METALS AND METALLOIDS IN FOOD: SPECIATION AND -OMICS

Ryszard Lobinski[1*]

[1] CNRS

*Corresponding author - E-mail: ryszard.lobinski@univ-pau.fr , Phone: +33623897074

The consumer confidence in the quality and safety of food is a fundamental value of modern society. One of the parameters characterizing food both from the toxicological and nutritional point of view is the concentration of metals. The public perception distinguishes toxic elements (eg. Cd, Hg, or Pb) and essential nutrients (e.g. Fe, Zn, Cu or Se) but the scientific understanding of the risks and/or benefits associated with the presence of one or another metal is more complex. The same element can be essential or toxic as a function of concentration, speciation (the distribution among the different chemical compounds) and the presence or absence of other elements or potential ligands in a food. The rapidly developing industry of food supplements requires a complete account of all the forms of the supplemented elements present as only some of them have beneficial value while others may even be harmful. Adding to that that the trace element distribution and t he isotope ratios of some elements (Pb, Fe, Sr) can be valuable tracers of food origin, there is a large number of situations where modern analytical tools for multielement food analysis, precise isotope ratios determination and speciation analysis become essential for the consumer protection. This contribution discusses the advances in analytical techniques addressing different aspects of trace elements in food. The democratization of inductively coupled plasma mass spectrometers (ICP MS) fitted with collision cells and the availability of reference materials has made total element analysis a quasi-routine task. ICP MS has also proved to be a convenient detector in gas and liquid chromatography rendering straightforward the analysis for particular species (methylmercury, inorganic arsenic, organotin, polybromine compounds). ICP MS – based coupled techniques have boosted exploratory speciation studies aimed at the identification of chemical forms (endogenous or artificially enriched) of trace metals and metalloids), their bioaccessibility and metabolism (e.g., selenomethionine, zinc and chromium species in functional food and food supplements) and the identification of metabolic pathways. Particular attention will be given to large-scale speciation approaches combining information obtained from the parallel use of elemental mass spectrometry (ICP MS) and molecular high accuracy Fourier Transform MS detection in chromatography and electrophoresis. The lecture will be illustrated with a number of examples addressing targeted and nontargeted speciation analysis. Analytical approaches aimed at the correlation of the multielement concentration pattern with genomic, proteomic and metabolomic data and their underpinned potential of the improvement of our understanding of the use of trace elements by plants will be will be highlighted.

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