PRODUCT SHEET

CU Resin

Main Applications

- Separation of copper

Packing

Order N°.	Form	Particle size
CU-B25-A, CU-B50-A, CU-B100-A, CU-B200-A	25g, 50g, 100g and 200g bottles CU resin	100-150 µm
CU-B10-S, CU-B25-S, CU-B-50-S	10g, 25g and 50g bottles CU resin	50-100 µm

Physical and chemical properties

Density : 0.38 g/ml

Capacity : 3 mg Cu/g CU resin

Conditions of utilization

Recommended T of utilization : /

Packing of the resin in columns : CU resin has hydrophobic tendencies. The packing is facilitated when performed under vacuum (cf. method TKI-CU01).

Flow rate : A grade: 0.6 – 0.8 mL/min, utilization with vacuum or with pressure for a grade resin possible: flow rate for load and elution: 1 mL/min, rinsing up to 6 mL/min

Storage : Dry and dark, T<30°C

For additional information see enclosed literature study

Methods

Reference	Description	Matrix	Analytes	Support
TKI-CU01	Separation of Cu isotopes from irradiated targets	Irradiated Ni or Zn targets	Cu isotopes	bulk

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LITERATURE STUDY

CU RESIN

The CU Resin is used for the separation of copper and is based on a Cu selective extraction system.

The extraction behaviour of the Cu Resin towards a number of different elements in three different acids at varying acid concentrations is presented in figures 1 a-c.

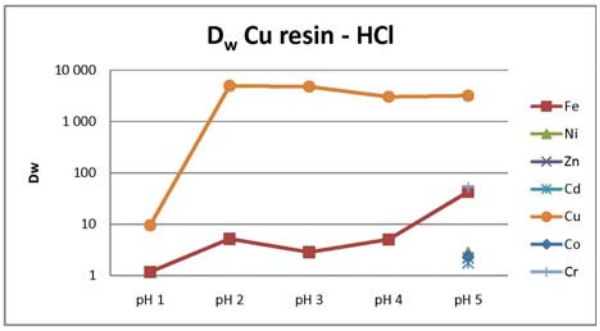

Fig. 1a: *D_W of Cu and selected elements on Cu resin in HCl in varying pH values (1).*

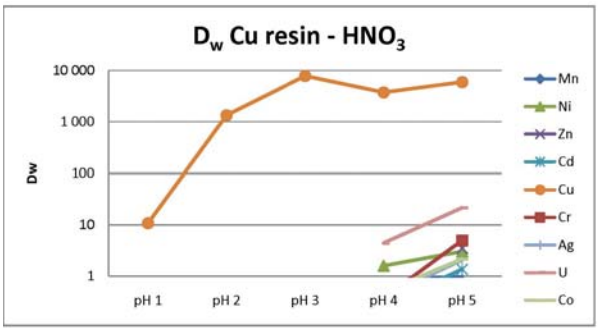

Fig. 1b: *D_W of Cu and selected elements on Cu resin in HNO_3 in varying pH values (1).*

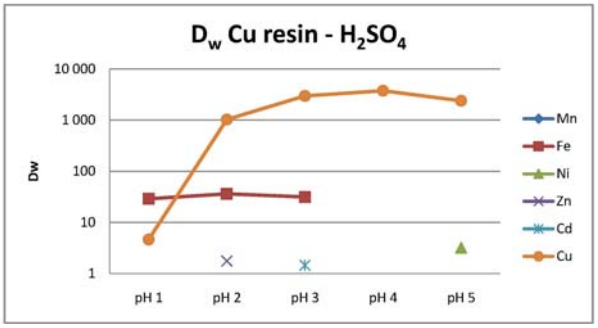

Fig. 1c: *D_W of Cu and selected elements on Cu resin in H_2SO_4 in varying pH values (1).*

Overall the resin shows high selectivity for Cu over all the tested cations including Ni and Zn. Cu uptake is generally high at pH values greater than 2 while it can be easily eluted with mineral acids of concentrations greater than 0.1M.

Main application of the CU resin is the separation of Cu isotopes (e.g. Cu-64, Cu-67) from irradiated targets (typically Zn or Ni targets). Accordingly, besides having high selectivity for Cu over Ni and Zn, the resin also has to be robust against interference by elevated amounts of Zn and Ni. Figures 2a and 2b summarize the influence of Zn or Ni on the Cu extraction. As can be seen even high amounts of both elements interfere only slightly with the Cu uptake in HCl at pH 2, even at 1g of Ni or Zn per g of CU resin employed the D_W(Cu) remains greater than 1000.

