TRISKEM
Expertise in Separation Chemistry

PRODUCT SHEET

TK201 RESIN

Main Applications

- Separation of Cu isotopes (incl. in combination with CU Resin)
- Separation of technetium
- Separation of rhenium

Packing

Order N°.	Form	Particle size
TK201-B25-A, TK201-B50-A, TK201-B-100-A, TK201-B200-A	25g, 50g, 100g and 200g bottles TK201 Resin	100-150 µm
TK201-C20-A	20 x 2 mL TK201 Resin columns	100-150 µm
TK201-B25-S, TK201-B50-S, TK201-B100-S, TK201-B200-S	25g, 50g, 100g and 200g bottles TK201 Resin	50-100 µm
TK201-R10-S	10 2mL TK201 Resin cartridges	50-100 µm

Physical and chemical properties

Density: 0.35 g/mL TK201 Resin

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

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The TK201 Resin is based on a tertiary amine, it further contains a small amount of a long-chained alcohol (radical scavenger) to increase its radiolysis stability. The TK201 Resin acts as a weaker ion pair binding agent than to the TEVA Resin, accordingly it is generally possible to elute under softer conditions. Its main application is the separation of anionic species such as Tc(VII) or Re(VII).

Graph 1 shows the Dw values for Tc in HNO_3 and HCl.

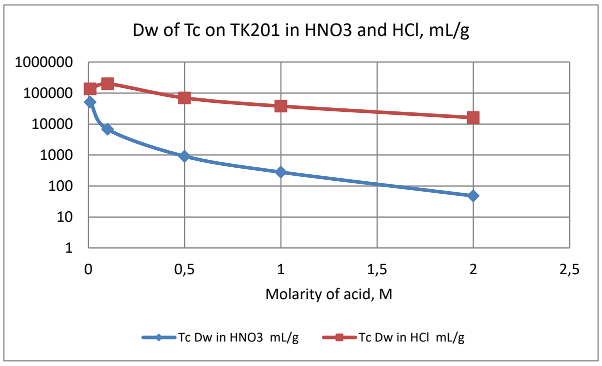

Figure 1: Dw values of Tc on TK201 Resin in HCl and HNO_3, obtained by LSC, data provided by N. Vajda (RadAnal)

Tc(VII) is very well retained at low acid concentrations. Its retention is generally significantly higher in HCl than in HNO_3, even at elevated HCl concentration such 2M it remains very strongly retained. In HNO_3 on the other hand its retention is rather low at concentrations above 2M.

Graphs 2 – 6 show the selectivity of the TK201 Resin for a wide range of elements in HCl (fig. 2 – 4) and HNO_3 (fig. 5 and 6). All Dw shown in these graphs were obtained through ICP-MS measurements.

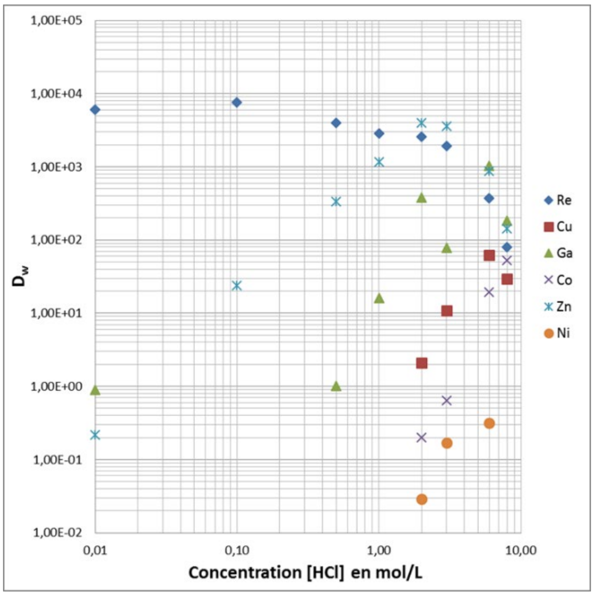

Figure 2: Dw values of selected elements on TK201 Resin in HCl

As expected, the TK201 Resin shows very high retention of Re(VII) in HCl even at rather elevated acid concentrations. Further Zn, Ga and Cu are retained, especially the latter allows for its use in radiopharmaceutical applications.

