



Analytical Grade Ion Exchange Resins

If you currently use one of the Bio-Rad resins listed below, we'd like you to evaluate our analytical grade ion exchange resins. Compare their performance and price to the resin you currently use. Eichrom's line of analytical grade ion exchange resins are purified through successive methanol, NaOH and HCl rinses to remove residual organic molecules remaining from the manufacturing process. The cleanliness is confirmed by performance of an extractables test under Eichrom's ISO registered quality system.

*Contact us for a complimentary sample
of one of our analytical grade ion exchange resins listed below.*

Anion Exchange Resins

Eichrom Part Number	Eichrom Product Description	Ionic Form	Size	Wet Mesh Size	Comparable Bio-Rad Part Number	Bio-Rad Product
A8-B500-C-CL	Analytical Grade Anion Exchange 1 x 8 Resin	Chloride	500g	50-100	140-1431	AG [®] 1-X8
A8-B500-M-CL	Analytical Grade Anion Exchange 1 x 8 Resin	Chloride	500g	100-200	140-1441	AG [®] 1-X8
A8-B500-F-CL	Analytical Grade Anion Exchange 1 x 8 Resin	Chloride	500g	200-400	140-1451	AG [®] 1-X8
A4-B500-C-CL	Analytical Grade Anion Exchange 1 x 4 Resin	Chloride	500g	50-100	140-1331	AG [®] 1-X4
A4-B500-M-CL	Analytical Grade Anion Exchange 1 x 4 Resin	Chloride	500g	100-200	140-1341	AG [®] 1-X4

Cation Exchange Resins

Eichrom Part Number	Eichrom Product Description	Ionic Form	Size	Wet Mesh Size	Comparable Bio-Rad Part Number	Bio-Rad Product
C8-B500-C-H	Analytical Grade Cation Exchange 8% Crosslinked	Hydrogen	500g	50-100	142-1431	AG [®] 50W-X8
C8-B500-M-H	Analytical Grade Cation Exchange 8% Crosslinked	Hydrogen	500g	100-200	142-1441	AG [®] 50W-X8
C4-B500-M-H	Analytical Grade Cation Exchange 4% Crosslinked	Hydrogen	500g	100-200	142-1341	AG [®] 50W-X4

Please note that this resin cross-reference should be used strictly as a product guide and should not be construed as a list of equivalents. AG is a registered trademark of Bio-Rad Laboratories, Inc. Please call Eichrom for complete product specifications and for the availability of additional resins and mesh sizes.

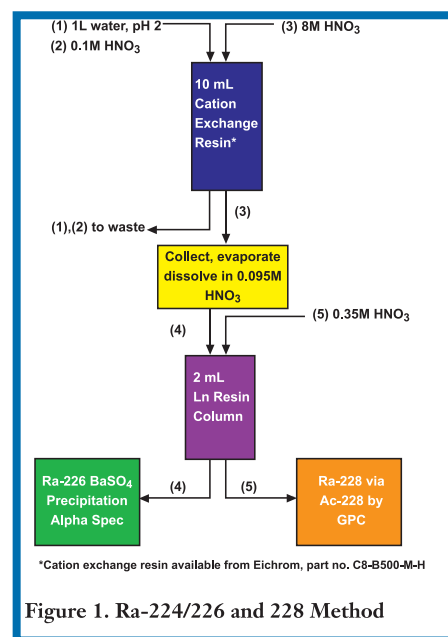
Improved Methods for the Analysis of Radium in Water

