TRISKEM INFOS

TRISKEM SHARING INNOVATION

RADIOCHEMISTRY

LN Resin

The LN resin (LaNthanides) is composed of di(2-ethylhexyl)orthophosphoric acid (HDEHP) (fig. 1) impregnated onto an inert support.

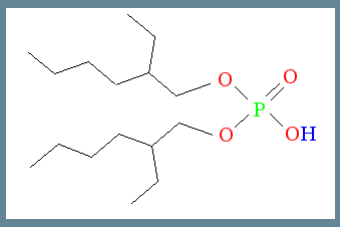

***Figure 1 : D**i(2-ethylhexyl)orthophosphoric acid (HDEHP).*

The following exchange equilibrium is assumed :

$$M^{3+} + 3\overline{(HY)_2} \leftrightarrow \overline{M(HY_2)_3} + 3H^+$$

Phil Horwitz studied the retention of different elements on this resin, figure 2 (p.2) summarizes the results he obtained [1].

Ln resin is mainly used for two types of applications : radium separation and determination, and the separation of light rare earth elements (REE) with respect to their measurement.

The determination of Ra isotopes in water samples is of high importance due to their radiotoxicity and their tendency to accumulate in bones, this is especially the case for Radium-226 which is a long lived (1600 years) alpha emitter.

B. Burnett et al.[2] proposed a method allowing the determination of the activity of the different Ra isotopes (226, 223/224, and 228 by measurement of Ac-228) in water samples:

1/ 0,5 to 2 L of the water sample are acidified, and a small amount of stable Barium as well as Ba-133, as internal standard for Radium, are added.

2/ Barium is precipitated as sulfate and then converted into the carbonate form.

3/ The precipitate is dissolved in 0,095M nitric acid and allowed to stand for at least 30 hours for Ac-228 ingrowth. In case a yield determination via Ce is performed a known amount of Ce is added at this point.

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EDITORIAL

Last 1srt of June 2008, Eichrom Environment has become TrisKem International.

You can find us on our website http://www.triskem-international.com where you can find information regarding the company and our products as certificates of analysis and MSDS. A forum is as well available following the link http://triskem-international.com/forum_triskem.html. Do not hesitate to visit it, post your questions and give your feedback in order to make it a rich location of exchange.

The RadChem Info becomes the TrisKem Info. For this first issue, we continue the presentation of the properties and characteristics of extraction chromatographic resins with the LN resins.

Aude Bombard
Product Manager

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TRISKEM INFOS
Publication Manager : Michaela Langer • Writting : Aude Bombard
Graphic Designer : Essentiel – Cesson-Sévigné • Printer : IPO-Bruz

New accessory :

2 mL column rack

12 positions polypropylene rack with carved number at each position.

Racks can come on top of each other for sequential separations with different 2mL columns (see picture 1)..

Simultaneous use of the 12 positions with 250mL beakers maximum for eluates collection.

Lot number of the rack carved in for tracability.

Overall dimensions (mm) : 475(L)x120(l)x130(h)

Product reference : AC-104.

Picture 1 : *rack superposition.*

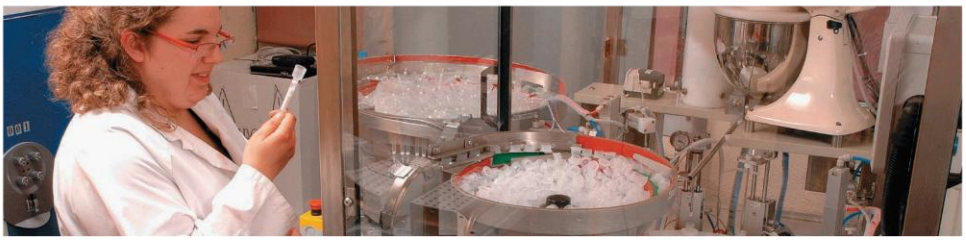


***Table 1** : Information about radium isotopes (http://nucleardata.nuclear.lu.se/database/masses/).*

Radio-nuclide	Half-life	Principle emission	Daughter nuclide
Ra-226	1600 ± 7 years	100% α	Rn-222
Ra-224	3,66 ± 0,04 days	100% α	Rn-220
Ra-228	5,75 ± 0,03 years	100% β	Ac-228
Ac-228	6,15 ± 0,02 hours	100% β	Th-228

4/ The sample is loaded onto LN resin and the resin is rinsed with 0,095M nitric acid. The sample load solution and the rinsing solution contain Ra-226, Ra223/4, Ra-228 and Ba-133. Ra-226 and Ra-223/4 can be determined from this solution by different methods (e.g. alpha spectrometry or emanation methods).