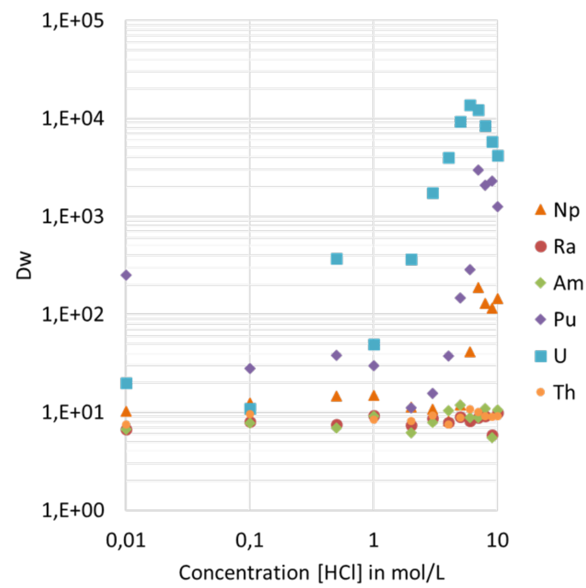

Figure 3: Dw values of selected elements on TK201 Resin in HCl, data provided by Russell et al. (NPL)

The TK201 Resin also shows strong retention of U and Pu at elevated HCl concentrations, both might subsequently be eluted in dilute acid.

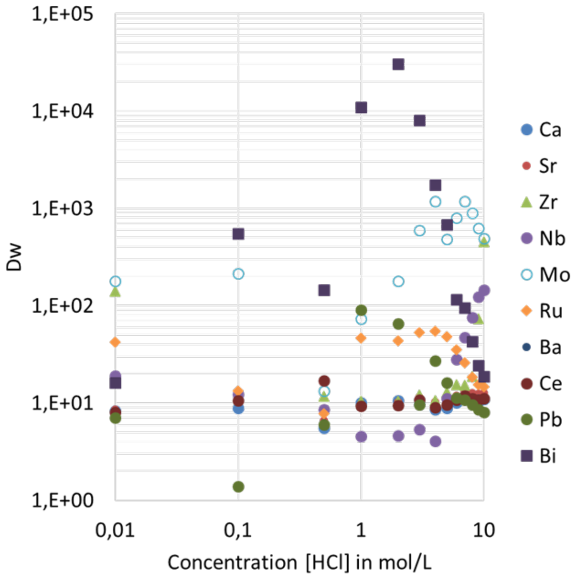

Figure 4: Dw values of selected elements on TK201 Resin in HCl, data provided by Russell et al. (NPL)

The TK201 Resin further strongly retains Bi and Mo at elevated HCl concentrations, while other elements tested show no or only very low retention (Ru, Nb).

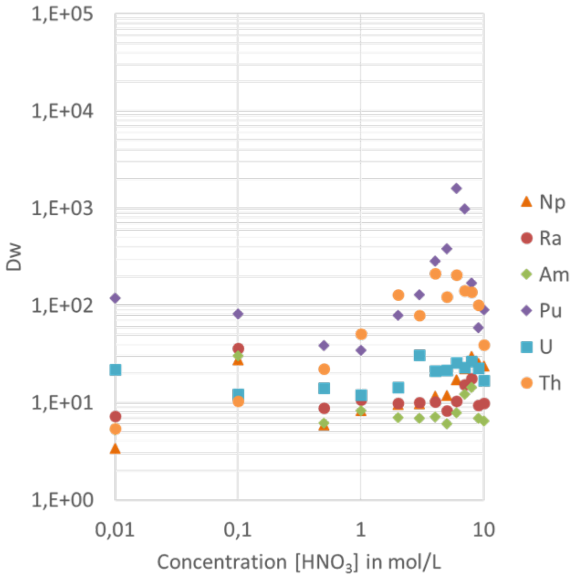

Figure 5: Dw values of selected elements on TK201 Resin in HNO_3, data provided by Russell et al. (NPL)

