Traceability in elemental speciation analysis:
Se and Fe species in human serum (EMRP T2J10)

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Selenium (Se) is an essential element found in enzymes like gluthatione peroxidase which play an important role in cancer prevention, while others like iodthyronine-5'-deiodonase are necessary in the hormone balance. However, the range between deficiency (70 µg per day for adults) and toxicity (700 µg per day for adults) is very narrow. Moreover, not only the dose but also the binding form is crucial for the uptake and effectiveness of Se in the body. Therefore, precise and traceable elemental speciation analysis is necessary to ensure a sufficient, non-toxic provision of patients with Se (1).

One goal of the project T2J10 of European Metrology Research Program (EMRP) is the development of a primary method of measurement for the determination of Se species in biological samples ensuring the traceability of Se speciation analysis. Especially in cancer therapy, Se supplements are often used to reduce negative side effects of chemotherapy and to prevent the growth of new tumours. To adjust this complementary treatment to the individual need of each patient, reliable determination of Se content and speciation in serum is important.

One approach includes the enzymatic digestion of the sample using a mixture of protease, lipase and driselase followed by separation of the species with high pressure liquid chromatography (HPLC) and detection with inductively coupled plasma mass spectrometry (ICP-MS) using species specific double ID-ICP-MS (2, 3). Therefore, new species specific reference materials and isotopically enriched species are necessary and will also be developed within this project.

Another important element in clinical diagnostics is iron (Fe). In serum, especially transferrin and ferritin are named in the "Bundesärztekammerrichtlinie (RiLiBäk)" (German medical association directive) as important measurands to be determined in a range of 0.5 to 6 g/L and 10 to 600 µg/L, respectively (4). Up to now, these Fe species are mainly determined by immunoassays which can hardly meet the requirements of the RiLiBäk. Therefore, a primary analysis method comparable to the determination of Se species in serum will be developed using HPLC coupled to ICP-MS and time-of-flight mass spectrometer (TOF-MS).

References

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