

## 4.5.4 Radiochemical

# Americium

*Am-04-RC*

## AMERICIUM IN QAP WATER AND AIR FILTERS - EICHROM'S TRU RESIN

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### APPLICATION

The following procedure has been applied to the preparation, separation, and analysis of spiked water and air filter samples that contain americium but not lanthanides (Berne, 1996). Lanthanides, if present, will not be removed by this method and will significantly reduce the resolution of the  $\alpha$ -spectrograph. Combined with Procedure Pu-11-RC, this procedure allows for the sequential determination of plutonium and americium. Other researchers have applied TRU Resin methods to other matrices (Horowitz et al., 1990). The procedure is used in the EML Quality Assessment Program (QAP; Sanderson and Greenlaw, 1996).

The water and air filters are equilibrated with  $^{243}\text{Am}$  and processed through the plutonium separation steps using ion exchange resin according to Procedure Pu-11-RC. If determination of plutonium is desired, an appropriate plutonium tracer should be added along with the  $^{243}\text{Am}$  tracer. The eluate from the ion exchange column containing americium (and all other ions, except plutonium) is evaporated, redissolved, and loaded onto a TRU Resin extraction column. The americium (and curium, if present) is separated and purified on the column and finally stripped with dilute nitric acid stripping solution. Microprecipitation is used to prepare for  $\alpha$  spectrometry.

### SPECIAL REAGENTS

1. Americium-243 tracer solution, about  $0.15 \text{ Bq g}^{-1}$  in dispensing bottle - standardize for total disintegration rate. Measure purity on an  $\alpha$  spectrometer.

2. TRU Resin 2 mL ion extraction columns or equivalent or can be prepared from TRU Resin, Eichrom Industries, Inc., 8205 Cass AV, Suite 107, Darien, IL 60561. Place a plug of glass wool in the bottom of a polyethylene transfer pipette (see Specification 7.7). Add slurried TRU Resin (0.5 g). Assemble immediately before use.
3. Column feed solution, 0.5M  $\text{Al}(\text{NO}_3)_3$  in 2M  $\text{HNO}_3$  - place 18.76 g of  $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$  in a 100-mL volumetric flask and add 2M  $\text{HNO}_3$  to the mark. Shake to mix thoroughly.
4. 2M  $\text{HNO}_3$  - 125 mL  $\text{HNO}_3$  diluted to 1 L with water.
5. 1M  $\text{HNO}_3$  - 62.5 mL  $\text{HNO}_3$  diluted to 1 L with water.
6. 0.025M  $\text{HNO}_3$  - 25 mL 1M  $\text{HNO}_3$  diluted to 1 L with water.

### SAMPLE PREPARATION

See Procedure Pu-01-RC, air filters or Procedure Pu-10-RC, water.

### AMERICIUM DETERMINATION

1. Collect the sample and the wash effluent from Step 4, **Ion Exchange Separation**, Procedure Pu-11-RC, and evaporate almost to dryness. If necessary, sometime during the evaporation process transfer the solution to a smaller beaker. The final residue should be contained in a beaker not larger than 50 mL. Add 3 mL of 0.5M  $\text{Al}(\text{NO}_3)_3$  in 2M  $\text{HNO}_3$  to each residue and heat very gently to dissolve.
2. Prepare an ion extraction column.
3. Wash the resin with 15 mL of 2M  $\text{HNO}_3$ , and discard the effluent.
4. Load the column with the sample solution from Step 1. Wash the beaker with 3 mL of column-feed solution and add to the column. Discard the effluent.

5. Rinse the column with 8 mL of 2M HNO<sub>3</sub>, followed by 8 mL of 1M HNO<sub>3</sub>, and discard the effluents.
6. Elute the americium fraction with three 3-mL aliquots of 0.025M HNO<sub>3</sub>, and collect the eluate in a 50-mL beaker.
7. Evaporate the eluate to dryness. Convert the residue to the chloride form by adding 5 mL of HCl three times and evaporating to dryness at a low temperature.
8. Prepare the sample for  $\alpha$  spectrometry by microprecipitation (see Procedure G-03).

### DATA PROCESSING AND ANALYSIS

For  $\alpha$  spectrometry, see Alpha Radioassay, Procedure A-01-R.

#### LOWER LIMIT OF DETECTION (LLD)\*

Counter Efficiency	(%)	30
Counter Background	(cps)	$1.6 \times 10^{-5}$
Recovery	(%)	80
Blank	(cps)	-
LLD ( 400 min)	(mBq)	0.5
LLD (1000 min)	(mBq)	0.3
LLD (5000 min)	(mBq)	0.1

\*Reagent blanks must be analyzed with each set of samples.

### REFERENCES

Berne, A.

“Use of Eichrom’s TRU Resin in the Determination of Americium, Plutonium and Uranium in Air Filter and water samples.”

USDOE Report EML-575, December (1995)

Sanderson, C. G. and P. Greenlaw

“Semi-Annual Report of the Department of Energy, Office of Environmental Restoration and Waste Management, Quality Assessment Program”

USDOE Report EML-581, July (1996)