

DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

The aim of the research project is to develop new analytical procedures enabling multielemental speciation analysis of food samples by an advanced hyphenated technique – high performance liquid chromatography combined with inductively coupled plasma mass spectrometry with dynamic reaction cell (HPLC/ICP-DRC-MS). The study will undertake a speciation analysis of elements which are toxic to human organisms: Pb, Cd, As (elements which are included in legal regulations concerning food analysis) and Cr and Sb (elements determined in processed and stored food products). The research will include liquid food products (drinks, fruit and vegetable juice, tea, coffee, milk and wine) and solid food products (edible vegetable parts, fruit, grains and related products, seafood including algae and meat products).

So far, most analytical procedures enabling speciation analysis have concerned determining species of single elements. Thanks to the availability of an advanced hyphenated technique of HPLC/ICP-DRC-MS, allowing scientists to conduct multielemental analysis, it is possible to develop more effective procedures for multielemental speciation analysis. In comparison with speciation analysis of single elements, multielemental approach makes the analysis time shorter, the number of reagents used and leachates from cement-based materials smaller (“green chemistry”), and as a result, the costs of analysis are lower. On the other hand, shorter analysis time is also convenient from the analyte stability standpoint, which is essential in speciation analysis as ensuring unchanged form of species of certain elements in real sample from the moment of sampling until the time of analysis is a challenging task.

HPLC/ICP-DRC-MS is the most frequently applied technique in speciation analysis. It is popular due to its advantages: excellent selectivity, high sensitivity and last but not least, very low detection limits which are the result of almost 100% efficiency of elements ionisation in inductively coupled plasma. Apart from these benefits, it is worth mentioning that liquid chromatography provides a wide range of separation mechanisms.

Basic research will allow us to solve problems with the determination of different species of a few elements in one analytical run: three: Pb, Cd and As, two: Cr and Sb, and five: As, Pb, Cd, Cr and Sb, whose individual forms show varied, toxic influence on human organisms. The research objective is to obtain new knowledge on the behaviour of As, Pb, Cd, Cr and Sb species which are present in raw and processed, liquid and solid food products in different separation and determination conditions, which will make it possible to create a database for solving problems with multielemental speciation analysis of food samples. Systematising information within the project will help prepare new validated analytical procedures which will be applicable in monitoring species of As, Pb, Cd, Cr and Sb in foods of different origins, at different preparation stages and requiring different storage conditions.

The research project will involve checking analytical capacity of HPLC/ICP-DRC-MS technique in the context of separation and determination of a few elements species in one analytical run: 1) Pb, Cd and As; 2) Cr and Sb and; 2) As, Pb, Cd, Cr and Sb as well as solving analytical problems in multielemental speciation analysis of raw and processed food samples for the contents of the above-mentioned elements species.