PRODUCT SHEET

Chelating ion exchange resins

Diphonix/Diphosil

Main applications

- Preconcentration of actinides
- Removal of Fe(III) from Cu electrowinning solutions
- Manganese removal from potable water
- Uranium removal from aqueous radioactive waste

Packing

Order N°.	Form	Particle size
DP-B500-C-H	500g bottle Diphonix resin	50 – 100 mesh
DP-B500-M-H	500g bottle Diphonix resin	100 – 200 mesh
DS-B500-C-H	500g bottle Diphosil resin	50 – 100 mesh

Physical and chemical properties

Iron capacity (hydrated resin)	Diphonix:	≥ 10g Fe/L resin
Dry weight acid capacity	Diphonix: Diphosil	≥ 5,3 mEq/g resin ≥ 1,0 mEq/g resin
Moisture content	Diphonix:	60 – 70%
Wet Density	Diphonix: Diphosil	1,16 g/mL 1,50 g/mL
Bed density (dry resin)	Diphonix: Diphosil	0,30 g dry resin / mL chrom. bed 0,39 g dry resin / mL chrom. Bed

Conditions of utilization

Recommended T of utilization: /

Flow rate: 40 – 800 $L.min^{-1}.m^{-2}$

Storage: Dry and dark, T<30°C

For additional information see enclosed literature study

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PRODUCT SHEET

Chelating ion exchange resins

Monophos

Main applications

- Removal of Fe(III) from Cu electrowinning solutions

Packing

Order N°.	Form	Particle size
MP-B500-20-50	500g bottle Monophos resin	20 – 50 mesh

Physical and chemical properties

Iron capacity (hydrated resin)	Monophos:	≥ 18g Fe/L resin
Dry weight acid capacity	Monophos:	≥ 8,0 mEq/g resin
Moisture content	Monophos:	55 – 70%

Conditions of utilization

Recommended T of utilization: /

Flow rate: 40 – 800 $L.min^{-1}.m^{-2}$

Storage: Dry and dark, T<30°C

For additional information see enclosed literature study

Diponix/Diphosil/Monophos

The Diphonix resin is comprised of a polymeric support which has been functionalized with diphosphonic and sulphonic acid groups. (fig .1).

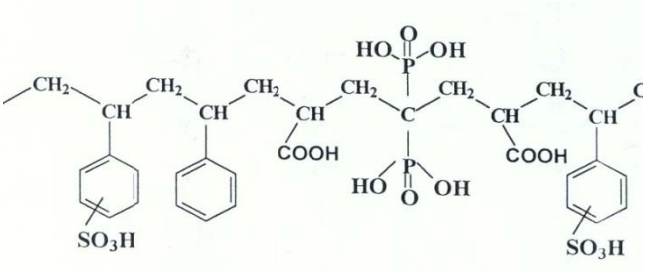

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***Fig.1** : Diphonix® resin*

Diphosil resin is based on diphosponic acid groups grafted onto the surface of a silica resin (fig. 2).

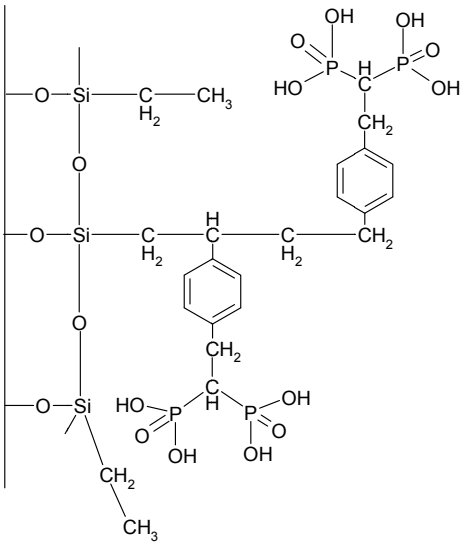

***Fig. 2 :** Diphosil resin*

Monophos like Diphonix, is based on a Polystyren-DVB support, the difference between the two resins is that the polymer is functionalized with monophosphonic acid in place of diphosphonic acid (fig .3).

