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THE POLLUTION OF THE SOIL WITH HARD METALS

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Abstract

High presence of hard metals in the soil determines the movement in vegetation and in the food chain representing a risk factor for animals and human health. There are efforts at European and national level to limit heavy metal inputs in soils and to avoid enrichment in the food chain. This accumulation in the food chain has important implications for human exposure.

Key words: *pollution, food chain, hard metals, soil*

Introduction

The pollution of environment join the man from his appearance, but in the past the low density of population and the almost exclusive utilization of natural resources, determined small quantities of residues that, by them own nature, were dangerous for men and animals. Demographic explosion from the last decades and development of technique are joining by high quantities of residues that invade and strongly alter natural stage of medium. This demographic explosion increases and diversified the capacity of industrial production that now is considered the most important source of pollution.

Considering the impact on environment after high industrial activity from Baia Mare, begining with 1971 were started firsts actions of atmosphere monitoring who confirmed the existence of some major issues:

- Synergic action of some industries with specific degree of high pollution;
- Geographical position of the town in an depression area, plus meteorological parameters who offer weak conditions for dispersing of polluting substances;

- Un-favourable emplacement near habitable area of big pollution factories.

The pollution of soil with hard metals in Baia Mare depression is the consequence of mining industry and processing of un-iron ores. The principal source of soil pollution with hard metals is S.C. Romplumb S.A. and S.C. Phoenix S.A., because of dust emitted in atmosphere, dust that pollutes the soil and the vegetation. The highest concentrations of hard metals from the soil are near these two, but also near to un-protected mass of sterile. This soil pollution is very complex and influences negative the activity of biocenosis from the soil, the development of plants and physical-chemistry qualities of soil. Washing of atmosphere from hard metals after the rains determines acidity of soil through acid precipitations that are abundant in this area because of pollution with SO_2 and hard metals.

The level of hard metals pollution in soils from industrial area reached an alarming point, the practical works for ecological reconstitution are lasting long time and are very expensive. There are efforts at European and national level to limit heavy metal inputs in soils and to avoid enrichment in the food chain. This accumulation in the food chain has important implications for human exposure.

Experimental

For determination the level of soil pollution with hard metals in Baia Mare depression analyse of soil quality was made. Determination of hard metals from the soil was made by spectrophotometer of atomic absorption using AAS VARIAN 250 PLUS, the specific wavelength absorption of analysed hard metals being: Pb = 283.30 nm; Cd = 228.2 nm; Zn = 213.86 nm; Cu = 324.75 nm.

Gathering soil samples is made in conformity with ISO/CD 10381. From 250 m^2 area gathered cca. 2 kg soil who is homogenized in a medium sample, (from many points of studied depth). Maximum concentrations for sensitive soils are establish by Decision of Ministry of Water, Forestry and Environment 756/1997 (table 1). Analyse of results was done comparative with the Decision of Ministry of Water, Forestry and Environment 756/1997. Analyse of soil quality was done at 2 depths 0 – 10 cm, 20 - 40 cm, on indicators Pb, Cd, Cu, Zn.

Table 1. References values for sensitive soils establish by Decision of Ministry of Water Forestry and Environment 756/1997

Element	UM	References values	PA	PI
Pb	mg/kg	20	50	100
Cd	mg/kg	1	3	5
Cu	mg/kg	20	100	200
Zn	mg/kg	100	300	600

PA – alert threshold; PI – intervention threshold

Results and discussions

The obtained data are shown in tables 2 and 3.

Tabel 2. Minimum and maximum values of some hard metals from sensitive soil, from Baia Mare industrial pollution area

Element	U.M.	Depth			
		0 – 10 cm		20 – 40 cm	
		min.	max.	min.	max.
Pb	mg/kg	44	3266	36	610
Cd	mg/kg	0	19.2	0	7.2
Cu	mg/kg	39	1476	27.8	175
Zn	mg/kg	85.4	923.1	60.4	446.7

Table 3. Overtaking frequencies of references values - alert threshold (PA) and intervention threshold (PI) (%) (dry soil 105°C)

Element	Depth			
	0 – 10 cm		20 – 40 cm	
	PA	PI	PA	PI
Pb	96.8	93.5	94.4	72.2
Cd	90.3	64.5	66.7	16.7
Cu	58.1	38.7	16.7	0
Zn	67.7	41.9	44.4	0

