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Separation and analysis of Sr-90 and Zr-90 for nuclear forensic applications

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In this work, a technological development to determine the age of radioactive strontium sources through the [Zr-90]/[Sr-90] ratio using mass spectrometry and liquid scintillation to quantify both isotopes is presented. Because Sr-90 and Zr-90 are isobaric interferences in mass spectrometry, a radiochemical separation to isolate Zr-90 has been shown to be mandatory prior to analysis. Four commercial resins (AG50W-X9, Dowex1-X8, Sr and DGA resins) were tested to isolate Zr-90 from Sr-90. Best performance was observed for the DGA resin, including recoveries higher than 99% for Zr-90. DGA has also demonstrated to be the faster approach and the most efficient not only to eliminate isobaric interferences from Sr-90, but also from Y-90, potentially present in samples containing high levels of radioactivity.

The use of ICP-MS/MS using oxygen as a reaction gas in the Octopole Reaction system (ORS) was also evaluated as a potential approach to reduce isobaric interferences at m/z 90. While some level of decontamination was achieved, the coupling of this instrumental configuration with a pre-plasma separation was deemed necessary.

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