Abstract

submitted to the 41st Annual Conference on Bioassay, Analytical, and Environmental Radiochemistry, Boston, 11/ 13 - 17/ 1995

Simultaneous Determination of ^{237}Np, ^{232}Th and $^{234, 235,238}U$ in Urine Samples using Extraction Chromatography, Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Gamma Spectroscopy

Son N. Nguyen, Philip E. Miller, John F. Wild, David P. Hickman and Gary WM. Mansfield, Lawrence Livermore National Laboratory, P.O. Box 808, L-379, Livermore, CA 94551.

We have succeeded determining ^{237}Np, ^{232}Th and $^{234, 235,238}U$ (natural U isotopes) simultaneously in urine samples using extraction chromatographic sample preparation coupled with gamma spectroscopy and ICP-MS detection. After being spiked with ^{239}Np, ^{230}Th, and ^{233}U tracers, urine samples were wet-ashed with HNO_3 and loaded onto an extraction chromatographic column. Following elution, samples were spiked with a known quantity of ^{242}Pu and brought to a constant volume. The quantity of ^{232}Th and U in the sample was determined using the isotope dilution technique. Similarly, the U isotopic composition of the sample was determined by isotopic measurements of $^{234}U/^{238}U$ and $^{235}U/^{238}U$ isotope pairs. The quantity of ^{237}Np in the sample was determined using a set of external standards combined with the recovery yield for Np obtained by the gamma counting of the short-lived ^{239}Np.

Direct comparison of the recovery yield of the Np in a set of spiked urine samples as determined by gamma counting of ^{239}Np and ICP-MS detection of ^{237}Np are consistently in good agreement with one another (±3%). Np is recovered with good yield (85-95%). U and Th are typically recovered, from the column clean up procedure, with efficiencies of 75 - 85%. The MDA of the ICP-MS for ^{237}Np, ^{232}Th, ^{234}U, ^{235}U, ^{238}U in 50 mL urine samples are 8×10^{-3} dpm, 1×10^{-6} dpm, 7×10^{-2} dpm, 2×10^{-5} dpm, and 4×10^{-6} dpm, respectively. Experimentail details are reported.