RAPID SEPARATION AND DETERMINATION OF ^{55}FE AND ^{63}NI FOR DECOMMISSIONING AND NUCLEAR FORENSICS

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A novel method for the selective separation of ^{63}Ni and ^{55}Fe, coupled with the simultaneous wash-out of interfering radionuclides has been developed. ^{63}Ni and ^{55}Fe are considered as hard-to-measure pure beta emitters because of the similarities in their decay properties and low emitted energies. These radionuclides are usually found in nuclear samples alongside ^{60}Co, which is easy to measure due to its characteristic gamma emission. The elaborated procedure utilizes the chelating ion-exchange resin Chelex 100, enabling efficient purification of ^{63}Ni and ^{55}Fe from both aqueous and stainless steel matrices. The method achieved average recovery rates of 80% for both isotopes, as verified by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Liquid Scintillation Counting (LSC), which was proven to be considerably high in terms of fast methods, utilized when the response time is the key. A vital advantage of this approach is the effective removal of interfering radionuclides prior to the separation of ^{63}Ni and ^{55}Fe. The most crucial one is ^{60}Co, which interferes with the isotopic spectra in the similar energy range, possibly contributing to the count rates. Compared to existing methods, the proposed technique offers several benefits, including a significantly reduced separation time, the use of a single chromatographic column, and overall procedural simplicity. These features enhance the efficiency and practicality of radionuclide analysis in complex matrices, especially in decommissioning and nuclear forensics, as monitoring of these isotopes is crucial in the first 5 years after shut down of most nuclear reactors.

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