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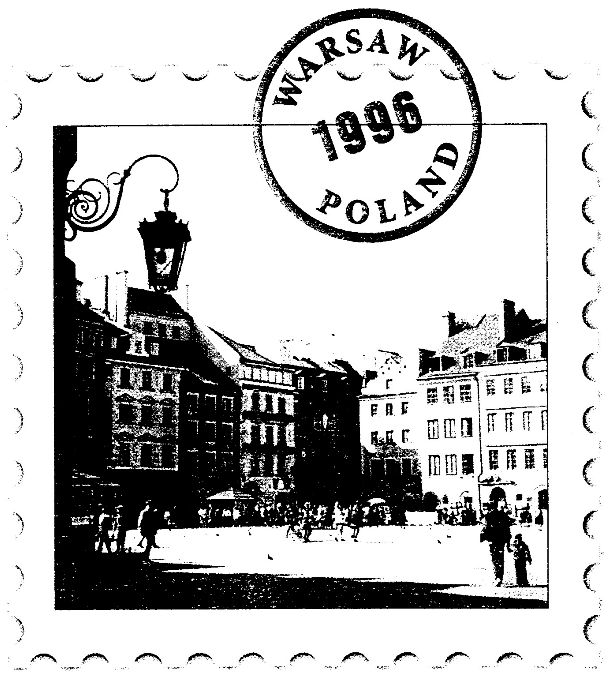

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Symposium Proceedings

DETERMINATION OF LEAD AND ZINC IN SOME VEGETABLES PRODUCED IN THE AREA NEAR THE LEAD AND ZINC SMELTING PLANT IN TITOV VELES CITY, MACEDONIA

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Abstract

The occurrence of lead and zinc in soils samples and some fresh vegetables (onion, lettuce, cabbage, carrot, spinach, cucumber, leek) produced in the area near the lead and zinc smelting plant in Titov Veles City, Macedonia has been presented. The determination of lead and zinc was performed by atomic absorption spectrometry. The results from the lead and zinc content in the soil and vegetable samples taken from the different distances of the smelting plant (1, 1.5 and 3 km) are compared. The concentration of lead and zinc in the soil samples which are near to the smelting plant is higher than in the samples which are far-away from the Pb-Zn smeltery. From the results of the investigations it can be also concluded that the lead and zinc concentrations in vegetable samples depend from the distance of the kitchen-gardens from the smelting plant. It was found evident differences in the lead and zinc concentrations in the washed and unwashed vegetable samples. In some of the investigation vegetables the content of lead is higher than those permitted by Macedonian government regulations.

Introduction

The presence of heavy metals in the plants is expected in small quantity. As a results of polluted environment their concentrations can be increased, and metals which are not normally present in the constitution can be found in the plants. The most present contaminants are lead and zinc. The main threat from lead and zinc is in places near lead and zinc smelters, as lead and zinc may escape as dust with flue gases. It is known that lead is a extremely toxic element [1]. In the human body lead is accumulated in the bones, from which it is mobilized when the changes in the organism occur in that case it blockades the work of the enzymes which are taking part in the synthesis of hemoglobin. Also, higher levels of lead in the body can cause some disorders as in heart functions, higher blood pressure, influence on central nervous system, etc.
Because of the fact that lead can be absorbed into the body by consumption of lead-containing food stuffs, there is a necessity of precise and exact determination of lead in various types of food. The survey of the literature has shown that there are many data on lead and zinc determination in food. It can be seen that usually the methods of flame atomic absorption (AAS) [2-6] and electrothermal atomic absorption spectrometry (ETAAS) [7-9], were used.
In this work the determination of lead and zinc by AAS in soil, as well as in some vegetables samples, taken from different places near the lead and zinc smelting plant in Titov Veles city, Macedonia has been done.

Experimental

Instrumentation

A Perkin-Elmer models 303 and 703 atomic absorption spectrophotometer equipped with a deuterium background corrector, HGA-72 graphite furnace and model 056 strip chart recorder were used. The lead and zinc hollow cathode lamps were used as sources. Lead and zinc were determined by flame atomic absorption spectrometry except in the case of low concentrations of lead were electrothermal atomic absorption spectrometry was used. Optimal instrumental conditions for lead determination by ETAAS (temperature and time) are: drying: 110 °C, 20 s; charring: 400 °C, 20 s; atomize: 2000 °C 5 s and cleaning 2650 °C and 3 s. Argon was used as an inner gas. Gas mixture of acetylene and air was used for flame AAS determinations.

Procedure for the lead and zinc determination in soils

1 g of fine milled soil sample was transferred in a glass beaker and 50 cm^3 of acid mixture of HCl and HNO_3 (*v/v*, 3:1) were added. A mixture was heated 3-4 hours on a hot plate to obtained a minimum volume. Then, 50 cm^3 of deionized water were added and the solution was filtered off. The filtrate was collected in a volumetric flask of 100 cm^3.

Procedure for the lead and zinc determination in vegetable samples

10 to 20 g of food samples were put in an Erlenmeyer flask. 20 cm^3 of hydrochloric acid solution (2:1, $v(HCl)/v(H_2O)$) was added, brought to a boil on a hot plate and simmered for 5 minutes. The solution was cooled, filtered and transferred to a 50-mL volumetric flask and made to volume with deionized water.