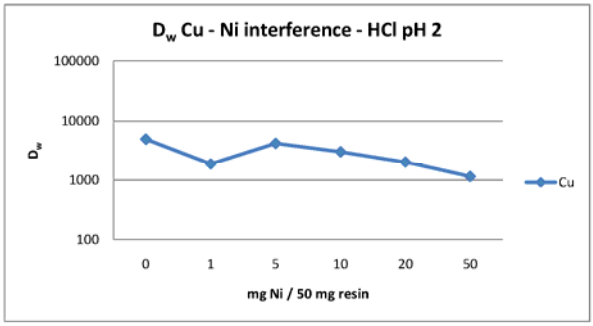

Fig. 2a: *D_W of Cu on Cu resin in HCl at pH 2 in presence of various amounts of Ni (1).*

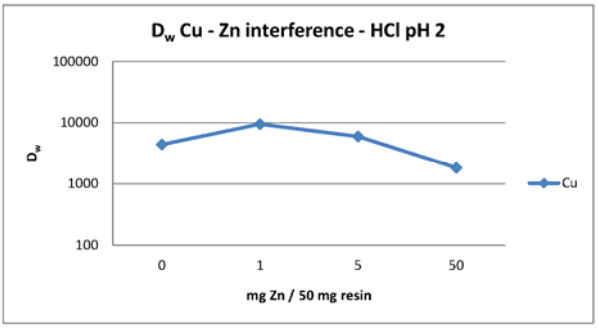

Fig. 2b: *D_W of Cu on Cu resin in HCl at pH 2 in presence of various amounts of Zn (1).*

A method for the separation of Cu from Ni and Zn targets was optimized using simulated target solutions (1). Two types of solutions were tested, simulated Ni target solutions (containing 10 µg each of Cu, Co, Zn and 200 mg of Ni in 5 mL HCl at pH2) and simulated Zn target solutions (containing 10 µg each of Cu, Co, Ni and 200 mg Zn in 5 mL HCl at pH2); figures 3a and 3b show the results of the elution studies. For both simulated target solutions Ni, Zn and Co are quantitatively removed from the column during sample solution loading and rinsing whereas Cu is recovered in high yield in 1 – 1.5 mL 8M HCl (2,3).

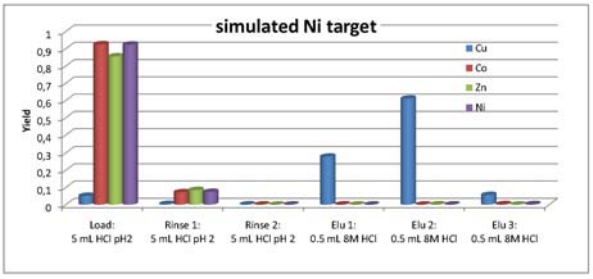

Fig. 3a: *Elution study, 350 mg CU resin, simulated Ni target solution, vacuum supported separation (2).*

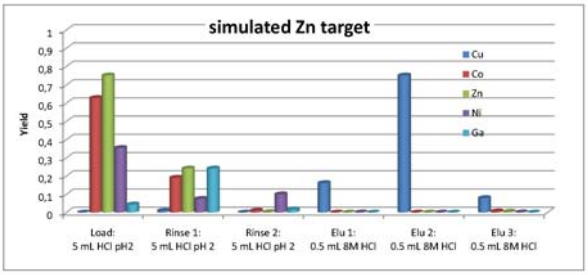

Fig. 3b: *Elution study, 350 mg CU resin, simulated Ni target solution, vacuum supported separation (2).*

Further optimisation of the elution conditions led to the method shown in Figure 4 (2). The method can be performed at elevated flow rates (e.g. using a vacuum box) without impacting its performance. Loading of the column and Cu elution should be done at approx. 1 mL/min, rinsing of the column can be done at up to 6 mL/min; the final Cu fraction can thus be obtained in 3 – 5 minutes.

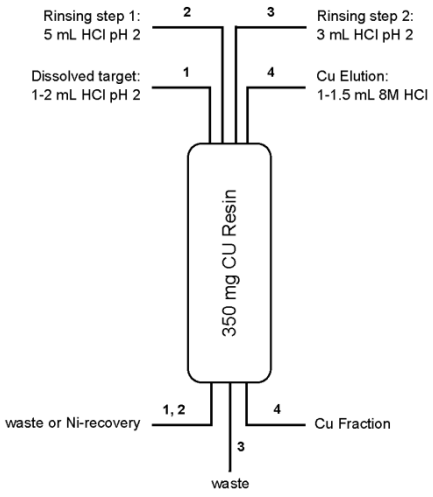

Fig. 4: *Optimized Cu separation method (2, 3).*

Table 1 shows mean decontamination factors obtained using this method.

