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Simultaneous Determination of Th and U in Urine by ICP-MS

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^{232}Th is expected to be the major internal dose contributor for nuclear workers in the development of new Th fuels. Since new fuels are usually processed in the same facilities as U fuel is handled, U might also be a significant internal dose contributor. The development of rapid and sensitive analytical methods for the determination of these elements at the levels observed in bioassay samples such as urine is needed. Inductively coupled plasma mass spectrometry (ICP-MS) allows for fast and sensitive detection of these long-lived radionuclides. However, urine contains a significant amount of dissolved salts, organic matter, and suspended particles, which prevent the direct measurement of Th and U by ICP-MS. The traditional purification method for U consists in directly passing an acidified urine sample through an extraction chromatography (EXC) resin; however, this rapid method resulted in inconsistent and poor recoveries for Th.

We have demonstrated that the salinity, ligands and suspended particles of urine were hindering the extraction of Th on UTEVA resin without significantly affecting U extraction. A calcium phosphate coprecipitation was first done to remove most of the interferents. Then, the precipitate was dissolved in 8M HNO_3 and the solution oxidized. The solution was passed through a UTEVA resin and the actinides were eluted with 5 mL of a dilute acidic solution. Using this method, a high and consistent recovery was obtained with a low detection limit of 80 and 230 pg•L^{-1} for ^{232}Th and ^{238}U, respectively.

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