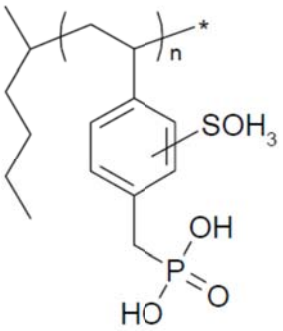

***Fig. 3 :** Monophos resin*

The Diphonix resin allows retaining actinides in the oxidation states III, IV and VI (fig.4). At the same time other cations which are frequently found in environmental samples (e.g. Ca and Fe(II)) are not well retained (fig. 5-7).

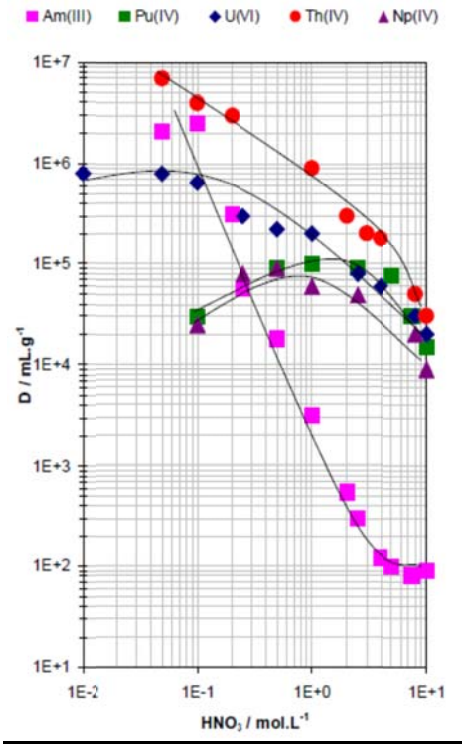

***Fig. 4 :** Retention of actinides on Diphonix in HNO_3 (1)*

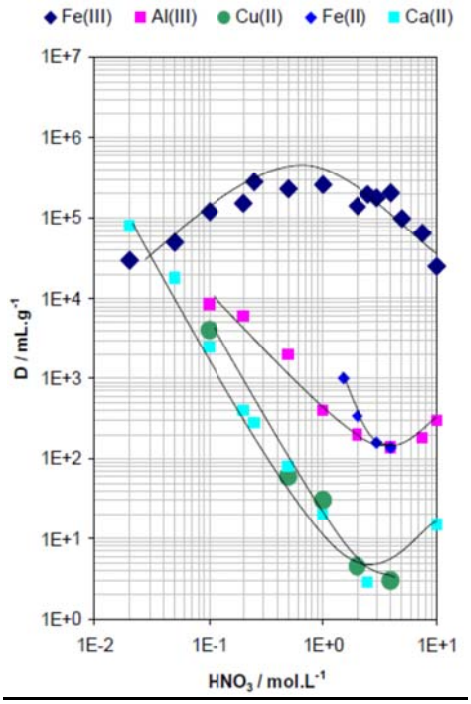

Fig. 5 : Retention of selected elements on Diphonix in HNO_3 (1)

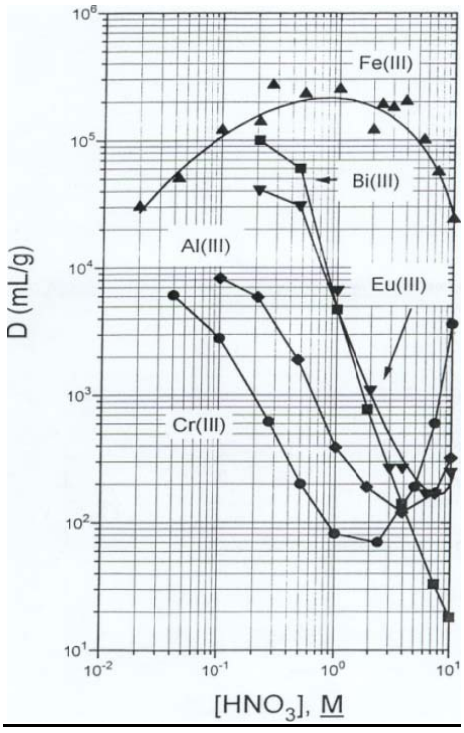

Fig. 6 : Retention of selected elements on Diphonix in HNO_3 (1)