5/ Ac-228 is eluted using 0,35M HNO_3 for measurement, after CeF_3 co-precipitation, by gas proportional counting.

The chemical yield of the Ac separation can be determined e.g. gravimetrically via the internal standard Ce.

The preconcentration step via Barium sulfate/carbonate can be replaced either by a cation exchange resin or by using MnO_2 resin.

Recently Benkhedda et al.suggested a method for the automized separation and measurement of Ra-226 from water samples consisting of a preconcentration by flow injection and a on-line measurement by ICP-MS [3].

Each water sample is adjusted to a pH of 10.6, followed by the addition of EDTA. Ca and Mg form stable complexes with EDTA under these conditions, which are not retained on the LN resin. The earth alkalines retained on the LN resin (Sr, Ba and Ra) are eluted with 5M HNO_3. Ba and Sr are finally separated from Ra by passing the solution through SR resin. Ba and Sr are retained while Ra passes, allowing an interference free determination of Ra-226 in the sample load solution.

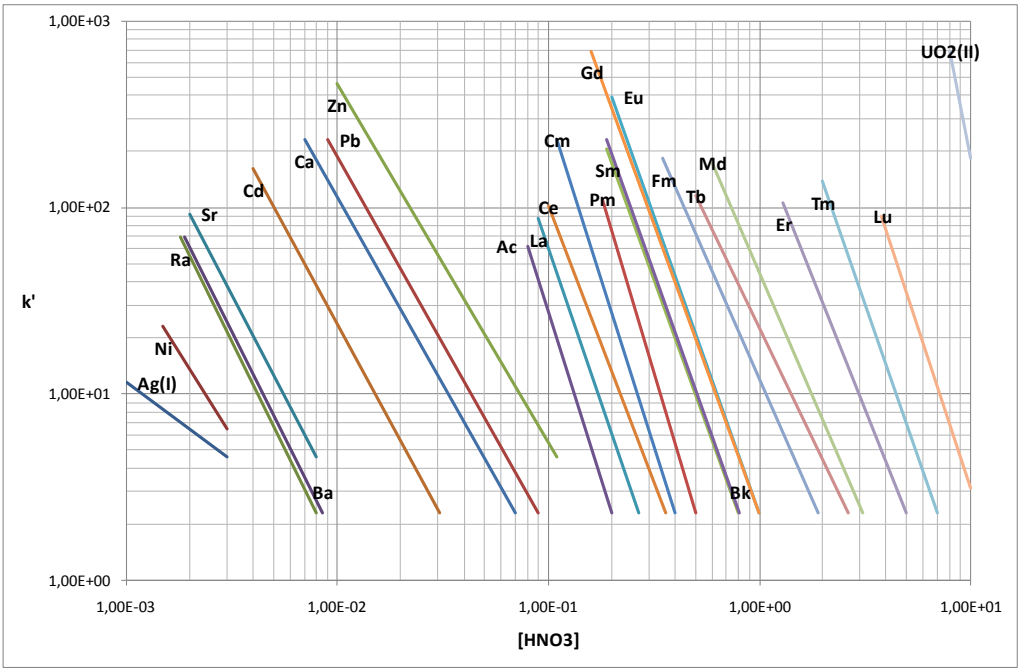
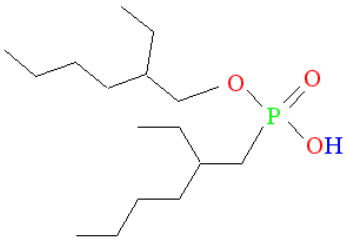


