Development of ozone reaction technique for determination of ultra-trace radioactive iodine

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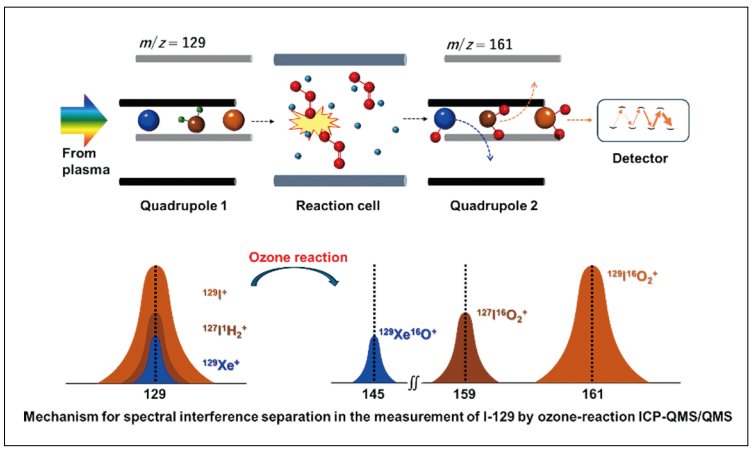
Radioactive iodine (I-129, half-life time 15.7 Ma) is one of the radioactive nuclides covered by the World Health Organization's (WHO) Drinking Water Quality Guidelines. As a result, analytical techniques are required to determine I-129 at extremely low concentrations to fulfill the regulation at the guideline level in drinking water, i.e. 1 Bq/L (equivalent to 152 ng/L). Inductively coupled plasma mass spectrometry (ICP-MS) is a candidate technique for determining low-concentration I-129, as well as a versatile analytical technique for analyzing various chemical elements in research fields such as the environment, food, and energy. However, the measurement of I-129 by ICP-MS is affected by spectral interference from the dihydride of non-radioactive iodine (I-127) and a xenon isotope (Xe-129), both of which have the same mass-to-charge ratio as I-129 (m/z = 129). Mathematical-based interference correction is usually required, which results in insufficient precision and accuracy for determining I-129 at the guideline level. Therefore, NMIJ developed a unique ozone reaction technique and applied it to tandem quadrupole ICP-MS (i.e., ICP-QMS/QMS), which helps taking full advantage of molecule-ion reactions to efficiently resolve the spectral interference problem in I-129 measurement. Direct determination of I-129 at extremely low concentration was achieved with a lower limit of detection of 60 pg/L. The blank value was reduced to approximately one hundredth compared with those reported so far. We are currently working to popularize this technology through collaboration with related organizations.



Mechanism for spectral interference separation in the measurement of I-129 by ozone-reaction ICP-QMS/QMS

Reference:
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