RiO5 METHOD (56)

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^{7}**Be** — Fe-Fibers — seawater

Extraction of ^{7}Be from seawater using Fe-Fibers

Disclaimer

It is the responsibility of the analyst to follow established safety and health practices. Although each laboratory identified as the source has tested the methods, each user should perform an individual validation procedure.

Table of Contents

1 SCOPE

This describes the general steps required for extracting ^{7}Be from seawater. This includes sampling preparation, sampling, post sampling counting preparation, and gamma counting.

2 EQUIPMENT AND CHEMICAL REAGENTS

2.1 Equipment and consumables

- Aluminum foil- fiber ashing post sampling
- Centrifugal pump (1 hp)- sampling
- HPGe Gamma Detector (Ortec)- counting
- Laboratory furnace (e.g. Thermolyne 6000)- fiber ashing post sampling
- Laboratory oven - fiber drying post sampling
- Laboratory press (Carver Model C)- pellet preparation
- Nalgene tank (30 liter)- fiber preparation
- Pellet die- pellet preparation
- Petri dishes (95 mm polystyrene)- pellet holder for counting
- PVC vacuum hose (1.5 inch dia.) – sampling
- PVC pipe (4 Inch w End Caps)- sampling
- Quartz immersion heater- fiber preparation
- Steel loaf baking pan- fiber ashing post sampling
- Thermometer- fiber preparation
- Water meter (Sensus or Badger Meter)- sampling
- Ziplock bags - fiber storage

2.2 Tracers

- Mixed isotope standard (100 kBq in 2M HCl solution, Eckert & Ziegler)

2.3 Chemical reagents

- Acrylic fiber
- Iron (III) chloride hexahydrate (97%) - fiber preparation

2.4 Solutions

- Ammonium hydroxide (29.7% aqueous solution)- fiber preparation
- Beryllium standard solution (1000 ppm, aqueous)- extraction tracer
- Mixed isotope standard (100 kBq in 2M HCl solution, Eckert & Ziegler)

3 PROCEDURE

Fiber Preparation

1. Place 20L of DI water in a 30L bucket and then add 3 Kg of iron (III) chloride hexahydrate. Stir to dissolve. Warm the solution to 90^{o}C with an immersion heater. Remove the heater and then add approximately 2 kg of acrylic fiber. Let soak for 30 minutes.
2. In a fume hood, prepare a second bucket with 2.5 L of ammonium hydroxide solution and 7.5 L of DI water. Remove the acrylic fiber from the first bucket, wring it out, and place it in the ammonium hydroxide. Cover and let soak for 2 hours.
3. After two hours, remove the fiber and wring it out, then place the fiber in a bucket containing 10 L of DI water to rinse. Remove the fiber and wring it out. Repeat this step.
4. The fiber can now be spread out on a bench to air dry for several days. In order to speed the drying, it is recommended to turn and fluff the fibers daily to loosen the clumps and create more surface area.
5. When dry, the iron-impregnated fiber is placed in ziplock bags (200g per bag).

Sampling

6. Place one fiber portion in a PVC tube (3 feet long, 4 inch diameter). The tube is fitted with screw tops with suitable connections for seawater flow. Pump seawater with a deck mounted centrifugal pump through the fibers. Volume is determined by an inline flowmeter.
7. The efficiency of the fiber for extraction of Be from seawater is determined by adding 500 ml of a 1000 ppm Be atomic absorption standard to a drum containing seawater. The seawater is pumped through an iron fiber cartridge and at every 100 L the Be content of the cartridge effluent was measured by atomic absorption. From this data, the integrated Be extraction efficiencies is calculated.

Sample Prep for Gamma Counting

8. Dry the fibers in an oven at 90^{o}C. Place the dried fiber in a bread pan lined with heavy-duty aluminum foil. Incinerate at 450C in a furnace inside a fume hood for 24 hours. Collect and weigh the iron powder.
9. Next, pour the powder into a cylindrical pellet die. Press to 5k psi. Extract the pellet from the die and measure the thickness. Place in a plastic petri dish for gamma analysis.
10. Gamma efficiency will be a function of the pellet thickness. The ^{7}Be has a readily identifiable gamma peak at 478 keV. The detector is calibrated for the pellet geometry by adding a commercially prepared mixed solution of known gamma activities to an ashed fiber, pressing the ash into a pellet, and counting the activities to derive a calibration curve. Prepare pellets of several thicknesses.

4 REFERENCES

Kadko, D. (2017), Upwelling and primary production during the U.S. GEOTRACES East Pacific Zonal Transect, Global Biogeochem. Cycles, 31, doi:10.1002/2016GB005554.

5 IMAGES

Figure 1. Hose used to collect pumped sample

Figure 2. Hose attached to CTD rosette package