RiO5 METHOD (1)

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^{137}**Cesium** — Column Chemistry — 20 liter Seawater Samples

KNiFC-PAN

^{137}Cesium Column Chemistry for 20 liter Seawater Samples

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.

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1 SCOPE

This method has been widely used to measure ^{134}Cs and ^{137}Cs in seawater samples from the Pacific Ocean after the Fukushima nuclear accident. It requires a 20 L seawater sample (filter/unfiltered) and a KNiFC resin. Seawater does not need to be acidified and Cs chemical recoveries are monitored by sampling before and after column using stable Cs as yield monitor measured by ICP-MS. Average chemical recoveries are > 90%.

2 EQUIPMENT and CHEMICAL REAGENTS

2.1 Equipment and consumables

- 1 ml pipette
- 1 ml pipette tips
- 5 ml pipette tips
- SUPELCO 5 ml Rezorian Column Kit (57613-U)
- KNiFC-PAN resin (Czech Technical University, Prague)
- 20 L (5 gal) Cubitainers with caps
- Waterproof marker
- 2 ml cryo-vials
- 2 ml transfer pipettes
- Peristaltic pump w/controller
- Cubitainer-peristaltic sampling line
- Milk crates
- Large scale or balance

2.2 Tracers

- Stable Cesium carrier (0.5-0.7 mg/ml)
- J.T. Baker

2.3 Chemical reagents

- KNiFC-PAN resin 0.1-0.7 mm (Czech Technical University, Prague)

3 PROCEDURE

1. Cs-1 Label cubitainer with sample ID using permanent marker. Record date, time and, if possible, water salinity and temperature. Use a bucket and funnel or pump to fill 20 L cubitainer with sample water.

2. **Cs-2** Weigh 20 L cubitainer and record weight.

3. **Cs-3** Add 1ml of Cs carrier (0.5-0.7 mg/ml) using 1 ml pipette. Cap cubitainer and agitate to mix. Equilibrate (let sit) for at least 1 hour.

4. **Cs-4** Use disposable transfer pipette to remove about 1 ml aliquot of sample w/ carrier and store in labeled cryo-vial for recovery analysis. Label using sample ID and "I" for initial fraction.

5. **Cs-5** Label pre-filled resin column with sample ID.

6. **Cs-6** Attach spigot top with peristaltic line, put through pump head and attach column. Open spigot and adjust pump to flow rate of 60 ml/min flow rate and process through column. Collect processed sample in cubitainer.

7. **Cs-7** When column is finished, remove 1 ml aliquot using transfer pipette from processed sample cubitainer and store in labeled cryo-vial. Label using sample ID and "F" for final fraction.

8. **Cs-8** Remove KNiFC-PAN into labeled acrylic snap vial.

9. **Cs-9** Dry resin at low temperature (<60°C) for Gamma analysis.

10. **Cs-10** Cesium recovery is determined from ICP analysis of stable cesium in initial and final aliquots.

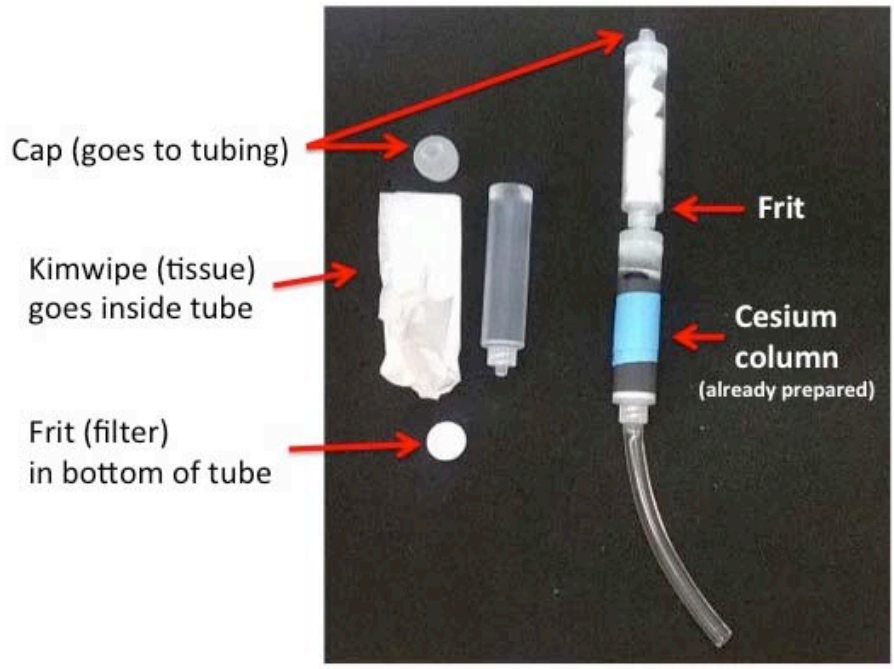
4 REFERENCES

Šebesta, F.: Composite sorbents of inorganic ion-exchangers and polyacrylonitrile binding matrix I. Methods of modification of properties of inorganic ion-exchangers for application in column packed beds, J. Radioanal. Nucl. Ch., 220, 77–88, 1997

Breier, C.A.F., S.M. Pike, F. Sebesta, K. Tradd; J.A. Breier and K.O. Buesseler (2015). New applications of KNiFC-PAN resin for broad scale monitoring of radiocesium following the Fukushima Dai-ichi nuclear distaster. Journal of Radioanalytical and Nuclear Chemistry, DOI 10.1007/s10967-015-4421-x.

5 IMAGES

Picture 1. KNiFC-PAN columns with pre-filter.



Picture 2. Cesium column set up

Picture 3. Samples filtering through KNiFC-PAN.