Figure 2 : *Retention of different elements on LN resin as a function of the nitric acid concentration (Horwitz 1975)[1]*



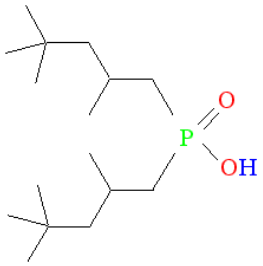
3a -HEH[EHP] (LN2)

La, Ce Pr et Nd are eluted using 0.25M HCl in the cited order; Sm and Eu are then eluted using 0,75M HCl. The described separation was performed using 0.3 g of LN resin with a particle size of 50-100µm.

Ln resin can also be used in more specific applications: Hidaka et al. use LN resin for the determination of Sm/Gd ratios in moon rock samples[5].

Beside the normal LN resin two other varieties have been tested: LN2 and LN3 resins (fig. 3a et 3b)[6].

The acidity of the impregnated extractants is diminishing in the order LN>LN2>LN3. This difference in acidity is having an impact on the retention behavior of the resins as figures 4 and 5 show.



3b - H[TMPeP] (LN3)

Figures 3a and 3b :*Extractants used for the LN2 and LN3 resins*

Ln resin is also used for the determination of light rare earth elements. C. Pin et al. showed the possibility to sequentially separate La, Ce, Pr, Nd, Sm and Eu[4].

For matrices with very high iron content an iron/rare earth separation is performed upfront using a 50W4 type cation exchange resin. The obtained sample is then redissolved, after further treatment, in nitric acid.

In a first separation step the sample is passed through TRU resin in order to eliminate unwanted matrix elements and to remove remaining traces of iron, while the REEs stay retained. To further purify the REEs the TRU resin is rinsed with 1M nitric acid.

The light rare earth elements are then eluted with 0.05M HNO_3 and directly passed onto LN resin, which was previously conditioned with 0.05M HNO_3. At this acid concentration the REEs are retained on the LN resin. LN.

