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technical FACT SHEET
BUILDING A SCIENTIFIC FOUNDATION FOR SOUND ENVIRONMENTAL DECISIONS

Rapid Radiochemical Method Phosphorus-32 (^{32}P) in Water Samples


EPA's rapid radiochemical methods expedite analytical turnaround time for selected radionuclides while providing quantitative results that meet measurement quality objectives. Methods are applicable to samples where contamination is from either known or unknown origins. This fact sheet is intended for radioanalytical laboratory personnel, decision makers within the incident command structure, additional reoccupancy decision makers (e.g., state and local public health), and other field environmental response personnel.

Method Summary: The method uses rapid radiochemical separation techniques for determining ^{32}P in water samples following a radiological or nuclear incident. A 100 mL water sample is filtered and phosphate carrier is added. The solution is passed through a cation exchange resin and then a high performance, gel-type cation resin to remove interferences from cation radionuclides. The eluent is treated with a mixture of hydrogen peroxide and concentrated nitric acid, reduced in volume, by heating, and quantitatively transferred to a liquid scintillation vial for counting. The Čerenkov photons from the ^{32}P beta (1710 keV, Emax) decay are detected using a calibrated liquid scintillation counter. Following counting of the sample, an aliquant of the final solution is used for yield determination by the inductively coupled plasma-atomic emission spectrometry (ICP-AES) method.

Time to Process: 8 hr

Includes radiochemical processing and counting

The rapid method takes approximately half the time as other P-32 methods.

Measurement Quality Objectives

Required method uncertainty: 150 pCi/L
Analytical action level (AAL): 12,000 pCi/L
Required relative uncertainty: 13% above AAL
Minimum detectable concentration (MDC): 3 pCi/L
Sample quantity: 100 mL; 500 mL (MDC)
Count time: Less than 30 minutes; 100 minutes (MDC)

Sample Preservation

Analysis within 3 days of sampling: No preservation required
Holding time >3 days: Adjust pH to <2 with concentrated nitric acid

Waste Generated per Sample

2 mL of gel-type cation resin
10 mL of cation exchange resins
~ 2 mL extraction chromatographic resin
~ 20 mL of acidic waste
Isotopes of uranium, neptunium, and thorium, if present in the sample originally will be contained in extraction chromatographic resin

Method Access:
https://www.epa.gov/sites/production/files/2015-06/documents/p-32_epa-600-r-11-181l_11-10-11.pdf

Method Application

The method is specific for ^{32}P in drinking water and other aqueous samples. Application of this method should be validated by the laboratory using the protocols provided in *Method Validation Guide for Qualifying Methods Used by Radiological Laboratories Participating in Incident Response Activities*, or the protocols published by a recognized standards organization for method validation.

Equipment and Supplies

Balances: Analytical — 0.001 g readability or better; toploader — 0.1 g readability | Hot plate or other suitable device for reducing sample volume | Laboratory supplies: glass beakers — 250, 400 mL; glass stirring rods; graduated cylinders — 25, 50, 100, 250, 1,000 mL; pipettes — volumetric/automatic — assorted volumes down to the microliter range; scintillation vials — 22 mL glass; volumetric flasks — 25, 100, 200, 500, 1,000 mL | Liquid scintillation counter: detector capable of measuring Čerenkov radiation | Inductively Coupled Plasma-Atomic Emission Spectrometer (ICP-AES)

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