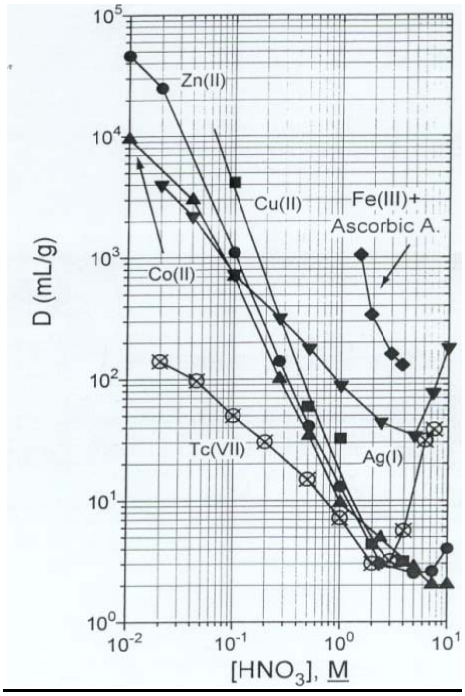

Fig. 7 : Retention of selected elements on Diphonix in HNO_3 (1)

The Diphonix resin shows a great stability against interference from complexing agents like hydrofluoric and oxalic acid (fig. 8) which are often used during mineralization and preconcentration of environmental samples.

The regulations for environmental monitoring demand very low detection limits. Therefore it is often necessary to analyse large samples and in consequence a preconcentration step is required. The mineralization of fecal and large soil samples (5-50g) is usually time consuming and difficult resulting in low recoveries (3, 4).

W. Burnett et. al. (5) have used Diphonix Resin as preconcentration step for Actinides in 10g soil samples. The actinides form stable complexes with the functional groups of the diphosphonic acid and remain therefore on the resin while the major part of the matrix can be eliminated with the rinse step. The elution of the actinides is then performed with another diphosponic acid, HEDPA (fig 9).

