

The role of trace element speciation in life-science research

Erik H. Larsen

Technical University of Denmark, The National Food Institute, Mørkhøj Bygade 19, DK-2860 Søborg, Denmark. E-mail ehl@food.dtu.dk

Selenium remains an element of great importance and also fascination in the study of human health and prevention of disease. The suggested anti-carcinogenic role of this element has attracted much attention from many scientific communities. In order to study the fate of selenium administered as selenised yeast, a pilot study of the planned Prevention of Cancer by Intervention by Selenium (PRECISE) trial was undertaken. A group of 96 elderly Danes (60-74 y) volunteered for a 5-year Se-yeast supplementation pilot study of the trial. The participants were randomised to supplementation with 100, 200 or 300 µg Se/day as selenised yeast or placebo. Following the termination of the supplementation period, the Se contents in toenails, whole blood and in blood plasma were analysed. The scope of the study was to investigate whether the concentration of selenium in toenails was useful as a biomarker of exposure to supplemented selenium. Furthermore, the scope was to understand if toenail selenium ranked the volunteers in the same way, as did plasma or whole blood selenium. The selenium content in biological materials was determined as ⁷⁸Se by ICP-MS. Selenium-containing plasma proteins including selenoprotein-P (Sel-P) were separated using a heparin affinity column and detected on-line by ICP-MS. The results showed that the selenium concentrations in plasma, whole blood and in toenails (used as biomarkers) were significantly different ($p < 0,001$) between the three dosages used and placebo. Furthermore, the expression of glutathioneperoxidase (GPx) and Sel-P showed that GPx was remained constant in plasma from all dosage groups whereas Sel-P increased as function of dosage. This result raises the question, which daily intake of selenium should be recommended from a nutritional and from a disease prevention point of view.

The exposure of humans to nanoparticles (NPs) is a rather new area in life-science and food safety research. Initial experiments using field flow fractionation (FFF) with static and dynamic light scattering (DLS) detection were undertaken. The results showed that gold NPs were efficiently separated by FFF and that the sizes were accurately determined by DLS. Another food-relevant application is the determination clay NPs migrated from clay-enforced biodegradable plastic. The FFF separation of the non-spherical clay poses problems in terms of their separation and their size determination. This will be discussed in detail. Future coupling of FFF with ICP-MS will pave the road towards multivariable detection of the presence of clay NPs migrated into food. Furthermore, it will enable a highly selective detection and therefore superior performance to the light scattering methods currently used.