OBSERVATIONS FROM ANALYSIS OF ALPHA/BETA RADIONUCLIDES IN FOOD USING QUANTULUS 1220, QUANTULUS GCT, AND HIDEX 300 SL LIQUID SCINTILLATION SPECTROMETERS

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Globalization of the food supply presents immense challenges to the U.S. Food and Drug Administration (FDA). In the event of a nuclear accident or radiological terrorism, a large number and variety of food samples may need to be analyzed to ensure food safety and protect public health. Among the conceivable radionuclides, those emitting alpha/beta radiation pose major food safety concerns due to their energetic ionizing radiation and internal exposure after ingestion. Liquid scintillation counting in conjunction with solid phase extraction is widely used for analyzing alpha/beta radionuclides in complex matrices. The benefits from this type of analysis are high counting efficiency, consistent sample characteristics, superior alpha/beta discrimination, and great sensitivity.

To achieve ultra-low background and further improve alpha/beta pulse separation, novel technologies have been developed. The Quantulus GCT 6220 employs a spectral algorithm using Guard Compensation Technology (GCT, patent pending) (PerkinElmer). The Hidex 300 SL liquid scintillation spectrometer uses a Triple-to-Double Coincidence Ratio (TDCR) technique (LabLogic). The potentials and advantages in analysis of food for alpha and beta radionuclides need to be explored and realized through experimental study under real world conditions.

A series of test samples, including a variety of foods spiked with ^{3}H, ^{89}Sr, or a mixture of ^{90}Sr and ^{241}Am or ^{239}Pu, were analyzed by traditional, Cerenkov, and simultaneous alpha/beta methods, respectively. Typical instrument performance characteristics were studied and evaluated among different liquid scintillation spectrometers, which include the lowest achievable background count rates, typical alpha/beta counting efficiencies at optimal figure of merits, minimum detectable activity, and energy dependency of alpha/beta pulse separation. This presentation summarizes the experimental results and observations from the analysis of ultra-low level ^{3}H, ^{89}Sr by Cerenkov counting, and mixture of alpha/beta radionuclides by simultaneous alpha/beta counting.