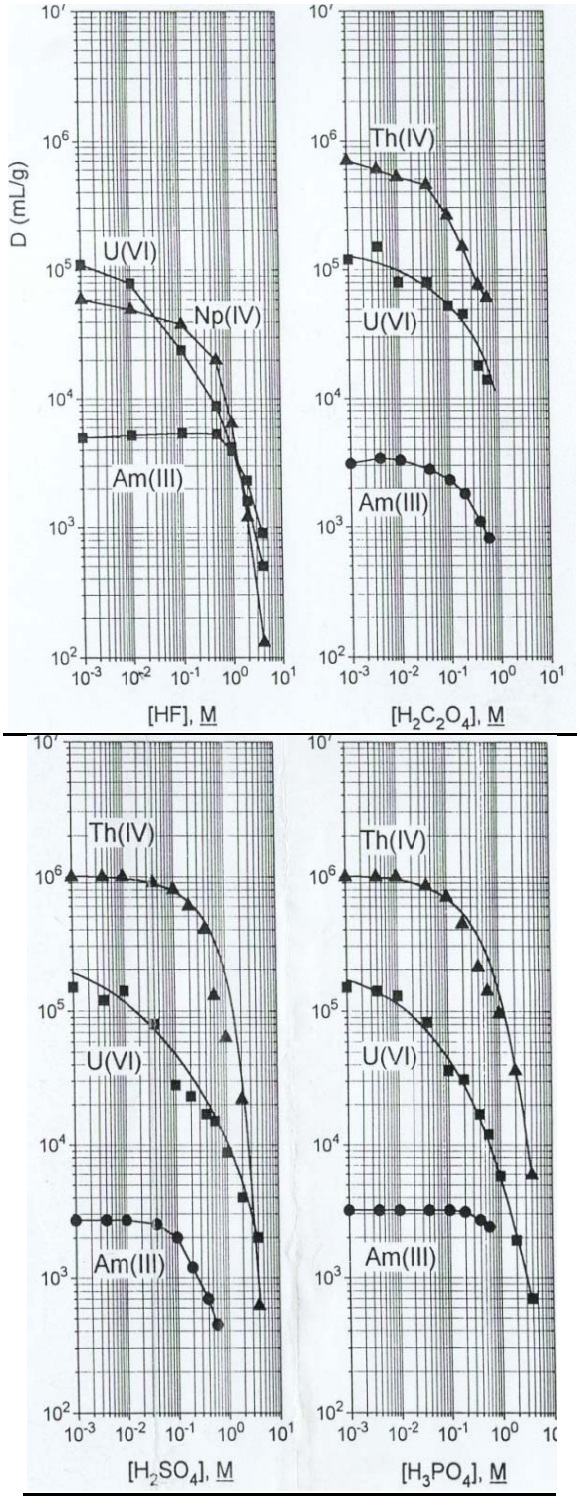

Fig. 8 : Retention of actinides in presence of complexants on the Diphonix® resin (1)

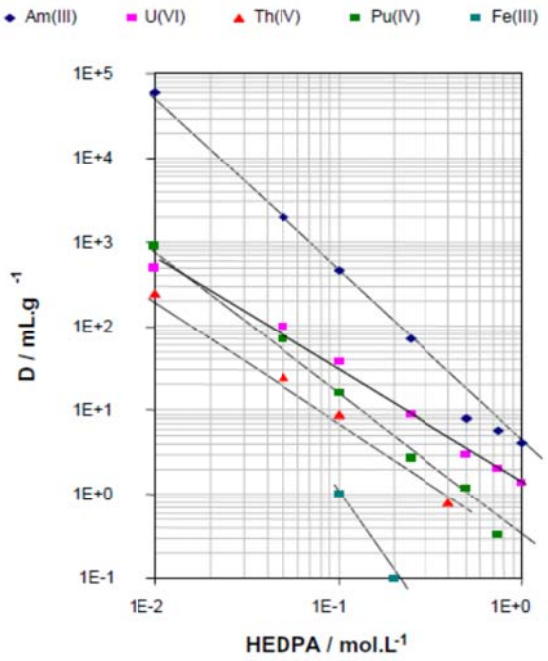

Fig. 9 : Retention of selected elements on Diphonix in HEDPA (1)

The separation scheme proposed by W.Burnett is describe below (Fig.10) :

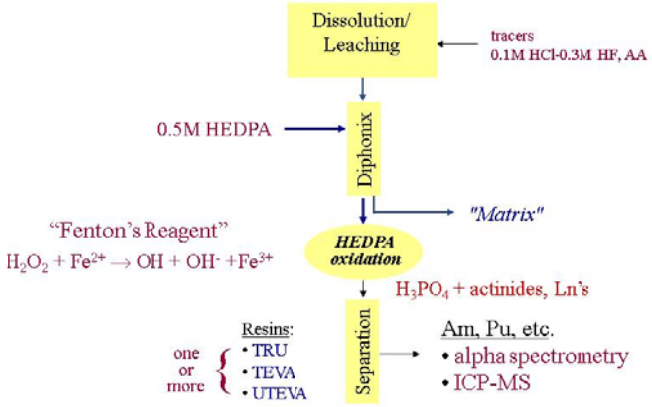

Fig. 10 : *Preconcentration of Actinides of a 10g soil sample*

The Fenton's Reagent (HNO_3 / H_2O_2 / $Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$) causes the decomposition of the complexes, formed between the actinides and HEDPA and sets the actinides free.
The separation of the actinides can be realised with the different extraction chromatographic resins TRU, TEVA, UTEVA depending on which actinide needs to be determined. Due to the presence of phosphate in the sample the use of TRU Resin is recommended (Fig.11).