Pb – presents low concentrations (minimum and maximum) 44 mg/kg, respective 3.266 mg/kg, compared to concentrations of references admitted 20 mg/kg, passing this value by 2,2, respective 163,3 at depth of 0 – 10 cm. At depth of 20 - 40 cm, minimum and

maximum concentration of Pb was situated at values between 36 mg/kg and 610 mg/kg, passing references concentrations admitted by 1,8, respective 30,5. Frequency of passing alerts threshold (P.A.) - 50 mg/kg, at depth of 0 - 10 cm was 96.8%, respective 93.5%

Cd - presents concentrations minimum and maximum in soil of 0 mg/kg, respective 19.2 mg/kg, maximum value passing by 19.2 at depth 0 – 10 cm reference concentration admitted by 1 mg/kg. At 20 – 40 cm depth, minimum concentration was 0.0 mg/kg, maximum – 7.2 mg/kg, passing reference concentration admitted by 7.2 times. Frequency of passing alert threshold (P.A.) - 3 mg/kg, at 0 – 10 cm depth was 90.3% compared to 41.9%.

Cu - presents concentrations minimum and maximum in soil - 39 mg/kg respective 1.476 mg/kg, passing reference concentration admitted 200 mg/kg for 1.95 times, respective 73.8 times at 0 – 10 cm depth and 1.39 times, respective 8.75 times, at de 20 – 40 cm. Frequency of passing, at 0 – 10 cm depth, alert threshold (P.A.) at value 300 mg/kg was 58.1%, respective 35.5%. Frequency of passing intervention threshold (P.I.) at value 600 mg/kg was 38.7%. At 20 – 40 cm depth frequency of passing P.A. being 16.7%.

Zn – presents concentrations minimum and maximum in soil – 85.4 mg, respective 923.1 mg/kg, at 0 – 10 cm depth, passing reference concentration admitted 20 mg/kg for 14.27 times, respective 46.15 times, and at 20 – 40 cm concentrations minimum and maximum were 60.4 mg/kg respective, 446.7 mg, passing reference concentration by 3.02 times, respective 22.3 times. At 0 – 10 cm depth, frequency of passing alert threshold (P.A.) of 100 mg/kg was 67.7%, and frequency of passing intervention threshold (P.I.) placed at value 200 mg/kg was 41.9%. At 20 – 40 cm depth, frequency of passing alert threshold (P.A.) was 44.4%, and P.I. was 0%.

From analyse of presented we notice that the bigger part of metals is stored in superior horizon, confirmed by Ou and col. (1995), Reedy and col. (1995), who show that hard metals are canton more in superior horizon of soils. Regarding pollution of soils with hard metals, the danger is the effects on biocoenosis of soils with serious implications on substance circuit (Koller – 2002, Răuță - 1983). As toxic effect on biocoenosis of soil, we notice Pb > Cu > Cd > Zn. (Li and col. – 2002). Another aspect about pollution of soils with hard metals is their movement in vegetation. (Weng and col. – 2001). The presence of Pb

or another hard metals in soil is a risk factor for depth water. It was demonstrate that Pb level on children's is positive correlated with it's concentration in soil. (Alonso and col. – 2001). Great stability of hard metals in and their characters un-biodegradation is another risk factor. (Moffat and col. – 1995)

Conclusions

From dates analyse presented, was reached next conclusions: Concentrations of Pb in soil pass reference value at 0-10 cm by 2.2 – 163.3x, at 20-40 cm depth – 1.8-30.5x and alert and intervention threshold was pass with 90.3-96.8 %/90.3 – 94.4 %. Concentration of Cd is passing reference value at 0-10 cm depth by 0.0 – 19.2x, at 20-40 cm by 0.0 – 7.2x, and alert and intervention threshold was pass with 41.9 – 90,3 %/38.7 – 66.7 %. Concentration of Cu from the soil pass reference value at 0-10 cm depth by 1.95 – 73.8x, at 20-40 cm depth by 1.39 – 8.75x, and alert and intervention threshold was pass with 35.5 – 58.1 %/16.7 – 19.3 %. Concentration of Zn from soil pass reference value at 0-10 cm depth by 14.27 – 46.15x, at 20-40 cm depth by 3.02 – 22.3x, and alert and intervention threshold was pass with 45.2 – 67.7 %/44.4 – 45.2 %.

The major sources of soil pollution are extraction and remaking of un-ferrous materials activities, especially factories SC Romplumb SA and SC Phoenix SA, and also mineral industry and transports from the area. Dust from the air is a cause of soil pollution. The level is higher near the two factories. High presence of hard metals in the soil determines the movement in vegetation and in the food chain representing a risk factor for animals and human health.

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