Protocols for ^{234}Th and 230Th Shipboard Use

Objectives Thorium 234 is a naturally occurring radionuclide in seawater that we will sample for during OTZ cruise AR41.

Requested information

Radioisotope Information

Thorium 230 is an alpha emitter with a half-life of 77,000 years. The amount of isotope needed is very small, the total amount needed at sea will be 20 nano Ci.

Protocols

2 liter bottle is filled with seawater to graduated mark on neck.

Adjust pH to ~1.5 with conc HNO_3 (around 7ml) and shake well.

Add 1ml of 230-Th (10 dpm/g) yield monitor and shake well. Let sit >8 hours.
Bring pH to 8 +/- 0.15 using NH_4OH.
Check pH with OAKTON electronic pH meter just to dial in amount.

Add 100ul of diluted 1:20 (0.45 g/60 mL H_2O for $KMnO_4$) solution cap and mix.

Add 100ul of diluted 1:20 (1.2 g/60 mL H_2O for $MnCl_2$) solution cap and mix. Note time.

Let sample sit capped for at least 8 hours to form MnO_2 ppt.

Filter sample using 25mm QMA filter.

When sample is done close valve, remove pvc filter head and rinse using bench top filtration.

Sample is dried and mounted using mylar and 2 foil layers, trimmed, labeled and beta counted.

Waste management

Our sample extraction procedure insures that waste seawater does not contain any thorium isotopes. The waste seawater samples are neutralized to pH 8 for over the side disposal. Average recovery of 230-Th from this procedure is 98%. This translates to an equivalent discard activity of 0.022 ppb /sample. A second attachment is a letter from the WHOI Safety Officer, attesting to our ability to discharge these filtrations waters over the side of the USCG Healy during Arctic GETRACES cruise.

PPE

PPE requirements of lab coat and appropriate gloves only are needed.

Use and storage

230-Th solution will be stored in polyethylene 100 ml bottles at room temperature and sealed with Parafilm until use. 1 milliliter aliquots will be added by pipet to each 2L water sample after collection.

Authorized User Training and Experience

Mr. Pike has had extensive at-sea experience using radioactive materials in the manner proposed in the present study, i. e. as yield tracers added to sea water samples.

Mr. Pike has participated in many cruises over his 20-year career at WHOI including all GEOTRACES US cruises that carried out procedures involving Th-230 similar to those proposed here.

REFERENCES

Pike, S.M., Buesseler, K.O., Andrews, J., and Savoye, N., 2005, Quantification of ^{234}Th recovery in small volume sea water samples by inductively coupled plasma-mass spectrometry, *Journal of Radioanalytical and Nuclear Chemistry, Vol. 263*, No. 2, pp. 355-360.