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Measurement of Fissiogenic Cs Radioisotopes in Seawater by QQQ-ICPMS: Progress Report

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The anthropogenic radioisotope, Cs-137, is routinely used in oceanographic studies and the monitoring of radioactive contamination. Currently, this isotope is measured radiometrically by observing its characteristic 662 keV gamma emission. In low concentrations, however, this method of measurement can take days per sample. Recently there has been much interest in the measurement of this isotope by mass spectrometry, specifically, inductively coupled plasma mass spectrometry (ICPMS).

Currently, the efficiency and limit of detection of these isotopes limit measurements to soil samples which have relatively high concentrations of the isotopes of interest (>100 mBq/g). Seawater samples, however, have a much lower concentration (<1 mBq/g) and have yet to be measured by ICPMS. Therefore, the development of a method for Cs measurement by mass spectrometry would result in much higher sample throughput and more precise measurements.

The primary challenge in achieving this measurement is the isobaric interference from Ba isotopes (135 amu and 137 amu) which cannot be distinguished from the Cs radioisotopes by mass spectrometry. The "Agilent 8800" is an ICPMS with two quadrupole mass analyzers and one on-line octupole reaction cell located between the mass analyzers. The on-line reaction cell exploits the chemical nature of isobars, such as Ba, so the interference can be reduced during the measurements. This instrumentation has been used to successfully quantify Cs-135 and Cs-137 in samples with high concentrations of the radionuclides.

Here we outline the developments made towards low concentration ICPMS Cs radioisotope measurements including sea water cleanup chemistry, measurement methods, and isobaric removal using the online reaction cell.

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