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Rapid ultra-trace determination of Fukushima-derived radionuclides in food

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Abstract

A selection of 35 food samples from Japan (plus one seawater sample and one mushroom sample from Russia) were analyzed by gamma spectrometry and liquid scintillation counting. The analytical protocol included concentration of the sample by lyophilization and/or thermal treatment, resulting in exceptionally low limits of detections (in the low mBq/kg range or even below) for the radionuclides ^{134}Cs, ^{137}Cs, ^{108m}Ag, and ^{110m}Ag, as well as low limits of detection for ^{90}Sr (in the low Bq/kg range). Radiosilver was found in several mussels at low concentrations. Most samples exhibited detectable radiocesium concentrations (below the regulatory limit). An analytical protocol for ^{90}Sr in food was developed and optimized, allowing detection limits in the sub-Bq/kg range. However, despite this high sensitivity, no Japanese food sample exceeded the limit of detection. Only one mushroom sample from Russia revealed detectable traces of ^{90}Sr, but the lack of ^{134}Cs in this sample proves that these radioactive traces did not originate from the Fukushima Daiichi accident. Several moderately time-consuming steps in the analysis of ^{90}Sr increase the sensitivity so far that this radionuclide can be measured directly with high sensitivity, without having to wait for about 2 weeks for the ingrowth of its daughter nuclide ^{90}Y. Our study supports previous studies, which also attested Japanese foods a high level of radiological safety.

Keywords: radionuclide contamination; Fukushima nuclear accident; food safety; ^{137}Cs; ^{90}Sr; radiosilver; food concentrates