The TK201 Resin generally shows rather limited selectivity in HNO_3, similar to Tc(VII) Re is well retained at low HNO_3 concentrations (0.01 – 0.1M HNO_3). At elevated HNO_3 concentrations Pu is well retained and Th fairly well, other actinides are not retained under these conditions.

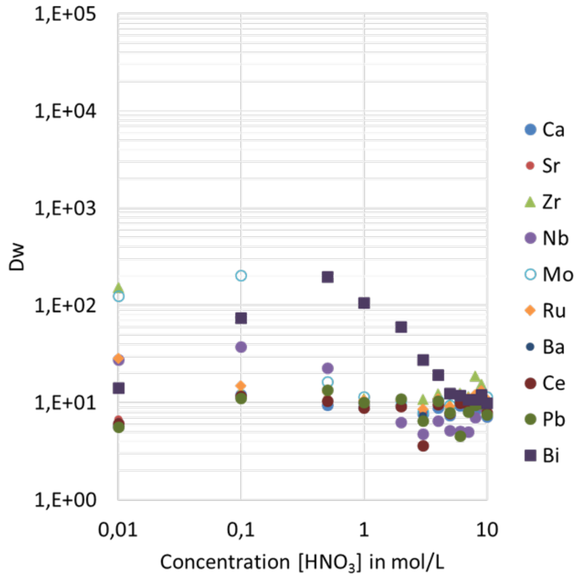

Figure 6: Dw values of selected elements on TK201 Resin in HNO_3, data provided by Russell et al. (NPL)

Out of the other elements tested only Bi (at about 0.5M HNO_3) and Mo (at low HNO_3 concentrations) are retained. It is important to note that Mo is not retained at HNO_3 concentrations above 0.5M while Tc and Re are well retained (Fig. 1), allowing for their clean separation.

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It could further be shown by Vajda et al. that Dw values for Tc(VII) are very low in dilute NH_4OH: in 0.1M NH_4OH Tc(VII) shows a Dw of only ~2, accordingly it is easily eluted by ≥ 0.1M NH_4OH.

Additional elution studies indicated that an efficient Mo separation from Re is possible (Fig. 7) using 0.7M HNO_3 for Mo removal and dilute NH_4OH for Re elution.

Figure 7: Elution study, Re separation from various elements (incl. Mo and W).

Vajda et al. could confirm that Tc is, like Re, not eluted in 0.7M HNO_3, validating that Re is a good surrogate for Tc and thus also allowing an efficient Mo/Tc separation. Most suitable conditions for Tc elution were found to be NH_4OH greater or equal to 0.2M (Fig. 8).

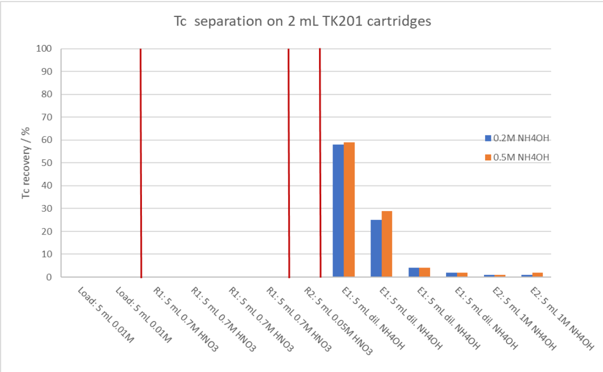

Figure 8: Elution study, Tc separation on 2 mL TK201 cartridges, data provided by N. Vajda (RadAnal)

One of the main applications of the TK201 Resin is the separation of Cu isotopes (e.g. Cu-64) from solid Ni targets. Other than the CU Resin the TK201 Resin allows for Cu retention from high HCl (e.g. 6M), while letting Ni pass for subsequent recycling. Other potential impurities (e.g. Co) may be removed through rinses with 4 – 5M HCl. Cu may then be eluted in dilute HCl leaving Zn on the column.
A typical separation is shown in the graph below.

