Simultaneous determination of cadmium, iron and tin in canned foods employing HR CS GFAAS

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Abstract

A method for simultaneous determination of cadmium, iron and tin in canned food samples using high resolution continuum source graphite furnace atomic absorption spectrometry (HR-CS GF AAS) was established. The proposed procedure was applied for the determination of cadmium, iron and tin in canned samples of peeled tomato and sardine.

Introdução

The high-resolution continuum source atomic absorption spectrometry (HR-CS AAS) employing as continuum source the xenon lamp and the CCD array as detector allowed the development of analytical strategies for sequential or simultaneous determination of two or more elements. The simultaneous determination is possible when the atomic lines of the elements are in the same spectral window of the CCD array detector[1,2]. Particularly, in graphite furnace atomic absorption spectrometry (GF AAS), the simultaneous determination provides a significant increasing in the analytical frequency of the method and also in the number of analytical determinations using a same graphite tube, because a single temperature program can allow the determination of two or more elements[1]. The atomic lines chosen should be compatible with the element concentrations in the samples and the chemical modifier selected also should be efficient for the quantification of all the elements that will be determined[1,2]. Another critical question is the establishment of the experimental conditions for the pyrolysis and atomization steps of the elements involved. Generally, the pyrolysis temperature is determined by the most volatile element and the atomization temperature is defined by the most refractory element.

This paper proposes a method for the simultaneous determination of cadmium, iron and tin in canned foods employing HR-CS GFAAS.

Resultados e Discussão

Considering that the simultaneous determination using HR-CS AAS requires employ of atomic lines in the same spectral window, the lines chosen were: 228.802 nm for cadmium, 228.725 nm for iron and 228.668 nm for tin. The chemical modifier used was an acid solution containing a mixture of 0.1% (w/v) Pd and 0.05% (w/v) Mg. A single temperature program was established, with pyrolysis and atomization temperature of 700 and 2550 ^{o}C, respectively. The method accuracy was confirmed by analysis of a certified reference material and use of other analytical technique. Employing the optimized conditions, this method allows the simultaneous determination of cadmium, iron and tin using the external calibration technique, with limits of detection and quantification of 0.04 and 0.14 µg L^{-1} for cadmium, 0.04 and 0.13 mg L^{-1} for iron and 0.06 and 0.20 mg L^{-1} for tin, respectively. Considering a mass of digested sample of 1.0 g, these limits expressed as analyte mass per sample mass, are: 0.62 and 2.10 ng g^{-1} for cadmium, 0.57 and 1.95 mg kg^{-1} for iron and 0.89 and 3.00 mg kg^{-1} for tin, respectively. The proposed method was applied for the simultaneous determination of cadmium, iron and tin in eleven samples of canned foods. The concentrations found in these samples varied from 3.57 to 62.9 ng g^{-1} for cadmium, from 1.62 to 31.48 mg kg^{-1} for iron and from 4.39 to 122.0 mg kg^{-1} for tin.

Conclusões

The developed method allowed the simultaneous determination of cadmium, iron and tin in canned food samples by HR CS GFAAS. The limits of quantification and the characteristic masses obtained were satisfactory for the simultaneous determination of the analytes in analyzed samples. The tin determination in canned foods is important because this element is an major component in the composition of packagings used for preservation of these foods. The cadmium and tin concentrations found in the samples analyzed are lower than the permissible maximum levels for both elements in canned food by Brazilian legislation.

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References

Welz, B.; Becker-Ross, H.; Florek, S.; Heitmann, U., High-Resolution Continuum Source AAS, 2nd ed., Wiley-VCH, Weinheim, 2005.

[2] Welz, B; Vale, M.G.R.; Castilho, I.N.B.; Dessuy, M.B. *J. Braz. Chem. Soc.* **2014,** 25, 799.