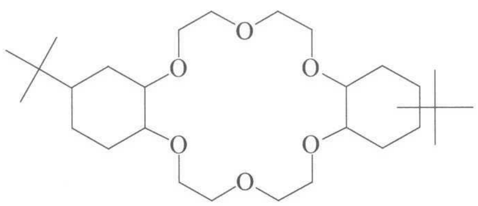

Figure 1: 4,4'(5')-di-t-butylcyclohexano-18-crown-6

Other than these resins the TK102 Resin contains a long-chained fluorinated alcohol as diluent. The resin further contains a larger amount of the crown-ether compared e.g. to the SR Resin. Further the organic phase is impregnated onto an inert support containing aromatic groups for increased stability against radiolysis.
The resin was originally optimized for the separation of Ba and Ra, how ever it also shows very interesting properties with respect to Sr and Pb separation.

Figures 2 and 3 show the selectivity of the TK102 Resin for a range of elements in HNO_3 (fig. 2) and HCl (fig. 3). Figure 4 shows the influence of increasing amounts of Na, K and Ca on the Sr retention in 3M HNO_3.
All D_W shown in these graphs were obtained through ICP-MS measurements.

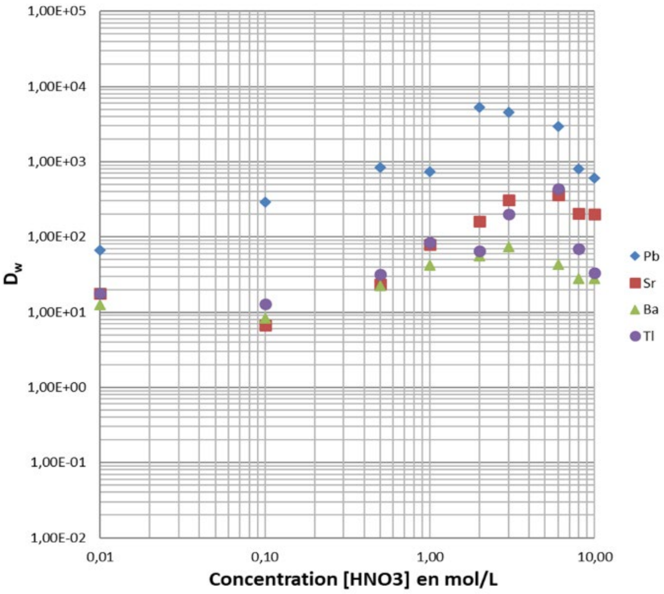

Figure 2: D_W values of selected elements on TK102 in HNO_3

Pb is very well retained over the whole HNO_3 concentration range. Sr is well retained at elevated HNO_3 concentrations (3 – 10M HNO_3), showing higher Sr D_W values than the SR Resin under these conditions. The same is true for Ba at 3M HNO_3, TK102 shows stronger Ba retention than SR Resin. Further it is notable that Tl is strongly retained from 3 – 6M HNO_3.

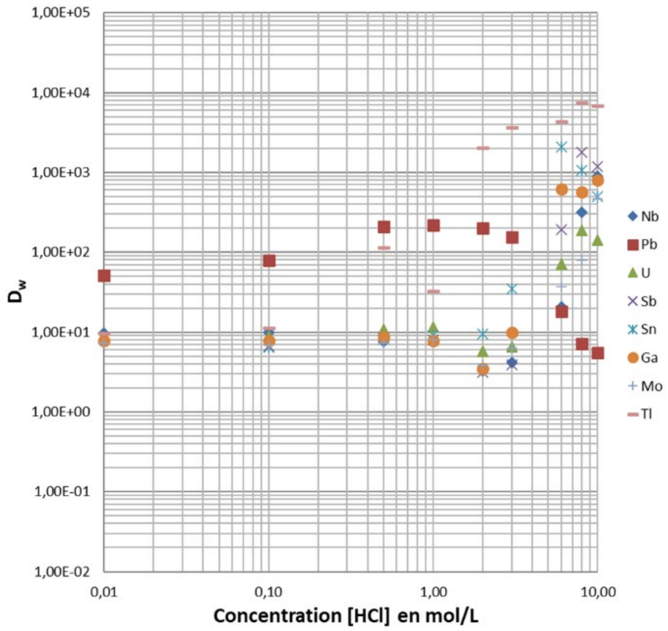

Figure 3: D_W values of selected elements on TK102 in HCl

As expected, Pb is well retained over a wide HCl concentration range, from dilute HCl up to 2 – 3M HCl. Pb D_W values drop strongly for higher HCl concentrations (≥ 6M HCl), allowing for its elution under these conditions.

