Accurate determination of ^{90}Sr in IAEA Proficiency Test using Thermal Ionization Mass Spectrometry

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Thermal ionization mass spectrometry (TIMS) equipped with magnetic sector and multicollector detector systems is a standard and powerful analytical technique for precise stable Sr isotope ratio analysis. Other than stable isotopes, the determination of artificial ^{90}Sr ($T_{1/2}$ = 28.8 y) is important from the radiation protection perspective.

The ^{90}Sr analysis in environmental samples is a challenging task using mass spectrometry instruments because the amount of ^{90}Sr is quite small, in the range of $fg \cdot g^{-1}$ (ultra-trace level). However, the utilization of detectors with low ion beam detection capacity, - such as dynode channel electron multiplier, secondary electron multiplier and Daly ion-counting system -, make the ^{90}Sr determination possible.

For ^{90}Sr analysis, the mass spectrometry method is faster than conventional radiometric techniques, although interference from ^{90}Zr and peak tailing on the higher mass side from ^{88}Sr must be considered for a reliable ^{90}Sr determination.

In our laboratory a novel method was developed for ^{90}Sr analysis using TIMS [1]. This novel method was successfully applied for ^{90}Sr measurement first time in the history of mass-spectrometry in a worldwide open proficiency test (IAEA-TEL 2017-3) conducted by IAEA. The ^{90}Sr concentration of tap water ($2.20 \pm 0.06\ fg \cdot g^{-1}$) and milk powder ($19.6 \pm 1.0\ fg \cdot g^{-1}$) samples were analysed in the proficiency test and an 'accepted' status was gained for both accuracy (relative bias of 4.2 % and 2.1 %, respectively) and precision (relative uncertainty of 3.1 % and 5.7 %, respectively).

[1] Kavasi & Sahoo (2019) Anal. Chem. 91, 2964-2969.