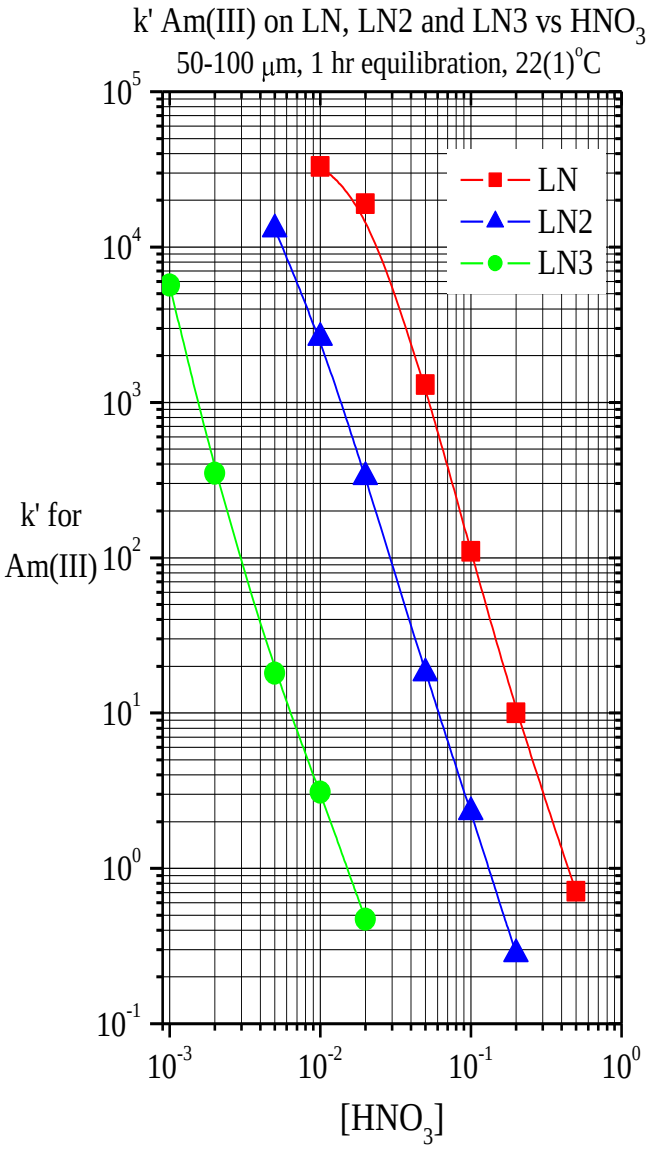


Figure 4 : *Capacity factors k' of Americium on the different LN resins (experiments performed at 22+/-1°C, particle size 50-100µm)[6].*

AGENDA

TrisKem International will be present at :

- **Braunschweig** (Germany) **22-26 September 2008 :**

  5th ICRM-LLRMT

- **Urbino** (Italy) **1-3 October 2008 :**

  Workshop « Metodi radiochimici per la caratterizzazione di matrici liquide ambientali, biologiche e industriali »

- **Dubaï (**UAE), **booth N°176 10-13 janvier 2009 :**

  ArabLab 2009, Stand N°176

In Brief

Your contacts at TrisKem International remain the same : Michaela Langer (President), Céline Vignaud (Administrative and financial manager), Anne Raoult (Quality manager and commercial assistant), Anne-Hélène Le Moing (Commercial assistant), Aude Bombard (Production manager and technical support), Steffen Happel (R&D manager and technical support). Last April Amalia Guillard joined the production team of the company (http://www.triskem-international.com/ressources_triskem.asp).

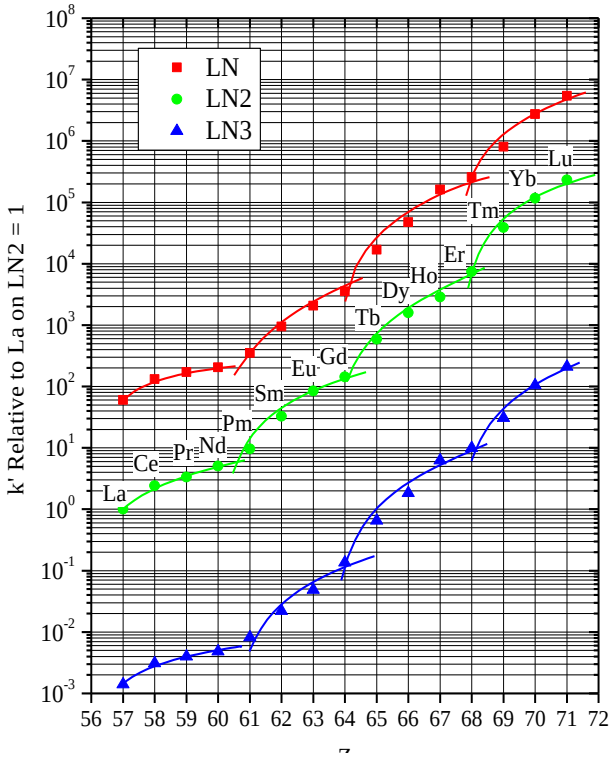


Figure 5 : *Relative capacity factors k' of rare earth elements normalized to La retention on LN2 resin (k'La/LN2=1)[6].*

Table 2 : *Characteristics of the LN Resins [6]*

Characteristics	LN	LN2	LN3
Extractant density (g/mL)	0,96	0,91	0,89
Resin density (g/mL)	1,15	1,13	1,13
Capacity of the resin (mmol/g) for trivalent lanthanides and actinides	0,42	0,43	0,46

Different applications/separations have been presented during the Users' Group Meeting in Madrid (May 2008) and can be consulted on our website www.triskem-international.com.

Bibliography

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TRISKEM INTERNATIONAL
Parc de Lormandière Bât. C - Rue Maryse Bastié - Campus de Ker Lann - 35170 Bruz - FRANCE
Tel +33 (0)2.99.05.00.09 - Fax +33 (0)2.99.05.07.27
www.triskem-international.com - email : contact@triskem.fr