RAPID ISOLATION OF NEPTUNIUM FROM SOLUTION AND SOIL

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Although actinides are the most informative elements with respect to the nature of a nuclear accident, plutonium analysis is complicated by the background created by nuclear fallout. Therefore, ^{239}Np, a short-lived actinide that emits several gamma rays, is a preferred proxy. The most prominent photopeaks from ^{239}Np are 106 keV, 228 keV, and 278 keV. However, the 106 keV and 228 keV photopeaks of ^{239}Np are also characteristic of ^{129m}Te and ^{132}Te, volatile fission products with half-lives of 33.6 days and 3.2 days, respectively. Although not as pronounced, there is also some spectral interference of the 278 keV peak with the 284 keV peak of ^{131}I. The aim of this study was to screen the available ion specific resins provided by Eichrom® for the highest possible recovery and isolation of trace amounts of ^{239}Np from samples with large amounts of fission products such as radiocesium, ^{131}I, and ^{129m}Te. The investigated environmental media for these separations were aqueous solutions (simulating rain water) and soil. Solutions containing ^{239}Np and volatile radionuclides were eluted through Eichrom® resin columns to ascertain the most effective means of isolating ^{239}Np from other fission products for detection. This was followed up with isolation of ^{239}Np from spiked soil. The resins most effective for isolating ^{239}Np in aqueous solution were UTEVA and RE (99±57% and 49±21%, respectively, calculated via 278 keV peak yield). Both resins can be used to isolate ^{239}Np from soil, although elution from the column was found achievable only by washing out the entire Np-loaded stationary phase from the resin particles with acetone. This suggests that soil components contribute to the formation of organometallic complexes within the resin matrix that enhance the retention of tetravalent neptunium. In conclusion, the RE resin provides the best recovery for ^{239}Np from soil while suppressing interference from other radionuclides. An analysis of the ratios between activities prior to resin extraction and afterwards indicate a recovery of approximately 60±24% of ^{239}Np (determined via the 278 keV photopeak) from soil using RE resins and 45±15% using UTEVA resins.