Talk

Heavy metals and nutritional elements analysis on food by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

Beatriz Ballesteros(1), Raquel Rojas(1) María de la Menta Ballesteros(2)

(1) Departamento Físico Químico. Laboratorios Vital, C/ Imprenta nº28, P.I. La Negrilla, 41016, Sevilla.

(2) Departamento de Ingeniería Química. Universidad Pablo de Olavide. Ctra. de Utrera Km 1 41013 Sevilla.

Keywords: ICP-MS start up; heavy metals; nutritional elements.

ABSTRACT

Motivation: Food companies are legally responsible of the safety of the food they produce, transport, store or sell in developed countries. In this sense, there is a strict control of pollutants, such as heavy metals, as well as restrictive labeling regulations applicable to food additives. In order to asses an adequate detection of these elements, high-resolution techniques are required and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) seems to be one of the best choice because of its ability to detect concentrations ranging from its detection limit of 1ppt. The objective of this project is the start up and development of this technique for lead (Pb), cadmium (Cd) and mercury (Hg) determination in fish, crustaceans and cephalopods; sodium (Na) in processed food, meat, dairy and bakery products; and iron (Fe), which is used in the olive blackening.

Methods: ICP-MS used was an ICP Mass Spectrometer ELAN DRC-e Axial Field Technology (Perkin Elmer SCIEX, Waltham). This equipment had a cooler recirculator PolyScience (Nile) coupled and an s10 autosample (Perkin Elmer, Waltham). Food samples were homogenized with a mixer and digested with a Digi-Prep 50/24 digestor with HNO3:HCl 6:1.

Results: Previously to this study, results generated by ICP-MS measurements had a great uncertainty associated. Therefore, several test were performed to optimize the method. For instance, procedure for cephalopods homogenization was changed, and results showed better recoveries when sample was frozen and broken up with a mortar. Sample weight was varied depending on sample moisture and fat content; a filtering step was introduced for removal dissolved solids below 0.2%; 2 µg/L of gold (Au) was introduced as a mercury stabilizer. The adequacy of the curve range was made according to legal limits, so concentration of internal standard (Rh) was changed an and its accurate performance was checked. Furthermore, major isotopes and its interfering were studied in order to establish interference correction equations. Finally, a quality control of the results was performed.

Conclusions: Sample preparation is crucial for reliable results. Moreover, standardization of all the steps involved in the ICP-MS determination of trace elements and other elements are necessary in order to reduce uncertainty. After this work, additional quality steps are required in order to achieve accreditation of the technique under different international standard guidelines.

REFERENCES

Andrade Korn, M. D. G., da Boa Morte, E. S., Batista dos Santos, D. C. M., Castro, J. T., Barbosa, J. T. P., Teixeira, A. P., Pires Fernandes, A.,Welz, B., Carvalho dos Santos W.P, Batista Guimara˜es Nunes dos Santos, E., & Korn, M. (2008). Sample preparation for the determination of metals in food samples using spectroanalytical methods—a review. Applied Spectroscopy Reviews, 43(2), 67-92.

Nardi, E. P., Evangelista, F. S., Tormen, L., Saint, T. D., Curtius, A. J., de Souza, S. S., & Barbosa, F. (2009). The use of inductively coupled plasma mass spectrometry (ICP-MS) for the determination of toxic and essential elements in different types of food samples. Food Chemistry, 112(3), 727-732.

Neubauer, K. (2010). Reducing the Effects of Interferences in Quadrupole ICP-MS. Spectroscopy, 25(11), 30.