Technical Information

Empore™
Radium RAD Disks

Method Summary: Test Method RA-195

Rapid Determination of Radium-228 in Water by Elution of Ingrown Actinium-228 from Empore™ Radium RAD Disks

Product Description

Empore™ Radium RAD Disks provide an efficient alternative to conventional radiochemical sample preparation methods that use wet chemistry or packed columns. A proprietary process is used to entrap radium selective adsorbent particles into a matrix of inert PTFE to create a mechanically stable sorbent disk. The disks can be used for purification and concentration of radium from aqueous samples.

Empore radium RAD disks provide a sample prep solution for large volume aqueous samples and the disk format provides a large surface area for sorbent/sample contact.

Scope and Application

This method uses Empore radium RAD disks to concentrate and purify radium from water samples, which results in significant reductions in sample preparation time over EPA Method 904.0. The method assumes quantitative extraction of soluble radium from the water sample, and at present, no correction for chemical yield has been included.

Method Overview

An acidified sample is passed through an Empore radium RAD disk to quantitatively extract soluble radium in the sample. After completion of a suitable ingrowth period, actinium-228 is eluted with 0.5 M HNO_3 and analyzed using a low background gas flow proportional counter.

Interferences

Sr^{2+} is not retained by the disk. Quantitative radium recovery (>95%) has been shown in one liter samples with the following individual concentrations of potential interfering ions:

Mg^{2+}	10,000 mg/L	Sr^{2+}	2.0 mg/L
Ca^{2+}	10,000 mg/L	Na^{+}	1,000 mg/L
Pb^{2+}	1.0 mg/L	K^{+}	10 mg/L
Ba^{2+}	1.0 mg/L		

'True' interference concentrations may be even higher than those tested.

Safety

When using solvents or other chemicals, be sure to read and follow the manufacturer's precautions, directions for use and disposal procedures.

Apparatus and Materials

- 47 mm Empore radium RAD disks
- 47 mm single or multiple station vacuum manifold
- Beta detector (low background gas flow proportional counter)
- 50 mm planchets

Reagents

Nitric Acid (HNO_3): 16 M, 2 M, and 0.5 M

Sample Collection, Preservation, and Handling

Samples may be acidified to pH < 2 with HNO_3 prior to sub-sampling.

3M

Procedure

1. Make the sample 2 M in HNO_3 by adding 126 mL concentrated HNO_3 per liter of sample being processed. If membrane clogging is anticipated, the sample may be prefiltered through a 0.45 µ filter.
2. Mount an Empore radium RAD disk in the filter support. Place the side marked "Side Down" against the filter support.
3. Wash the disk by drawing 20 mL of 2 M HNO_3 through the disk with a gentle vacuum. Do not allow the disk to go dry.
4. Extract the sample by pulling it through the disk at a nominal flow rate of 50 mL/min (about 20 minutes per liter).
5. Rinse the disk with 20 mL of 2 M HNO_3. The end of this rinse is recorded as the start of the actinium-228 ingrowth.
6. Remove the disk from the manifold and store it in a 50 mm Petri dish for 14-28 days to allow for ingrowth of actinium-228 and decay of radium-224.
7. Following storage, remount the disk in the filter support as described in step 2.
8. Elute actinium with 15 mL of 0.5 M HNO_3.
9. Mount the solution for gas flow proportional counting by evaporation on a planchet, by coprecipitation on yttrium oxalate (as described in EPA method 904.0), or by fluoride microprecipitation with neodymium or other suitable lanthanide.
10. Count the source as quickly as possible due to the very short half-life of actinium-228 ($T_{1/2}$=6.15 hours). The method is calibrated against standard actinium-228 mounted in a geometry equivalent to that of the sample.

Reference

Environmental Protection Agency, "Radium-228 in Drinking Water – Method 904.0", Section 8, *Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, EPA-600 4-80-032, August, 1980.

Note: Empore Solid Phase Extraction Products are intended for solid phase extraction during scientific research only. These products are not intended for use in medical devices or in assessment and treatment of clinical patients.

3130 Lexington Ave. S.
Eagan, MN 55121
Toll Free: +1 888 509 5330

Printed in the USA. Issued: 1/09
6342HB 98-0504-1696-9
LITEMP018 0309