Recent regulatory issues in the US and Europe have created renewed interest in the development of more efficient methods for the analysis of radium isotopes. A new rule for radionuclides in drinking water by the US EPA takes effect in December of this year.¹ Under this rule, a new set of sampling requirements must be implemented. In particular, most drinking water supplies must be analyzed for combined radium-226/228 during the next three years to establish a baseline and to determine the frequency of analyses in the future. The State of Georgia anticipates its sample load for Ra-228 in drinking water to increase from ~3 samples/month currently to approximately 100/month during the baseline measurement period.² In Europe the new drinking water directive 98/83/EC will become effective at the end of this year. It covers water intended for human consumption and the recommended guideline activity concentration maximums are set at 0.1 Bq/L (2.7 pCi/L) for gross alpha and 1 Bq/L (27 pCi/L) for gross beta activity. Below this activity level no further analysis is required; above this level, specific radionuclides need to be measured in order to evaluate their dose contribution. Due to its high radiotoxicity, radium is of particular interest.

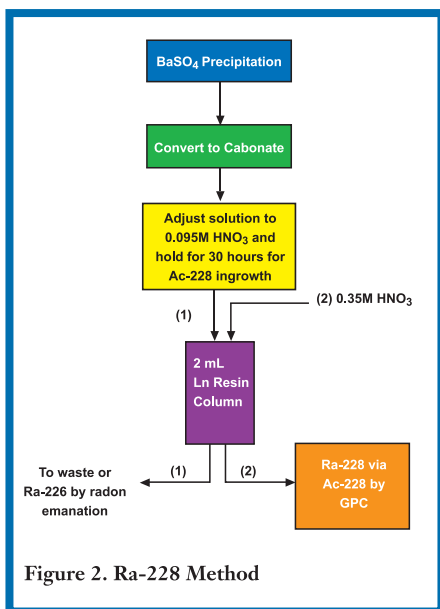
The existing “approved” methodology for analysis of radium isotopes in drinking water is based primarily on the techniques of barium/lead sulfate co-precipitation to pre-concentrate the radium isotopes from the water matrix. Ra-226 is measured by radon emanation. Ra-228 is calculated from ingrown Ac-228 by gas flow proportional counting (GPC) following isolation by one of two techniques: HDEHP solvent extraction or yttrium oxalate precipitation. These methods are lengthy and time consuming. Current laboratory capacity will be unable to meet the increased demand for radium analyses in the United States caused by the new drinking water regulations, if the currently approved methods are the only options.

Two methods have been developed in recent years that simplify the chemistry of radium analysis: one for Ra-228 only, the other for Ra-224, 226 and 228. These methods provide the opportunity to speed up the processing of samples. The Ra-228 method³ uses the front-end chemistry of one US EPA approved method, Ra-05 (barium sulfate precipitation) and substitutes Eichrom’s Ln Resin for the HDEHP solvent extraction of Ac-228. The Ra-224, 226, 228 method uses a cation exchange pre-concentration step in place of the sulfate precipitation. Ra-224 and 226 are counted by alpha spectroscopy following a barium sulfate microprecipitation. Since actinium follows radium through the cation column, it is unnecessary to wait for Ac-228 ingrowth and it can be counted by GPC immediately.

See Figures 1 and 2 for flowcharts of these methods. Eichrom versions of these methods (RAW01, Radium 228 in Water and RAW03, Radium in Water) are available on our web site.



The total radium method (Figure 1) is currently being evaluated by ASTM, D19.04 for suitability as a radium in drinking water method. Interlaboratory comparison testing should be completed by summer, 2003. Prior to commitment to a complex, multi laboratory study, ASTM D19.04 typically enlists one member laboratory to conduct a “Single Operator Test” (SOT) of the method. The SOT for this method was conducted by the EPA National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, AL. The NAREL study was conducted in the Spring of 2002 and the results were presented in a poster at the Radiobioassay and Radiochemical Measurements Conference in Knoxville, Tennessee in November, 2002.⁴