Results and discussion

The results from the lead and zinc determination in soils from three different places (1, 1.5 and 3 km from the smelter) in the Titov Veles city area are given in Table I. It can be seen that in the soil samples which are nearer to lead and zinc smelting plant, lead and zinc contents are higher than in the samples which are far-away from Pb-Zn smelter. It is obviously that the dust from the lead and zinc smelter influence on the contamination of the soil. From these results it can be concluded that even in the region of 3 km distance from the Pb-Zn smelter the contamination of soil by lead is higher than those permitted by Macedonian government regulations (max. 100 mg/kg), but the content of zinc is in the permitted concentrations (max. 300 mg/kg).

Table I. Results of the lead and zinc determination in soil samples from different distances of the smelting plant (1, 1.5 and 3 km)

No.	Distances of the smelter	Content of lead, in mg/kg	Content of zinc, in mg/kg
1	1 km	269.0	40.5
2	1.5 km	190.0	31.2
3	3 km	175.0	30.7

To determine the content of lead an zinc, different type of vegetables produced in these regions near Pb-Zn smelter, are analyzed by atomic absorption spectrometry. From the results of the investigations (Table II) it can be concluded that the lead and zinc concentrations in vegetable samples depend of the distance of kitchen-gardens from the smelter. For example, the content of lead in the lettuce taken from the distance of 1.5 km from smelter is 12.8 mg/kg, from 3 km is 0.80 mg/kg and respectively for zinc 17.7 mg/kg and 10.0 mg/kg. It was found that the contents of lead and zinc in some leafy vegetables (lettuce, spinach, parsley) are higher than in the other kinds of vegetable. It was also found evident differences in the lead and zinc concentrations in washed and unwashed vegetable samples. For example, the content of lead in unwashed sample of spinach is 25.7 mg/kg and in washed sample 4.5 mg/kg. In the most of the investigation vegetables (washed or unwashed), such as: lettuce, dock, spinach, onion, the content of lead is higher than permitted value (maximum 1.0 mg/kg). On the other hand, the content of lead only in a few samples (carrot, cabbage, cucumber, leek, washed sample of onion) is smaller than permitted value.

Conclusions

The results from the lead and zinc determination in soils from three different places show that in the soil samples which are nearer to lead and zinc smelting plant, lead and zinc contents are higher than in the samples which are far-away from Pb-Zn smelter. It is obviously that dust from the lead and zinc smelter influences on the contamination of the soil. It was found that the lead and zinc concentrations in vegetable samples depend from the distance of kitchen-gardens from the smelter and that the contents of lead and zinc in some leafy vegetables (lettuce, spinach, parsley) are higher than in the other kinds of vegetable. It was also found evident differences in the lead and zinc concentrations in washed and unwashed vegetable samples. In the most of the investigation vegetables the content of lead is higher than permitted value (maximum 1.0 mg/kg).

Table II. Results from the lead and zinc determination in different vegetable samples taken in the region of Titov Veles city

Vegetable	Content of Pb/mg kg^{-1}			Content of Zn/mg kg^{-1}		
	1 km	2 km	3 km	1 km	2 km	3 km
Onion						
Unwashed	1.50	-	1.50	4.30	-	-
Washed	0.5	-	<0.10	3.40	-	4.50
Parsley						
Unwashed	12.1	-	25.0	17.2	-	22.7
Washed	4.3	-	-	9.80	-	-
Celery leafs						
Unwashed	14.8	-	-	20.2	-	-
Dock						
Unwashed	-	4.3	-	-	21.9	-
Washed	-	4.0	-	-	9.0	-
Lettuce						
Unwashed	-	12.8	0.80	-	17.7	10.0
Washed	-	4.5	-	-	9.7	-
Carrot						
Washed	-	<0.5	<0.5	-	4.3	2.5
Carrot leafs						
Unwashed	-	27.8	-	-	26.0	20.1
Washed	-	-	-	-	-	-
Spinach						
Unwashed	-	25.7	-	-	16.4	29.4
Washed	-	4.5	-	-	2.7	2.6
Cabbage						
Unwashed	-	-	<0.5	-	-	2.1
Washed	-	-	<0.5	-	-	1.4
Cucumber						
Unwashed	-	-	<0.5	-	-	3.0
Washed	-	-	<0.5	-	-	2.4
Leek						
Unwashed	-	-	<0.5	-	-	3.1
Washed	-	-	<0.5	-	-	3.8
Meant tee						
Unwashed	-	-	32.2	-	-	34.8

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MONITORING OF ENVIRONMENTAL CONTAMINATION BY CYTOGENETIC METHODS

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Abstract

The degree of environmental contamination with different toxic substances has received global proportions. For early detection of toxic agents in the environment, numerous, frequently complex methods and monitoring programs are being applied. This paper assesses the possibilities for application of cytogenetic methods for monitoring certain toxic substances in domestic livestock. Methods of lymphocyte cultivation and preparation of chromosomes by a modified Moorhead's method were utilized. The obtained results indicate that chromosomal aberrations occur even in the presence of low concentrations of toxic agents which can be successfully observed by applying cytogenetic techniques.

Introduction

The impact of exogenous environmental factors on the genetic material of living organisms elicits a response in the form of certain alterations expressed through numerical and structural chromosomal changes. In spite of thorough pharmacological examinations, it's impossible to provide protection against unpredictable reactions to medication (1,4). Certain substances found in feed mixes can form DNA antimetabolites that inhibit processes of synthesis by preventing the formation of precursors, consequently causing numerous aberrations in the DNA molecule (4). Ionizing radiation causes chromosome and chromatide damage as well as alterations in the DNA molecular structure (2, 4).

The effect of genotoxic drugs, certain feed substitutes and ionizing radiation was studied under experimental conditions in domestic livestock (pigs, cattle and goats). The aim of this work was to examine the in-