



PRODUCT SHEET

MN resin

Main applications

- Separation of Radium

Packing

Order N°.	Form	Particle size
MN-B100-A	100g bottle MN resin	75-150 µm

Physical and chemical properties

/

Conditions of utilization

Recommended T of utilization : /

Flow rate : A grade: 0.6 – 0.8 mL/min

Storage : Dry and dark, T<30°C

For additional information see enclosed literature study

Methods*

Reference	Description	Matrix	Analytes	Support
RAW04	Radium-226/8 in water	water	Ra-226 and Ra-228	bulk

*developed by Eichrom Technologies Inc.

LITERATURE STUDY

MN RESIN (MnO₂ resin)

The regulation concerning the analysis of radium isotopes in water requires very low detection limits. MnO₂ Resin allows separating Radium from large volume water samples and provides an alternative to common separation techniques. The following results for the separation of Ra in water samples, was developed and published by Moon, et al.¹ The next few paragraphs highlight their work. Different parameters such as pH, reaction time, resin quantity, salt effect and flow rate have been evaluated when separating Ra from water using MnO₂. For most of the experiments, Ba-133 was used as tracer for Ra

According to figure 1, MnO₂ Resin shows the greatest affinity for Ba-133 when the pH of the solution is between 4 and 8.

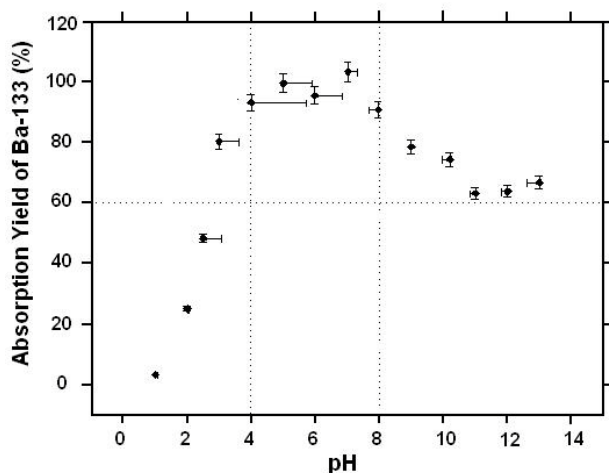


Fig. 1 : Absorption recovery in Ba-133 on MnO₂ Resin. 10mL deionised water, 25 mg of resin, magnetic stirring for 60 minutes at 20°C, pH adjusted with HCl or NaOH. Measurement performed on a NaI well-type detector.

The higher the salt contents of the water, the slower the kinetics of Ba (or Ra) uptake (Figure 2). The equilibrium is reached after 15 minutes of contact for samples with a salt content between 0 and 0.02%, whereas 25 minutes are required when the water contains 0.35% salt. For water with a similar composition as seawater (3.5% salts), the equilibrium is reached in 90 minutes.

The batch uptake of radium and barium by the MnO₂ Resin from deionised water and seawater have been studied and found comparable. The data in Figure 3 indicate equivalent uptake by the resin under two

conditions: 1 gram resin per liter of water and 2.5 gram resin per liter of water.

The recovery of Ba-133 and Ra-228 with respect to flow rate has been studied for 2 types of water : deionised and artificial seawater. For salt water, the flow rate must not exceed 20mL/min, otherwise a loss in recovery of 30% may be observed. Additionally the chemical recoveries of Ba and Ra start to differ from each other, Ba-133 can thus no longer be considered as a chemical homologue, making its use as an internal standard not appropriated.

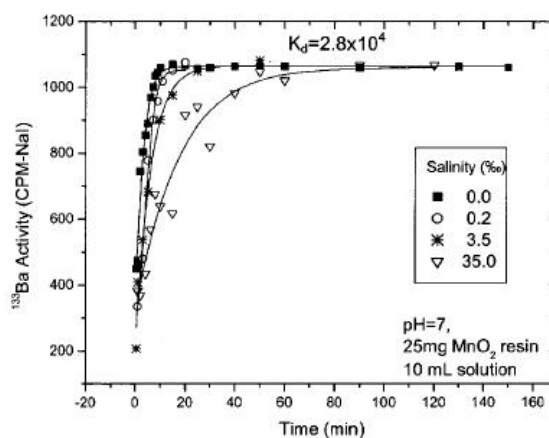


Fig. 2 : Absorption kinetics of Ba-133 with respect to the salinity of the water sample. 10 mL of water sample traced with Ba-133 with charges in salt of 0, 0.02%, 0.35% and 3.5%. 25 mg MnO₂ Resin are added to pH 7 solutions under magnetic stirring for different times.

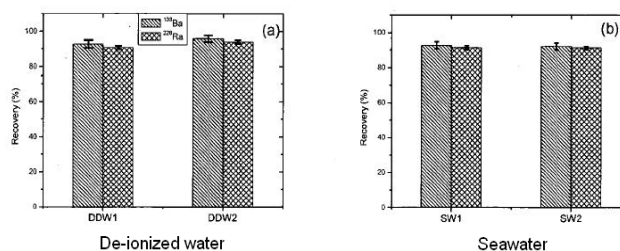


Fig. 3 : Absorption recovery of Ba-133 and Ra-228. Duplicate experiment on deionised and artificial seawater. 2.5g/L and 1g/L of MnO₂ Resin.

The MnO₂ Resin is currently used with LN Resin and DGA, Normal Resin in a method developed by Sherrod Maxwell² of Westinghouse Savannah River. It is used to pre-concentrate Ra from 1 to 1.5L water samples. 1.25 g/L of MnO₂ Resin is used per sample. The sample is initially stabilized at pH 6-7 and 25 mg Ca are added per liter. The sample is then loaded onto MnO₂ Resin with a flow rate of about 15 mL/min. Ra is eluted with



LITERATURE STUDY

15mL 4M HCl/1.5% H₂O₂. The 15 mL solution are left a minimum of 36 hours for Ac-228 ingrowths before being loaded onto 2 cartridges stacked on top of each other : LN Resin (retention of U and Th) and DGA, Normal Resin (retention of Ac-228). Ac-228 is eluted from DGA Resin with 10 mL 0.5M HCl, then micro-precipitated with CeF₃ on Resolve™ Filter. The Ac yield can be calculated from the Ba-133 yield (MnO₂ concentration step) and the Ac yield (extraction chromatographic separation and the precipitation) which can be obtained gravimetrically via CeF₃ (3).

Bibliography

- (1) Moon D.S., Burnett W.C., Nour S., Horwitz P., Bond A., *Applied Rad. Isot.*, **59**, 255 (2003).
- (2) Maxwell, S.L., presented at Eichrom's North American Users' Meeting, Oak Ridge, TN, May 3, 2005,
- (3) O'Brien, T. presented at Users Meeting at the RRM, Jackson Hole, WY, 2007