INVESTIGATION OF THE HEAVY METALS CONTENT OF SOME FOOD PRODUCTS BY USING ATOMIC ABSORPTION SPECTROMETRY♦

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Abstract: The content of some heavy metals (Cd, Pb, Cu and Zn) in some food products – beef, milk, and cheese – obtained from a rural farm located in Voroveni, Argeş, Romania has been investigated. At the same time, parallel investigations were done on samples of grassland soil. Atomic absorption spectrometry (GBC-Avanta) has been used to determinate the concentration of heavy metals: Cd (λ = 228.8), Cu (λ = 324.7), Zn (λ =

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213.9), Pb (λ = 217 nm). It has been observed that the concentration of these heavy metals exceeds the accepted limit values, both in food and soil.

Keywords: *heavy metals, atomic absorption spectrometry, food products*

INTRODUCTION

The increasing of metal concentration in food over the limits can cause toxic effects for consumers of these products. The gravity of toxic effect depends on nature, metal concentration, body resistance and presence of other contaminants. Heavy metals' toxicity is the result of their interaction with the enzymatic systems from the animal cells or some constituents of cells' membranes [1, 2].
In literature there are mentioned many methods for heavy metals determination in soils, phosphate rock, seawater, plants, biological materials, steels and cast iron, through inductive coupled plasma - mass spectrometry [3], inductive coupled plasma - atomic emission spectrometry [4], atomic absorption spectrometry with flame or electrothermal atomization [5, 6], spectrophotometric methods, X-ray fluorescence [7], electrochemically with ultramicroelectrodes [8], anodic stripping voltammetry [9, 10].
This work presents aspects regarding the pollution with heavy metals (Cd, Pb, Cu and Zn) of some food products collected from a rural small farm located in Voroveni, Argeş County. The analyzed products were of animal origin: cow milk and cheese and beef.

MATERIALS AND METHODS

The food samples (milk, cheese and meat) were collected from the rural farm during August 2007.
In order to determine the heavy metals concentrations, the cheese and meat samples were hashed, dried at 105 ^{0}C and mineralized by wet digestion method (HNO_3 - H_2SO_4). About 0.5 g of each dried sample was predigested in 2 mL 65% HNO_3 for 24 hours at room temperature, then 2 mL of 98% H_2SO_4 were added and the mixture was digested in a VELP DK6 heating digester. The milk samples were vaporized and after cooling, the residue was mineralized too by wet digestion method. All used reagents were of analytical reagent grade (Merck). The resultant solutions were analyzed with an atomic absorption spectrophotometer GBC-AVANTA (air/acetylene flame) using the following wavelengths: Cd (λ = 228.8 nm), Cu (λ = 324.7 nm), Zn (λ = 213.9 nm), Pb (λ = 217 nm). Two replicate determinations were done for each sample.

RESULTS AND DISCUSSIONS

The heavy metals concentrations in the analyzed samples have been compared with the maximum limit allowed for each food product [11] (table 1):

Table 1. *Maximum limits allowed in some food products (μg.kg^{-1})*

Food product	Cd	Pb	Zn	Cu
milk	0.01	0.1	5	0.5
cheese	0.05	0.5	25	2.5
meat	0.10	0.5	50	3.0

For each food product ten samples have been analyzed and the results were statistical processed by ANOVA (table 2).

Table 2. *Heavy metals concentrations in food sample analysed (μg.kg^{-1})*

Food product	Cd	Pb	Zn	Cu
milk	0.004 ± 0.001	0.091 ± 0.003	3.56 ± 0.03	0.42 ± 0.01
cheese	0.008 ± 0.002	0.64 ± 0.02	33.46 ± 0.02	3.12 ± 0.03
meat	0.07 ± 0.01	0.57 ± 0.01	38.82 ± 0.02	1.45 ± 0.01

The results presented in table 2 showed smaller amounts of Pb in cheese and meat over the limits and bigger concentrations for Zn and Cu in cheese. We remark that the milk corresponds to consumer's requirements.

CONCLUSIONS

Heavy metals may reach food from different sources: soil, water, chemicals applied to agricultural land, contaminating dirt, equipment used for food processing, storage and cooking.

The analysis performed showed that the milk collected from the small rural farm corresponds to consumer's requirements but not the cheese and meat samples. In cheese samples the concentrations of Pb, Zn and Cu exceeded the maximum allowed limits but in meat samples only the concentration of Pb exceeded the limit, probably because of an improper processing.

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