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Rapid ICP-MS Analysis of Ra-226 Concentration in Ultrapure Gadolinium Sulfate Octahydrate

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Many particle physics experiments utilize gadolinium (Gd), a rare earth element with the most significant neutron capture cross-section among all elements, to detect anti-neutrinos via inverse beta decays or to remove neutron-induced background events.

For example, to load Gd into water Cherenkov detectors, Gd sulfate is dissolved and rare event search experiments are required to screen for radioactive impurities in Gd sulfate before dissolution.

This study developed a new method to rapidly measure the Ra-226 concentration in Gd sulfate octahydrate. This method requires only 3 days to measure a batch of samples, as opposed to the usual method using high-purity germanium detectors, which takes approximately 20 days after arrival.

The detection limit for the measurement of Ra-226 concentration in Gd sulfate is 0.43 mBq/kg.

This method has already been used for Gd sulfate screening at the Super-Kamiokande Gd (SK-Gd) project, and it can be applied to future experiments.

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