

## The Sequential Analysis of Several Actinides in Urine Samples

M. Hotchandani

Many radiobioassay laboratories require only one urine sample to routinely determine Pu-238/239, Am-241, Cm-244, and Cf-252. Analysis of Th-228/232, U-234/235/238, and Np-237 is not included in the above scheme because of interference from impurities (decay products) present in their respective tracers (Th-229, U-232, and Np-239). Determination of each of these actinides, therefore, require a separate urine sample, and the complete actinide analysis may require up to four urine samples. In an incident situation, however, there may be one and only one sample available from which all these actinides need to be analyzed.

The following sequential method is proposed to address a single-sample multiactinide analysis. Appropriate tracers, freshly purified in case of Th-229, U-232, and Np-239, were added to determine chemical yield. The analytes were coprecipitated with basic calcium phosphate.

The precipitate was treated with HCl. Uranium, Np, and Pu which form chloro complexes were adsorbed onto a strong base anion-exchange resin from 9 M HCl. Th, Am, Cm and Cf do not form such chloro complexes; therefore, they were not adsorbed and passed through in the HCl effluent. These actinides, however, were adsorbed onto a similar resin (in a second column) from a CH<sub>3</sub>OH/HNO<sub>3</sub> mixture.

By lowering the oxidation state of Pu and lowering the molarity of HCl, the Pu, Np, and U were separated from each other and collected into three separate eluates from the first column. The second column was treated with a CH<sub>3</sub>OH/HCl mixture to collectively elute Am, Cm, and Cf leaving Th on the column. Thorium elution was completed with 9 M HCl.

The number of eluates was five. The eluted actinides were electroplated individually on stainless steel discs, except for Am, Cm, and Cf. The discs were counted in an alpha spectrometry system to determine the alpha activity.