The TK102 Resin retains, to a certain extent similar to the TK400 Resin, a number of elements at very elevated HCl concentrations, including Tl, Sb, Sn, Ga and Nb.

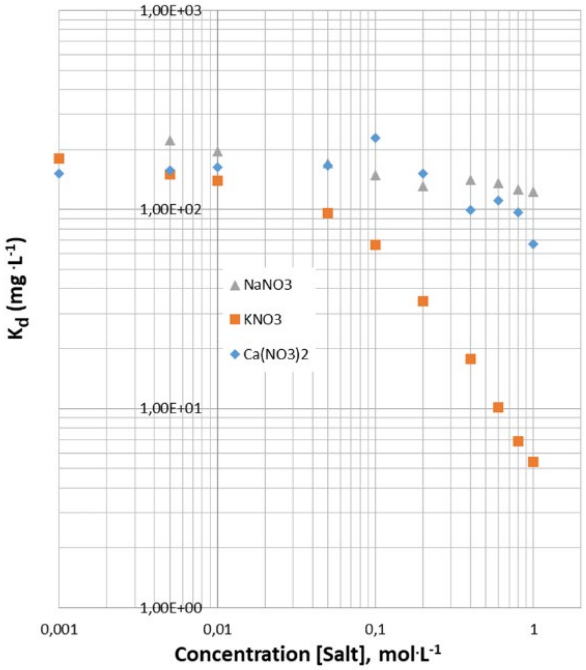

Figure 4: Dw values Sr on TK102 in 3M HNO_3 and in presence of increasing amounts of Na, K and Ca

Na shows very little influence on the Sr retention on the TK102 Resin, even at concentrations up to 1M Dw values for Sr remain high.
Ca is showing a higher impact, nevertheless even at concentrations up to 0.5M Sr shows elevated Dw values.

As expected, K is interfering with the Sr retention very strongly, even concentrations ≥0.05M will lead to a significant decrease in Sr retention.
Just like for the SR Resin, performing a co-precipitation (e.g. with calcium phosphate) to remove K before the actual separation on TK102 Resin is crucial.

The following figures are showing three comparative elution studies on TK102 Resin and SR Resin.

The first example is a typical Pb separation based on loading from 2M HCl, Po removal with dilute HNO_3 and finally Pb elution with citrate.
Both resins are showing very similar elution profiles, TK102 Resin might require a slightly larger elution volume for Pb though. Nevertheless, typically employed elution volumes (e.g. 10 mL) should assure quantitative elution of Pb also from TK102.

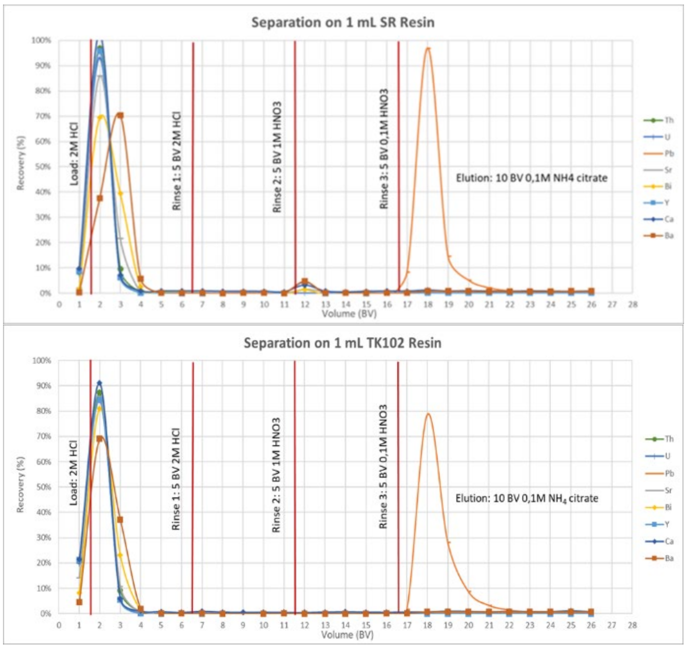

Figure 5: Comparative elution studies, SR and TK102 Resin, Pb separation

The second example is a typical Sr separation based on loading from 3M HNO_3, rinsing with 8M HNO_3 and 3M HNO_3/0.1M oxalic acid, and finally Sr elution in 0.05M HNO_3.

Again, both resins are showing similar elution profiles. One distinct difference being Th, for the TK102 Resin 3M HNO_3/0.1M oxalic acid rinse is required to remove most of the Th while on SR Resin the majority is already removed with 8M HNO_3.