In the NAREL study Ra-226 and Ra-228 were measured in DI water at three different activity levels. Sample A was spiked with ~1 pCi/L (~40 mBq/L) Ra-226 and ~30 pCi/L (~1200 mBq/L) Ra-228. Sample B was spiked with ~5 pCi/L Ra-226 (~200 mBq/L) and ~10 pCi/L Ra-228 (~400 mBq/L). Sample C was spiked with ~12 pCi/L Ra-226 (~430 mBq/L) and ~4 pCi/L Ra-228 (~150 mBq/L). Seven replicates of each sample and three blanks were analyzed. Table 1 summarizes the results of this study for Ra-226. Table 2 presents the results for Ra-228. It can be seen that chemical recovery using Ba-133 was in the range of 84-93% and no significant biases were observed at any activity level for either radium isotope. Single operator precision of the method, as estimated by the standard deviation of the seven replicates, was less than 7% for both Ra-226 and Ra-228 at all activity levels.

Table 1. NAREL Single Operator Test Data for Ra-226

Sample	Chemical recovery (Ba-133)	Spiked pCi/L (mBq/L)*	Found pCi/L (mBq/L)*	Std. dev. replicates %	% Bias	Number of replicates
A	92.8 %	1.16 (42.9)	1.22 (45.1)	4.9 %	4.9 %	6
B	87.1 %	5.80 (215)	5.73 (212)	5.8 %	-1.1 %	7
C	84.3 %	11.6 (429)	11.9 (433)	6.6 %	-0.86 %	7

*Values originally reported in pCi/L. Values in Bq/L were calculated using the equation: 1Bq = 27.03 pCi.

Table 2. NAREL Single Operator Test Data for Ra-228

Sample	Chemical recovery (Ba-133)	Spiked pCi/L (mBq/L)*	Found pCi/L (mBq/L)*	Std. dev. replicates %	% Bias	Number of replicates
A	92.8 %	32.8 (1210)	32.0 (1180)	6.9 %	-2.4 %	7
B	87.1 %	10.9 (403)	11.9 (440)	6.7 %	9.3 %	7
C	84.3 %	4.37 (162)	4.54 (168)	3.3 %	3.8 %	5

*Values originally reported in pCi/L. Values in Bq/L were calculated using the equation: 1Bq = 27.03 pCi.

The Ra-228 method highlighted in Figure 2 was published by Burnett, et al. in 1995. They reported measurements on a number of EMSL (U.S. Environmental Protection Agency) Performance Evaluation samples. As can be seen from the data summarized in Table 3, agreement between the reference values and the results obtained using this procedure was excellent. The method does not appear to result in any statistically significant bias at the activity levels reported here.

Table 3. Ra-228 Measurements Reported by Burnett, et al.

Sample	Reference Value pCi/L (Bq/L)*	Experimental Value pCi/L (Bq/L)*
EMSL - July 17, 1992	16.7 ± 3.3 (0.618 ± 0.122)	17.6 ± 0.7 (0.651 ± 0.026)
EMSL - Performance Evaluation "A" April 19, 1994	20.1 ± 5.0 (0.744 ± 0.185)	21.6 ± 1.2 (0.799 ± 0.044)
EMSL Standard ²²⁸ Ra Solution	59.3 ± 2.1 (2.19 ± 0.08)	58.0 ± 1.3 (2.15 ± 0.05)

*Values originally reported in pCi/L.

Values in Bq/L were calculated using the equation: 1Bq = 27.03 pCi.

In the coming years, we anticipate increasing interest worldwide in monitoring the drinking water supply for naturally occurring radioactive elements. Eichrom is now focused on developing methods appropriate for this purpose. We have also begun working with the appropriate regulatory and consensus bodies worldwide to achieve approval for these methods in regulated applications. See our web site for a listing of compendial methods (DOE, HASL-300, ASTM, etc.) using Eichrom's separation technology.

Among the topics covered in our next newsletter, we'll highlight additional methods of interest in drinking water analysis.

¹ Radionuclides Rule, 66 FR 76708, December 7, 2000, Vol. 65, No. 236.

² Personal communication from Robert Rosson, Georgia Technological University, 2002.