Table 1: Decontamination factors of selected elements (3)

Element	Decontamination factor
Ni	> 20000
Zn	> 40000
Ga	> 10000
Co	> 30000
Au	> 30000

Overall decontamination factors obtained are high. Cu yields were found to be in the order of 90% in 1 mL of 8M HCl and > 95% in 1.5 mL 8M HCl; Cu is thus recovered near quantitatively in a very small volume.

With respect to the high pricing of some target materials, like isotopically enriched Ni-64, it is very important to assure quantitative recovery of these materials. As figures 3a and 3b show approx. 100% of the Ni is contained in the eluate from the sample loading and the first rinsing step, Ni can thus be quantitatively recovered in a very small volume allowing for easy additional purification if necessary.

For certain applications the Cu eluate might be too acidic, in these cases (alternative to evaporation of the Cu fraction and redissolution in a more suitable solvent) it is possible to convert the Cu eluate using a small anion exchange column. Fig. 5 schematically shows such a conversion method using anion exchange resin (AIX resin). In addition to the converting the Cu elute from high acid conditions to low acid or neutral conditions the conversion step also further concentrates the Cu and increases Ni, Zn, Au and organic impurity decontamination.

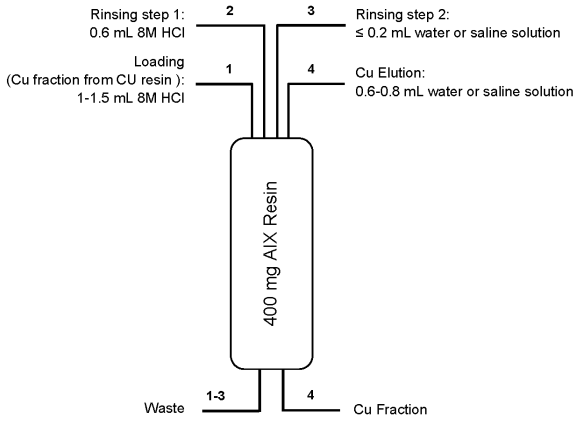

Fig. 5: *Conversion step using anion exchange, A8 resin (Eichrom Technologies), 100 – 200 mesh (2, 3).*

It was further tested whether the developed method could also be applied to other matrices and applications [3]. It could be shown that that Cu is quantitatively extracted from 10 mL acidified (pH 2.3) sea water. The Cu was then eluted with greater 95% yield in 1 mL 8M HCl, obtained Cu fraction is very pure (Fig 6).

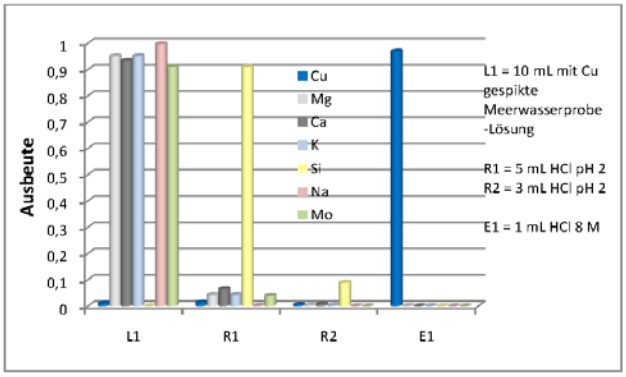

Fig. 6: *Elution study Cu spiked sea water sample (3)*

Bibliography

(1) C. Dirks, B. Scholten, S. Happel, A. Zulauf, A. Bombard, H. Jungclas: Characterisation of a Cu selective resin and its application to the production of 64Cu. J Radioanal. Nucl. Chem, 286 (2010) 671-674, DOI 10.1007/s10967-010-0744-9, (2010). TrisKem Referenz: T-DC110.

(2) C. Dirks, S. Happel: Characterization of a Cu selective resin and its application to the production of Cu-64. Presentation at the TrisKem International users group meeting, 14/09/2010, Chester (UK); available online: http://www.triskem-international.com/iso_album/ugm_chester_10_dirks_happel_cu_resin.pdf

(3) Diploma thesis C. Dirks: Charakterisierung eines extraktions chromatographischen Harzes zur selektiven Kupfer Trennung. Philipps-University Marburg December 2010. TrisKem Referenz: T-DC210.