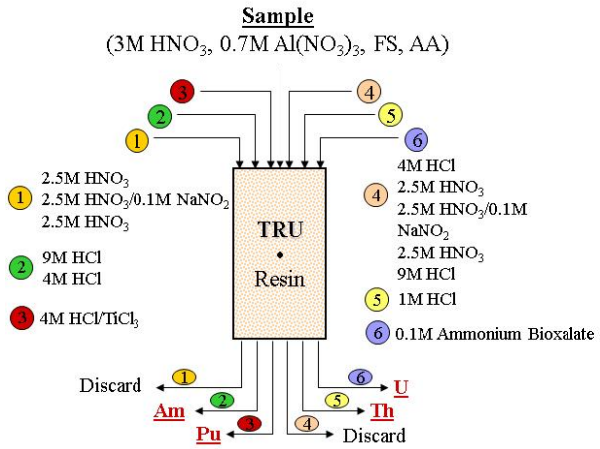

Fig .11 : Actinide separation on TRU Resin

Diphonix often finds use in process scale applications. Within these applications it is most frequently used in order to control of the Fe(III) concentration in Cu, Ni and Co electrowinning elektrolytes (6).

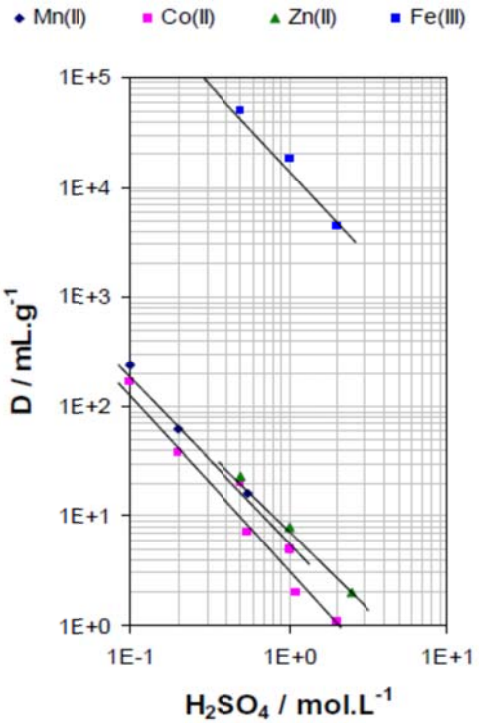

Fig. 12 : Retention of selected elements on Diphonix in H_2SO_4 (1)

Other applications are the removal of uranium from aqueous nuclear waste (7) and the removal of Mn from potable water.

Diphosil and Diphonix resin show very similar selectivities, nevertheless there are some distinct differences between the two resins.
Diphosil contains, other than Diphonix no sulfonic acid but only diphosphonic acid, this results amongst others in a lower capacity. It also shows a significantly higher selectivity for tetravalent actinides while it's selectivity for tri- and hexavalent actinides remains comparable to Diphonix'. Divalent cations like Ca, Zn and Co are distinctively less well retained on Diphosil than on Diphonix, in addition Na and Ca show much less interference on the extraction of actinides on Diphosil (2). Unfortunately the elution of actinides from Diphosil is even more difficult than from Diphonix. Finally Diphosil consist to 90% of silica which might be an advantage for applications where radiolytical degradation of the resin could be an issue.

Monophos is mainly used in the process scale control of the Fe(III) concentration in Cu, Ni and Co electrowinning elektrolytes (8).
Compared to Diphonix it shows a higher capacity for Fe(III).

Bibliography

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