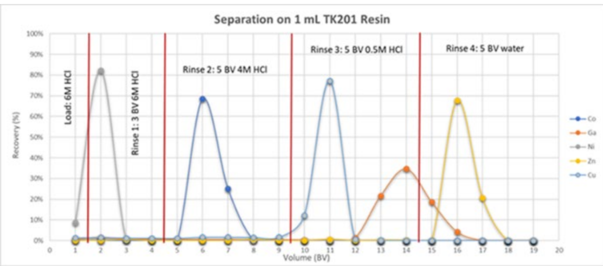

Figure 9: Elution study, Cu separation on 1 mL TK201 cartridges

In order to remove Fe and Ga impurities potentially present the dissolved Ni target (6M HCl) may first be loaded through a small TBP (or TK400) cartridge which will retain both elements while letting Ni, Cu and Zn pass onto TK201 for further purification. Cu may then be eluted from TK201 e.g. in 0.05M HCl. This could be demonstrated i.e. by Svedjehed et al. (2). The rinse with 5M NaCl/0.05M HCl is particularly noteworthy as it allows obtaining the final product in dilute HCl solution of defined concentration.

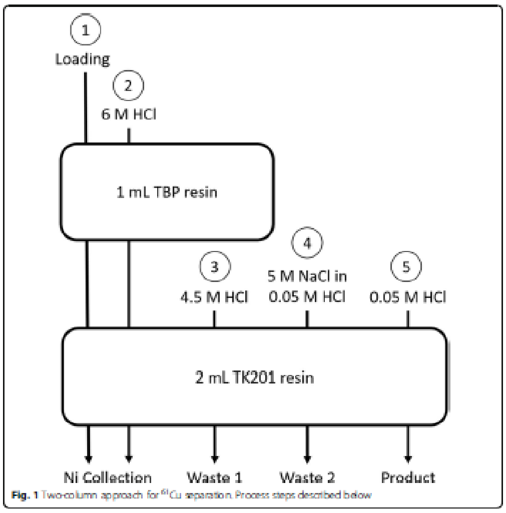

Figure 10: Cu separation using TBP and TK201 Resins according to Svedjehed et al. (2)

TK201 may also be used to convert the Cu fraction eluted from the CU Resin (e.g. for the separation of Cu isotopes from Zn targets) from a highly acidic solution (e.g. 6 - 8M HCl) to conditions more suitable for labeling (e.g. dilute HCl). TK201 will retain Cu e.g. from 6M HCl and can then be eluted with dilute HCl as shown e.g. by Kawabata et al. (3). This will also ensure further Zn removal.

Bibliography

(1) A. Bombard et al. "Technetium-99/99m New Resins Developments For Separation And Isolation From Various Matrices", presented at the ARCEBS 2018, 11-17/11/18 - Ffort Raichak (India)

(2) Svedjehed, J., Kutyreff, C.J., Engle, J.W. et al. Automated, cassette-based isolation and formulation of high-purity [61Cu]CuCl2 from solid Ni targets. EJNMMI radiopharm. chem. 5, 21 (2020). https://doi.org/10.1186/s41181-020-00108-7

(3) Kawabata, M., Motoishi, S., Ohta, A. et al. Large scale production of 64Cu and 67Cu via the 64Zn(n, p)64Cu and 68Zn(n, np/d)67Cu reactions using accelerator neutrons. J Radioanal Nucl Chem 330, 913–922 (2021). https://doi.org/10.1007/s10967-021-07987-3