Validation of an analysis method of metals in food products by ICP MS

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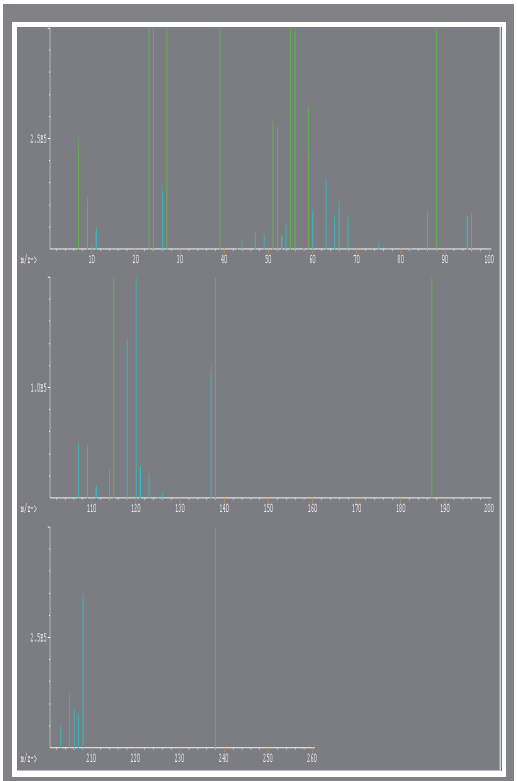
Introduction

Metals are present at trace in our environment and consequently in our food. The mean dose ingested by the human stands below the statutory dose. However, many living-organisms like fish or seafood (oysters, etc) accumulate metals. Through soil and plant contamination, wine also contains lead, cadmium and mercury.
Metals absorbed in large amounts can turn out to be dangerous for the health as well as cause cancer. Hence currently, regulation of food, paint and air is stricter and imposes regular controls. CARSO-LSEHL laboratory aimed to set up a food metal detecting method.
We are extending and validating a method for the analyzation of the following 19 elements: Aluminium, Lead, Copper, Zinc, Mercury, Arsenic, Chromium, Tin, Nickel, Antimony, Molybdenum, Cobalt, Titanium, Vanadium, Tellurium, Manganese, Selenium, Cadmium and Thallium.



Metals analysis in food sample by ICP MS.

Experimental methods

The food product samples were prepared into a homogeneous liquid representative for analyzation. Only edible parts of the food were selected for the analysis. Fresh products containing high level of water were freeze-dried first. Freeze drying consists of eliminating water from the sample, as it is being frozen, in vacuum conditions, using a direct transformation of ice into vapour. The dry powder was digested with a mixture of acids and hydrogen peroxide. Reactions took place in a microwave oven at 200°C. This technique changed the solid sample into a solution containing the analyzed elements. The analysis was done in a trial tube, in which a mineralized sample and an internal standard were introduced. Two internal standards, the Indium and Rhenium were added to the samples, in order to compensate for matrix effects. The analyses are made on an ICP MS (Inductively Coupled Plasma Mass Spectrometry) Agilent 7500ce. A collision chamber was used to remove some polyatomic interference.
A validation was made to test the linearity, specificity, repeatability, internal reproducibility of the method, and to determine the quantification limit. All representative matrixes of the different kind samples have been tested: peach leaves, apples, bread, rice, meat, chicken, oyster, lobsters, milk, fish and feedstuff.

Results and conclusion

The graph represents the signal intensity functions of the atomic mass of a sample. Each peak corresponds to an isotope of an element. The signal intensity is proportional to the concentration of metal. Most elements present at relatively high concentration in food and feedstuff have isotopes in the 7-100 m/z region, like copper, zinc, chromium, nickel and vanadium. The results of the trial analysis were analyzed with a statistical test with an Excel file (norm NF V03-110). The method took into account an uncertainty in measurement of 20% for each metal. The metal analysis method was validated for all metals. The validation file will be filed to an accreditation COFRAC within the next month.

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