Sulfur isotope analysis of medical sample by MC-ICP-MS

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Abstract

Evidence of S isotopic variability in the serum of hepatocellular carcinoma patients (1) calls for further investigations on the potential interest of this tracer for medical applications. So far, elemental analysis coupled to isotope ratio mass spectrometry (EA-IRMS) was considered a reference method. Here, we describe a technique of S isotope analysis of human serum by MC-ICP-MS. After digestion, sulfur was purified for the biological matrix using a one-step anion-exchange separation. Isotopes compositions were measured on a Neptune Plus in high-resolution mode (R_~ 9000) fitted with a desolvator system.
The external reproducibility of δ34S of the in-house standard solution is $\pm$0.10 (2σ). The accuracy of the method was verified by measurements of four inorganic standard reference materials leading to an agreement between IRMS and MC-ICP-MS. 16 biological samples were analyzed by both methods. The MC-ICP-MS values are heavier by a shift of 0.7 to 1.2 relative to those obtained by IRMS. Why this shift is specific to biological samples needs to be investigated further.

The advantages of MC-ICP-MS for biomedicine applications arise from 1) the small amount of sulfur (0.375 μg) required for a precise isotopic analysis 2) the possibility of measuring the isotope compositions of Fe, Cu, Zn, Ca, and S on a single 200 μL aliquot of serum.

We investigated the δ34S in the serum of cancer patients (2) and found the overall impact of pathologies minor. Most serum and plasma δ34S values fall within a narrow interval of _~1 around a mean δ34SVCDT of _~6.0. While sulfur in the serum of patients with non-malignant liver pathologies tends to be isotopically light, the serum δ34S of medicated hepatocellular carcinoma patients tends to be at the high end of control values.
(1) V. Balter et al. PNAS 2015, 112, 982-985 (2) Albalat, E. et al. JAAS 2016

Keywords: sulfur isotopes, medical samples, serum, MCICPMS

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