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Rapid and simultaneous determination of neptunium and plutonium in environmental samples by extraction chromatography using sequential injection and ICP-MS

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An automated analytical method for the rapid and simultaneous determination of plutonium and neptunium in environmental samples was developed. Extraction chromatographic column packed with Eichrom TEVA® resin was incorporated in a sequential injection (SI) system to automatically separate plutonium and neptunium from matrix elements and interfering radionuclides. Since valence adjustment is a crucial step to warrant the same chemical behavior of plutonium and neptunium on TEVA column, and therefore actualize their simultaneous separation and detection, we investigated and compared distinct methods for the valence adjustment of plutonium and neptunium to Pu(IV) and Np(IV). The results showed that two steps valence adjustment using disulfite and concentrated nitric acid as redox reagents was the most effective method. The analytical results for both plutonium and neptunium in three reference materials were in agreement with the reference or informative values at the 0.05 significance level. The column separation time within the SI system for a single sample was less than 1.5 hours. The developed method significantly improves analysis efficiency and reduces labor intensity, and enables a rapid and simultaneous determination of plutonium and neptunium which is especially important in emergency situations.

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