AN-1407

Rapid Determination of Sr in Animal Tissue Samples

Summary of Method Strontium is separated and concentrated from up to 200g tissue samples. Samples are digested with aqua regia, wet ashed with HNO_3-H_2O_2 and muffled over night at 550°C to destroy organic content. Strontium is separated from matrix impurities and potentially interfering radionuclides in the sample using stacked 2mL and 1mL cartridges of Eichrom Sr Resin. Radiostrontium is measured on a low background gas flow proportional counter or liquid scintillation counter. Chemical yield of strontium is determined by gravimetric recovery of stable strontium or ICP-AES measurement. Average chemical recoveries of strontium are 74-89% for 200g samples of catfish, bass, red drum, mullet, sea trout. Average strontium recoveries for 100 gram samples of deer, hog, bream and shellfish are 83-96%. A single operator can complete the sample preparation, including 16 hours for muffling, for 12-24 samples in less than 24 hours.

Reagents

Sr Resin, 2mL Cartridges (Eichrom SR-R50-S)
Sr Resin, 1mL Cartridges (Eichrom SR1ML-R50-S)
Nitric Acid (70%)
Hydrochloric Acid (37%)
Hydrogen Peroxide (30%)
Deionized Water
Strontium Carrier (10mg/mL)
Aluminum Nitrate, Nonahydrate
Sr-90 standard
Oxalic acid

Equipment

Vacuum Box (Eichrom AR-24-BOX or AR-12-BOX)
Cartridge Reservoir, 20mL (Eichrom AR-200-RV20)
Inner Support Tubes-PE (Eichrom AR-1000-TUBE-PE)
Yellow Outer Tips (Eichrom AR-1000-OT)
Cupped Stainless Steel Planchets (~5mL volume)
Gas Flow Proportional Counter
Muffle Furnace
Hot Plate
Analytical Balance
600mL Glass Beakers
Vacuum Pump

Figure 1. Sample Preparation

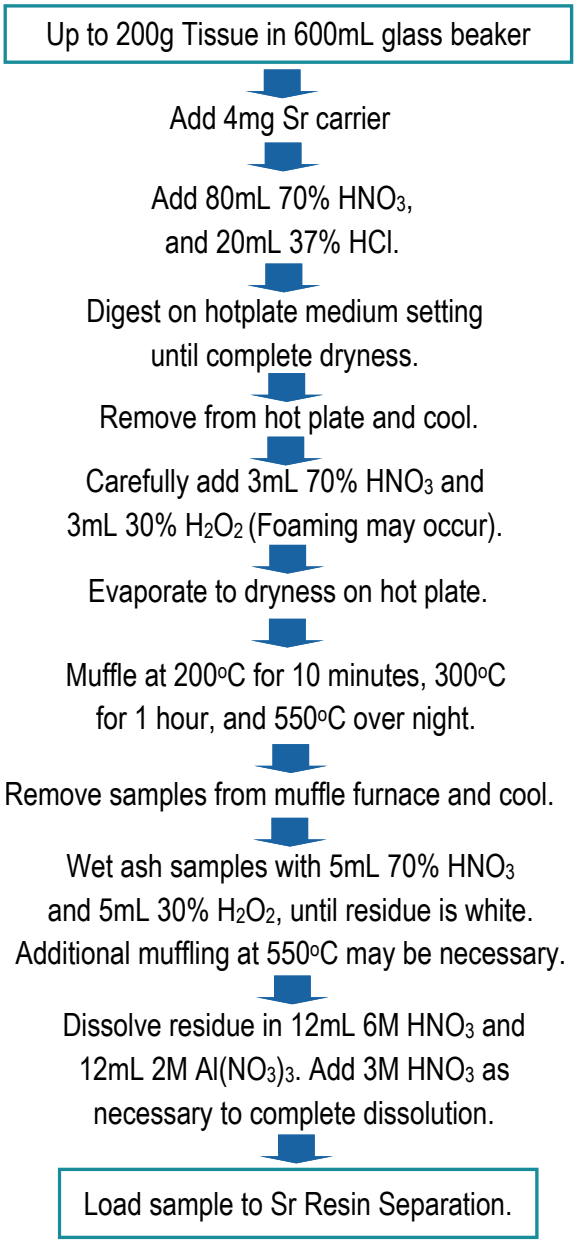


Figure 2. Strontium Resin Separation (Optional ^{90}Y Ingrowth)

(1) Precondition Sr Resin with 10mL 8M HNO_3.

(2) Load sample at 1-2mL/min.

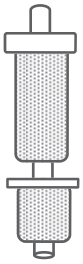
(3) Rinse sample beaker with 5mL 8M HNO_3.

(4) Add beaker rinse to Sr Resin. Elute at 1-2mL/min.

(5) Rinse Sr Resin sequentially with:
- 10 mL 8M HNO_3
- 10mL 3M HNO_3 - 0.05 oxalic acid
- 10mL 8M HNO_3

(6) Dispose of (1) to (5) as waste.

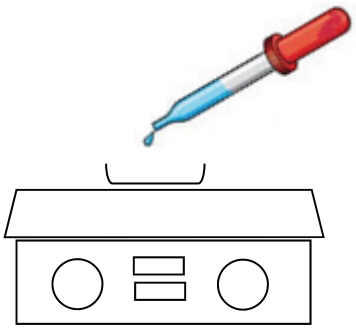
(7) Strip Sr with 20mL 0.05M HNO_3 at 1mL/min.



Gas Flow Proportional Counting:*

(8) Evaporate samples to dryness on tared cupped stainless steel planchets.

(9) Rinse Sr sample vials with 2mL 0.05M HNO_3. Transfer vial rinse to planchets. Evaporate to dryness.



(10) Weigh planchets on an analytical balance to determine gravimetric yield of stable $Sr(NO_3)_2$.

(11) Measure radiostrontium in samples on low background gas flow proportional counter.

*(Options for $^{89/90}$Sr Descrimination)

(a) Sr fraction from step (7) can be transferred to a liquid scintillation vial. ^{89}Sr can be measured by Cerenkov counting (no LSC cocktail). 89/90Sr may then be measured after adding liquid scintillation cocktail.

(b) Sr fraction from step (10) can be dissolved in 10mL 8M HNO_3 after >7 days of ^{90}Y ingrowth. $^{89/90}$Sr can be removed on Sr Resin. ^{90}Y will elute in Sr Resin load and can be counted by liquid scintillation or gas flow proportional counting.

Actinides may also be measured by adding 2mL TEVA, TRU and DGA cartridges above Sr Resin and following the separation scheme in Eichrom application note AN-1408, "Rapid Determination of Actinides in Animal Tissue Samples."

Sr Carrier Recovery for 100-200g Tissue Samples

Sample	grams	replicate	% Recovery Sr carrier	Sample	grams	replicate	% Recovery Sr carrier
Beef	100	6	96.3 ± 0.5	Fish-Mullet	200	6	85.6 ± 17
Deer	100	59	83.4 ± 3.5	Fish-Red Fish	200	6	77.7 ± 21
Fish-Bass	200	72	89.0 ± 16	Fish-Sea Trout	200	6	74.4 ± 25
Fish-Bream	100	57	91.7 ± 10	Hog	100	17	86.0 ± 7.1
Fish-Catfish	200	69	89.4 ± 17	Shellfish	100	5	97.5 ± 0.9

References

1) Sherrod L. Maxwell, Donald M. Faison, "Rapid column extraction method for actinides and strontium in fish and other animal tissue samples," *J. Radioanal. Nucl. Chem., 275(3), 605-612* (2007).