Like for the Pb separation Sr elution from TK102 seems to require slightly larger volumes, but here too typically employed elution volumes (10 – 15 mL) seem to assure quantitative Sr elution.

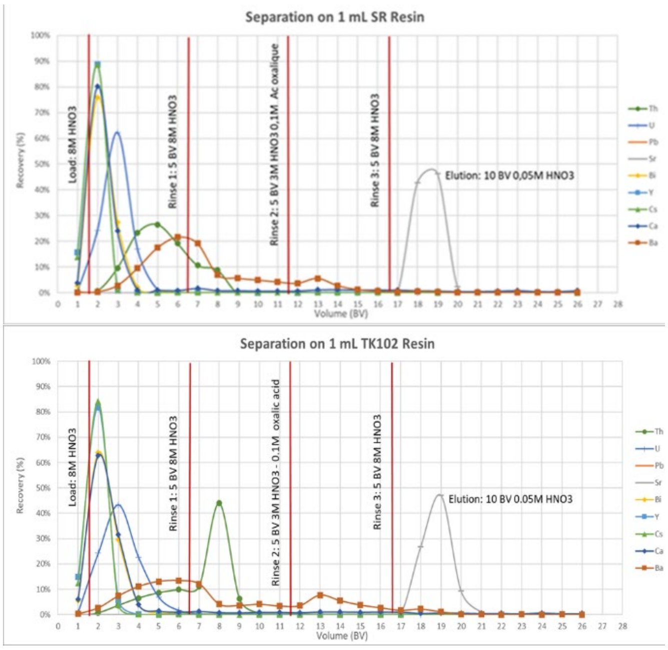

Figure 6: Comparative elution studies, SR and TK102 Resin, Sr separation

The third example shows a comparative Ba/Ra separation elution study. TK102 and SR Resin were both loaded from 3M HNO_3, then both resins were rinsed with several bed volumes (BV) of 3M HNO_3.

For both resins Ra is eluted quickly during load and first rinsing steps, while Ba remains retained.

On the SR Resin Ba starts to significantly break through after 6 BV, on the TK102 Resin the Ba retention is distinctively stronger, it starts to very slowly elute after about 8 - 9 BV.

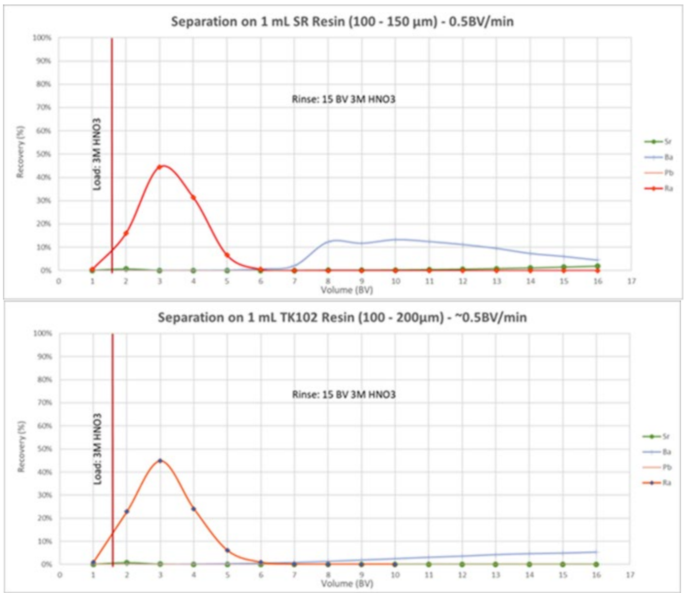

Figure 7: Comparative elution studies, SR and TK102 Resin, Ba/Ra separation

Further the TK102 Resin shows high dynamic capacity for Sr (>40 mg·g^{-1}) and Pb (>90 mg·g^{-1}).

Due to the higher hydrophobicity of the diluent employed in the TK102 Resin it also shows significantly (>10 times) less bleeding of organic material, measured as Non-Purgeable Organic Carbon (NPOC), than the SR Resin.

Bibliography

(1) Illarion Dovhy, Marine Bas, Nora Vajda et al. : "Characterization of new crown-ether containing TK102 Resin for the separation of Sr, Pb and Ba/Ra", Poster presented at the 14th International Symposium on Nuclear and Environmental Radiochemical Analysis from 12 – 15/09/2022 in York (UK). https://www.triskem-international.com/scripts/files/63317f16990d61.93025432/poster-tk102---v1.pdf