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The Accurate Determination of Radionuclides without Prior Chemical Separation of Interferences using an Agilent 8800 ICP-MS/MS

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This paper summarizes the accomplishments-to-date of the Agilent 8800 ICP-MS/MS in the direct determination of the radionuclides, 90Sr+, 129I+, 137Cs+, 238Pu+, 239Pu+, and 236U+/238U+ ratios by tandem mass spectrometry with chemical resolution using gas-phase ion chemistry.

The ICP-MS/MS configuration consists of a collision reaction cell (CRC) between two quadrupole mass filters, Q1 and Q2. The abundance sensitivity afforded by tandem MS is better than 10E-10, eliminating wing overlaps of 127IH+ on 129I+ and 238U+ on 237Np+ and 239Pu+.

The CRC is filled with a gas that reacts with the analyte and its interferences at different rates. When the reaction kinetics favor the analyte, the analyte is converted to a molecular ion which is then measured in "mass-shift"mode. The interference from 235UH+ on 236U+ was circumvented by oxidizing U with O2. The 236U+/238U+ ratio was determined as a 236U16O+/238U16O+ ratio.

When the reaction kinetics favor the interferent, the interferent is converted to another form and the analyte is measured at its elemental mass (the "on-mass"mode). Differences in the oxidizing efficiencies of N2O, O2, CO2 were used to discriminate interferences Ba+ from Cs+, 90Zr+ from 90Sr+, and 239U+ from 239Pu+, respectively. The 238U+ interference on 238Pu+ was removed by reacting U+ to amine cluster ions by a blend of 10% NH3/90% He. The 129Xe+ interference on 129I+ was removed by charge transfer reaction with O2.

Q1 is unique to the Agilent 8800x ICP-MS/MS: it is a unit mass resolution mass spectrometer, operated under vacuum, and precedes the reaction cell. This configuration is vital for the successful and simple implementation of chemical resolution in ICP-MS. Results from the efforts of many scientists will be presented.

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