Po-01-RC

POLONIUM IN WATER AND URINE

Contact Person(s) : Isabel M. Fisenne

APPLICATION

This procedure is applicable to water and urine (Hursh, 1958). Organic materials which can be converted to Cl^- solutions should also lend themselves to analysis by the procedure given. Reagent blanks must be analyzed along with the samples. [**Note:** It has been shown (Fellman et al., 1989) that urine samples must be wet ashed to release polonium from metabolically labeled organic compounds. The procedure has been modified to incorporate the destruction of organic matter.]

Polonium is quantitatively deposited on a nickel disc from a strong HCl solution. This is a very specific separation and therefore can be carried out while many other radionuclides are present in the sample.

The plated disc is α counted on a scintillation counter. It is also possible to use a ^{208}Po or ^{209}Po tracer and count on an α spectrometer to measure chemical yield and the activity of the sample.

SPECIAL APPARATUS

1. Nickel discs - made of 0.064-cm thick "commercial pure" nickel sheets. Discs are 2.2 cm in diameter with a 0.16-cm hole set 0.16 cm in from the edge. [**Note:** Coating the disc on one side with an acid resistant paint allows counting time to be cut in half.]

SAMPLE PREPARATION

A. Water.

1. To 1000 mL of tap water in a 1500-mL beaker, add 50 mL of HCl.

2. Evaporate to a volume of 20 mL and transfer to a 250-mL beaker. Add 100 mL of water and 100 mg of ascorbic acid.

3. Proceed to **Determination**.

B. Urine.

1. If the time between sample collection and analysis is much greater than 1 h, the urine samples should be preserved by adding 1 mg of sulfamic acid per mL of urine and storing in a refrigerator at 3°C.

2. Measure 100 mL of urine in a graduated cylinder and transfer to a 250-mL beaker. Rinse the graduated cylinder with 20 mL of 1:1 HNO_3 and add to the urine.

3. Evaporate the solution to near dryness and add 5 mL portions of HNO_3 to destroy organic matter.

4. Convert the sample to the Cl^- form by evaporating to near dryness with three successive 5-mL portions of HCl.

5. Add 20 mL of 1:1 HCl and 100 mg of ascorbic acid to the beaker.

DETERMINATION

1. Place the beaker in a constant temperature bath at 55°C.

2. Degrease a nickel disc by dipping in HNO_3, followed by dipping in HCl and rinsing in water. Repeat until the surfaces of the disc are bright and shiny.

3. Suspend the disc on a glass stirring hook in the solution and stir for 2.5 h at a speed giving maximum agitation without splashing.

4. Remove the disc, rinse the stirring rod and disc with water and let dry in air.

5. Alpha count each side of the disc. Subtract background from each count and sum the two net cps.

6. Standardize the counter with a known quantity of any α emitter on a metal disc. Natural U plated on a similar disc is a convenient standard.

LOWER LIMIT OF DETECTION (LLD)

		A	B	C
Counter Efficiency	(%)	50	50	25
Counter Background	(cps)	1.675×10^{-5}	1.67×10^{-5}	8.33×10^{-5}
Yield	(%)	70	70	70
Blank	(cps)	-	-	-
LLD (400 min)	(mBq)	0.5	0.33	1.5
LLD (1000 min)	(mBq)	0.33	0.17	1.0
LLD (5000 min)	(mBq)	0.17	0.10	0.5

A = alpha scintillation counter (both sides)
B = alpha scintillation counter (one side)
C = solid-state alpha spectrometer (one side)

REFERENCES

Fellman, A., L. Ralston, D. Hickman, L. Ayres, N. Cohen, H. Spitz and B. Robinson "The Importance Acid Digestion of Urine Prior to Spontaneous Deposition of ^{210}Po" Health Physics, 57, 615-621 (1989)

Hursh, J. B. (Editor)
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