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Development of three methods for determination of uranium isotopes in environmental samples by liquid-liquid extraction with tri-isooctylamine or solid-phase extraction by anion-exchange resin

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The methods are based on total decomposition of the solid materials by the use of closed vessels microwave acid digestion systems and preconcentration of uranium from the liquid samples by iron hydroxide co-precipitation (after heating in case of underground or carbonated waters). The separation of uranium from interfering radionuclides (thorium, polonium, etc.) and stable matrix elements (iron, calcium, etc.) is attained by liquid-liquid or solid-phase extraction with 10%-triisooctylamine in xylene or anion-exchange resin (AG 1x4, 100-200 mesh, BioRad) in hydrochloric and sulfuric acid media. The possible interferences from other natural (polonium, thorium, radium, etc.) and man-made (plutonium, neptunium, etc.) radionuclides were studied and successfully eliminated by different approaches. Purified uranium is electrodeposited on a stainless steel disks and then measured by alpha spectrometry. Typical energy resolution of the measured disks is 20-25 keV. The chemical yields of uranium are in the range 80-99%. The critical steps in the methods were examined in detail. The methods allow determination of uranium isotopes in macro amounts of iron (relatively large sample volumes). The analytical methods had been successfully applied to the determination of uranium isotopes in surface, mineral and tap waters, as well as in bottom sediments (the rivers –Danube, Ogosta and Tzibriza) and soils from Northwestern Bulgaria. The analytical quality of the results was checked by analyzing reference materials with different matrices.

References:

1. Popov L (2013) J Radioanal Nucl Chem 298:555-562.
2. Popov L (2012) Appl Radiat Isot 70:2370-2376.

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