³ Burnett, W.C., Cable, P.H., & Moser, R; Determination of Radium-228 in Natural Waters Using Extraction Chromatographic Resin, Radioactivity and Radiochemistry, vol. 6, no. 3 (1995)

⁴ Herbert, Velinda, USEPA National Air and Radiation Environmental Laboratory, Single Operator Test Report for the Standard Test Method for Radium in Water, poster 12 presented at the 48th Annual Radiobioassay and Radiochemical Measurements Conference, Knoxville, Tennessee, November, 2002.



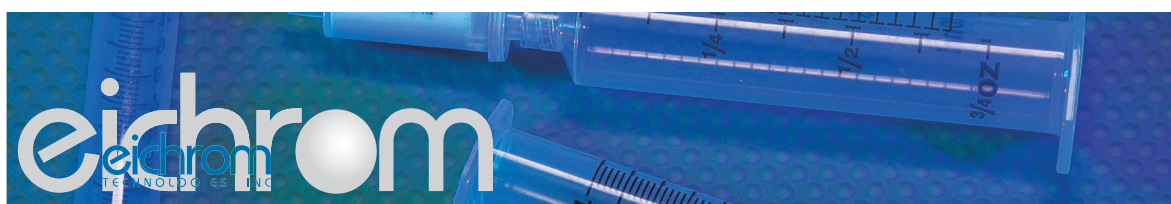
Color Code Change:

TEVA Resin

Actinide Resin

Eichrom is changing the color code for TEVA Resin to green to address customer concerns with reading yellow cartridge labels in fluorescent lighting.

We will use yellow to identify Actinide Resin in literature and label Actinide Resin cartridges with black ink.



Parlez-vous français?

In response to inquiries from a number of French-speaking customers, we have translated some of our downloadable methods into French. These versions are now available on our web site methods section (<http://www.eichrom.com/methods/methods.cfm>.) If you do not have access to the internet, please don't hesitate to contact us for a paper or electronic version of any of the following methods:

- RAW03-10F : Radium dans l'eau ;
- SRW01-13F : Strontium 89, 90 dans l'eau ;
- NIW01-10F : Nickel 63/59 dans l'eau ;
- ACW11-01F : Radioactivité Alpha Totale dans l'eau ;
- VBS01-11F : Guide d'utilisation de la boîte d'aspiration sous vide (VBS) ;

Watch our web site for additional French versions of our methods in the coming months.

More requests for larger pre-packed columns

Most common radiochemical procedures require our usual 2 mL pre-packed cartridges or columns. Depending on the application and/or the matrix you are working with, this quantity of the resin may not be sufficient and a larger column would be needed. Several customers have requested that we supply these larger sized columns to save them time and to ensure that the columns meet Eichrom's quality standards.

We now supply 5, 8 and 10 mL pre-packed columns and corresponding reservoirs.

Examples of larger column applications:

Analysis of trace amounts of Pu, Am and Np in uranium metal:

5 or 10 mL UTEVA Resin columns are used as guard columns to remove the bulk of U from the sample; afterwards Np, Pu and Am can be separated on standard 2 mL TEVA Resin and TRU Resin cartridges or columns.

Analysis of Sr-90 in soil:

In order to meet the required detection limits for Sr-90 in environmental samples, soil samples of 10g and more may need to be analysed. To overcome the matrix effect caused by the amount of Ca present, several laboratories use 8 mL pre-packed Sr Resin columns (2.8g of resin).

Analysis of radium in water:

In Eichrom's Radium in Water method (RAW03, see inside article), a 10mL cation exchange column is used to pre-concentrate the sample in place of the traditional sulfate precipitation. For your convenience we now provide 10 mL pre-packed cation exchange resin columns.



New Accessories

In response to customer requests, we now offer the following new accessories.

- 10 mL and 20 mL syringe barrels for use as cartridge reservoirs
- 20 mL empty columns and corresponding reservoirs