Single-Laboratory Validation Study on Simultaneous Detection of Alpha/Beta Radioactivity in Food Using Liquid Scintillation and Gas-flow Proportional Counting Techniques

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In response to the need for rapid triage of contaminated foods during a large-scale radiological emergency, a single laboratory validation study was conducted for developing a rapid and efficient radioanalytical method capable of simultaneously detecting alpha and beta radioactivity in food. The method incorporates the extraction of analyte radionuclides in food followed by radioactivity measurement using either a liquid scintillation counter (LSC) or a gas-flow proportional counter (GPC), which enable full leverage of laboratory resources to maximize the testing capacity for triaging contaminated foods. The study aimed to assess the method's applicability and reliability as a candidate method for further validation through a multi-lab validation study.

The results of this study revealed that the method can rapidly and reliably detect alpha and beta radioactivity in a wide variety of foods, providing semi-quantitative results within ±30% of the known values. Dairy, vegetable, meat, and grain samples, each spiked with ^{90}Sr and ^{239}Pu at three different activity levels in triplicates, were ashed and dissolved in concentrated HNO_3 to extract the analyte radionuclides. DGA resin was used to remove matrix and interference, ensuring quench-free and attenuation-free LSC and GPC counting. In contrast to the current method, which requires distinct procedures and instruments to detect alpha and beta-emitting radionuclides individually, this approach can detect both types simultaneously with a single instrument. It boasts a throughput of 8 samples per 7 hours, manageable by a single analyst. This represents more than a doubling of the sample throughput and leads to a substantial reduction in sample turnaround time, from several days to just a few hours.

This presentation details the preparation of food samples for alpha and beta radioactivity detection, instrument optimization and calibrations, and method performance characteristics revealed by the results from analyzing different types of foods.