ASSESSMENT OF SOIL LEAD CONTAMINATION IN COPŞA MICĂ AREA

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Abstract: *Copşa Mică area (Sibiu County, Romania) is mainly characterized by high environmental lead concentrations. The major source of lead in the environment is the activity of a heavy metal smelter (lead, zinc and other heavy metals). The major exposure for the most susceptible population group (children aged 0-6 years) is the lead in soil and dust and not the lead in the air. The lead in soil was measured in different areas of the town of Copşa Mică, by using the KX Ray Fluorescence technique. Blood lead level measured within the intervention programmes related to the concentrations of lead in soil should be taken into consideration.*

Keywords: *lead concentrations in soil, exposure, blood lead levels*

Rezumat: *Zona Copşa Mică (Sibiu, România) este caracterizată prin prezenţa deja de decenii a concentraţiilor crescute de plumb în mediu. Principala sursă a plumbului din mediu este activitatea unei topitorii de metale grele (plumb, zinc, alte metale). Principala cale de expunere la plumb în cazul grupului populaţional cu cea mai mare susceptibilitate (copii cu vârste cuprinse între 0 şi 6 ani) este solul şi praful, nu aerul. Plumbul în sol a fost măsurat utilizând tehnica fluorescenţei în raze X. În continuare, ar trebui avute în vedere acţiuni de screening ale nivelelor plumbemiei şi implementarea unor programe de intervenţie în relaţie cu concentraţiile mari de plumb în sol.*

Cuvinte cheie: *concentraţii de plumb în sol, expunere, plumbemie*

INTRODUCTION

Lead in the environment and the health outcomes associated to lead exposure is a matter of public interest. The levels of lead in soil are within a large range: concentrations from less than 100 and above 11000 ppm. (1) The normal values of the concentration of lead in soil are bellow 50 ppm. (2,3) The concentration of lead in the soil near the lead painted houses may reach 10000 mcg/g. (4) The correlations between the level of lead in soil and the blood lead levels cited in the scientific studies are influenced by factors such as: access to soil and dust, behaviours (especially in the case of children), soil covering, seasonal variations of the exposure conditions, size of lead particles, type of lead chemical compounds and the routes of exposure.

WORKING HYPOTHESIS

Assessment of the levels of lead concentrations in soil in the neighbourhood of a primary smelter, SC SOMETRA SA, in the town of Copşa Mica.

MATERIAL AND METHOD

A number of 194 soil samples were taken from a depth of 5 and 30 cm from the town of Copşa Mica and its surroundings. The soil samples were analysed using the KX Ray fluorescence technique. The STATA 5.0. programme was used for data entry and data processing.

RESULTS

The concentrations of lead measured in soil were bellow 50 ppm in 13.9% of the samples, 25.8% of the measured concentrations were within the range of 50-150 ppm, while in 33.5% of the samples, the measured lead concentrations were between 150 and 500 ppm and in 18% of the samples, the lead concentrations were within the range of 500-1000 ppm. In 8.8% of the samples, the lead concentrations were above 1000 ppm (Table 1).

Table no. 1. The distribution of lead concentrations in soil

CATEGORIES OF CONCENTRATIONS	NUMBER OF SAMPLES	PERCENTAGE
<50	27	13.9%
50-150	50	25.8%
150-500	65	33.5%
500-1000	35	18%
>1000	17	8.8%

Table no. 2. Mean and standard deviation of lead concentration in soil with different usages and the number of samples taken

Depth	Agricultural usage	Grazing	Forest	Residential usage
5	304.9	422.4	1635.5	997.5
	229.2	538.9	2037.	1133.3

			4	
	36	39	8	9
30	295	323.9	111.3	3713.4
	275.6	379.7	84.1	8808.2
	36	40	8	9

The mean values and standard deviations of soil lead concentration were as follows: 304.9±229.2 at 5 cm, respectively 295±275.6 at 30 cm depth – for the soil with agricultural usage, 422.4±538.9 at 5 cm, respectively 323.9±379.7 at 30 cm - for the soil with grazing usage, 1635.5±2037.4 at 5 cm, respectively 111.3±84.1 at 30 cm – for forest soil, 997.5±1133.3 at 5 cm, respectively 3713.4±8808.2 at 30 cm – for residential soil (Table 2).

DISCUSSIONS

The comparative analysis that used the statistical t test showed higher levels of lead at 30 cm depth in comparison with 5 cm depth, but the difference was not statistically significant (Table 3).

Table no. 3. Comparative analysis of the lead in soil at 5 and 30 cm depth

Depth (cm)	Lead in soil (Mean)	t	P
5	538.18	6.05	0.00
30	622.43	2.13	0.03
Difference between means	-84.24	-.27	*0.78*

Data statistical processing showed that the levels of lead in the soil of the residential areas were significantly higher as compared with the levels of lead in the soil of the lands used for agricultural and grazing activities. (Table 4)

Table no. 4. Comparative analysis of the mean values of the concentrations of lead in soils with different usages

Land use	Lead in soil (mean value)	Difference between the mean values of lead concentrations in soil	P
Residential	2355.4445	residential-agricultural 2055.52	0.001
Agricultural	299.92083		
Grazing	348.23563	residential-grazing 2007.21	0.001

CONCLUSIONS

1. In most of the soil samples (73.2%), lead concentrations were bellow 500 ppm, the maximum allowable concentration to keep the blood lead levels bellow 25 µg/dl, according to the scientific literature.
2. The average levels of lead in soil were higher at 30 cm depth, as compared to 5 cm depth but the difference was not statistically significant.
3. The average concentrations of lead in soil were higher in the residential areas as compared to the concentrations measured in the soil of the lands used for agricultural and grazing purposes.

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