

ANALYSIS OF PROMETHIUM-147 IN AQUEOUS SAMPLES§

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The fission product ^{147}Pm ($t_{1/2}$ 2.6 yrs.) can be of environmental and health concerns. We have developed a method for the analysis of ^{147}Pm and ^{151}Sm in aqueous solutions based on the extraction chromatographic resin LN Resin™ (Eichrom Industries, Inc.). Under specific column conditions promethium and samarium are separated from common matrix elements, most REE's, as well as other potentially-interfering radioactive elements. Elution curves (Figure 1) show that promethium and gadolinium are separated from americium and bismuth, both of which could interfere with the final analysis. Strontium-90, another common fission product, passes through LN Resin™ while its daughter yttrium-90 is retained and does not co-elute with promethium.

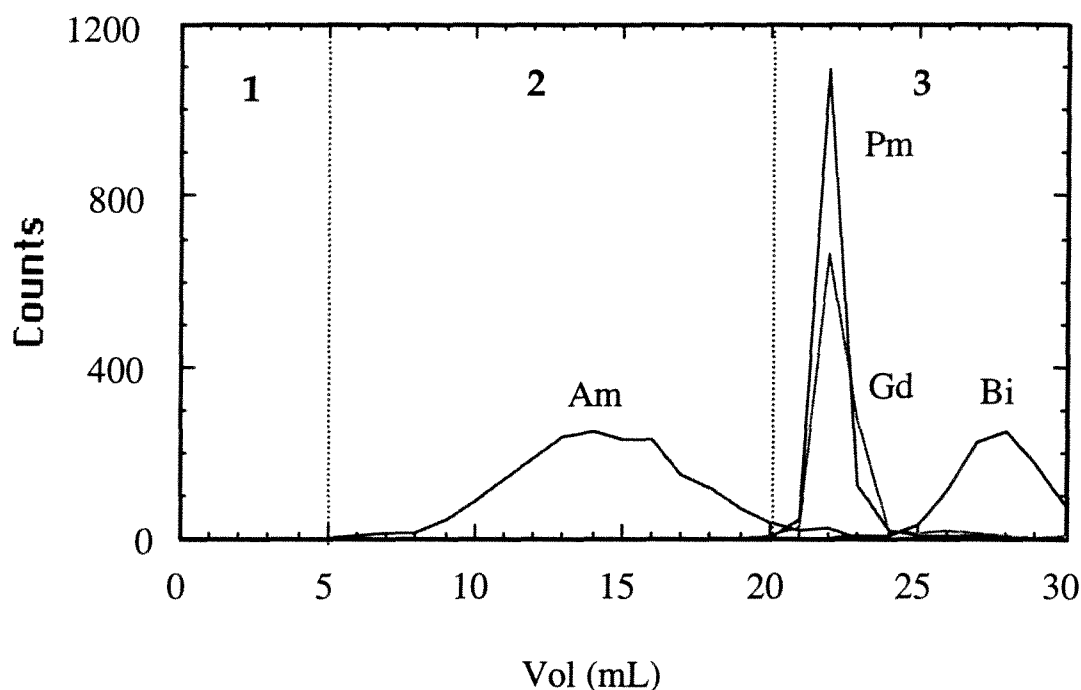


Figure 1. Elution curves for promethium, gadolinium, americium, and bismuth. The numbering sequence corresponds to: (1) sample load in 0.2M HNO_3 ; (2) rinse with 0.2M HNO_3 ; (3) promethium elution with 1M HNO_3 .

§For presentation at the 43rd Annual Conference on Bioassay, Analytical and Environmental Radiochemistry; Charleston, South Carolina; November 10-13, 1997.

Two separate chemical yield tracers have been investigated. Stable samarium or an alpha-emitting isotope, ^{148}Gd (3.18 MeV), may be used. When using samarium an aliquot of the final eluent is submitted for chemical yield determination by ICP analysis. Using ^{148}Gd allows for the simultaneous alpha/beta counting. The overall chemical separation is straightforward (**Figure 2**) and should be amenable to batch processing. After tracer selection and addition, a 0.5-2 L water sample can be concentrated by a CaHPO_4 scavenge or by evaporation. The resulting sample is then picked-up in the 0.2M HNO_3 load solution and

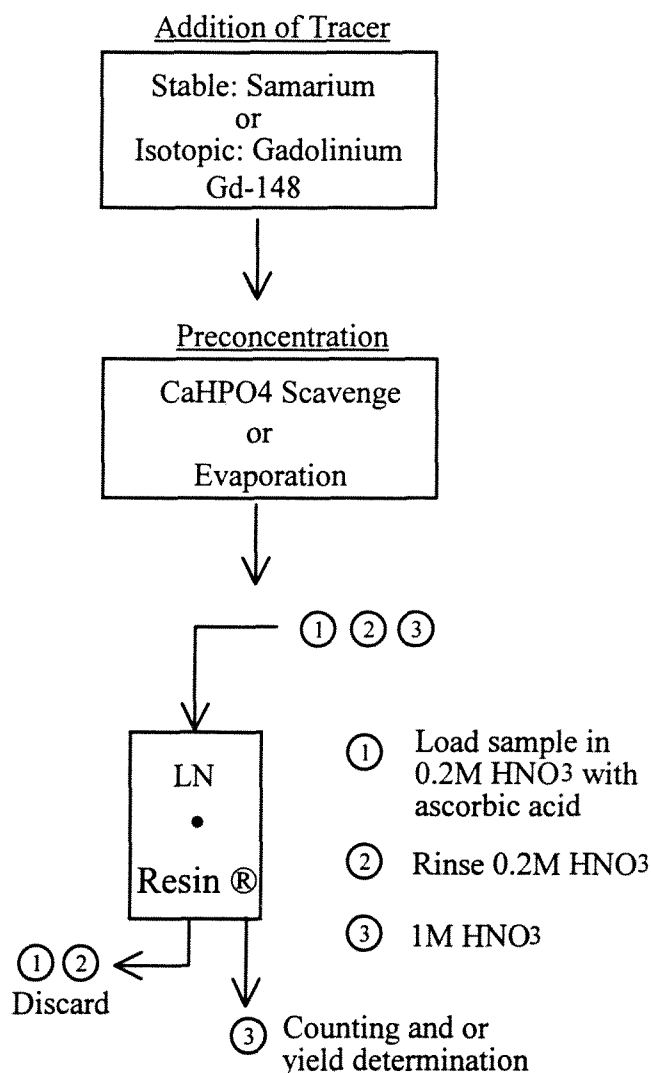


Figure 2. General flow diagram showing the isolation of promethium, samarium, and gadolinium from an aqueous sample.

passed over a preconditioned LN Resin™ column. After rinsing with 0.2M HNO_3 promethium, samarium, and ^{148}Gd are eluted with 1.0M HNO_3 . Source preparation for a

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gas-flow proportional counter could include fluoride coprecipitation/filtration or electrodeposition. Liquid scintillation counting is also possible.

By using polyethylene absorbers and successive countings both ^{147}Pm (224 keV) and ^{151}Sm (76 keV) may be quantified. If ^{151}Sm is of no interest its weak beta can be omitted by using an appropriate absorber.