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Aspects Regarding Pollution with Heavy Metals of Soils from Ploieşti City

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Abstract

In this paper it is proposed lead pollution supervising for soil and vegetation in the most intensely circulated areas from Ploiesti City. An important contribution to the environmental pollution in large urban agglomerations is represented by the road traffic. The burned gases resulted from the vehicles engines, by their compounds content, affect all the environmental factors. As a consequence, there were drawn soil and vegetation samples from the most intensely circulated areas from Ploiesti City, they were mineralized and it was determined the lead content by the spectrophotometric atomic absorption method, on a VARIAN type (AA 240 FS) apparatus.

Keywords: *pollution, traffic,lead, vehicles*

Introduction

An atmosphere lead pollution source is represented by motor vehicles, due to gasoline burning. Almost all gasolines for motor vehicles contain alkylic compounds of lead which enhance the antidetonant qualities of the fuel. Lead alkylic compounds are transformed into lead halides or oxohalides after the internal combustion process from the engine and 70%-80% from this lead is emitted as particles by the exhaust pipe.

The age and condition of motor vehicles and the cars type and the repression system determine the particles size and the quantity of lead emitted in the atmosphere.

Lead - in metallic form and as oxide - is eliminated in the environmental in the same time with the exhaust gases. Depending on the fluido-dynamic conditions of the atmosphere from the area where it is dispersed, lead compounds reach the soil level almost or at a larger distance from the roadway.

In time, these compounds can be taken over the rainwater to a waterway or they enter the soil where they can reach the local vegetation. This circuit can be continued with the possibility of reaching by a trophic chain, even the human food. Lead is accumulated in the human body because its elimination is very difficult. The exposure of the human body for a long time to high lead contents could generate the saturnism disease. Intoxication with lead or its compounds comes from foods, air, water or from different industrial processes. Lead is absorbed by the gastrointestinal and respiratory apparatus. The inhaled or absorbed lead is not retained totally in the body. The studies shows that only 10% from ingerated lead is retained on the gastrointestinal tract and 25-50% from the inhaled lead is retained and absorbed by the respiratory apparatus, in function of dimension, form and particles density. The medium quantity of lead which is absorbed by the urbans inhabitants is about 30 μg gastrointestinal lead dayily and under 20 μg lead- by the respiratory system.

The most important action of lead consists in the perturbation of iron settlement in the porphirine skeleton, which generates a severe anaemia. The excess of formed porphirines is eliminated by urine as coprioporhirine.

The intoxication with lead is characterized by abdominal pains, head aches, lose of appetite, anaemia, tiredness. Lead produces also perturbations in the system of blood formation by altering the hemoglobin synthesis. Kidneys functioning is also disturbed by lead intoxications.

Even at present Romania is to adopt the European legislation from the domain of carburants which forbide the lead gasoline using, nowadays in our country it is used sometimes the gasoline with tetraethyl lead. Considering the cumulative effect of pollution in the former years, knowing the lead pollution degree of soil in the intensely circulated areas is a necessary condition to set the optimal circulation roadways, such that to achieve an integrated transport system, based on the concept of long term transport.[1-3]

Experimental details

To study the pollution degree of soils and vegetation from the most circulated areas in Ploiesti City, there were drawn samples of soils, chestnut leaves and grass from zones where the traffic is very intense, but which differs in function of motor vehicles:

Soil samples:

Sample 1 – from the North side of Ploieşti City (Viişoara Cemetery);

Sample 2 – from the gyratory sense METRO;

Sample 3 – from the West Roadway, Mărăşeşti Street;

Sample 4 – from the South side of Ploiesti (Independence Avenue);

Sample 5 – from the gyratory sense St. John Cathedral.

Vegetation samples

1a. - chestnut-tree leaves
1b. - lime- tree leaves
1c. - grass
} from the North side of Ploieşti City (Viişoara Cemetery)

2a - grass– from the gyratory sense METRO;

3a - grass – from the West Highway, Mărăşeşti Street;

4a - grass
4b - chestnut-tree leaves
} from the South side of Ploiesti (Independence Avenue);

5a - grass
5b. chestnut-tree leaves
} from the gyratory sense St. John Cathedral.

In the areas which are exposed to lead pollution, this pollutant was found at the soil surface until a depth of 6 cm. Lead from soil can be determined by 2 methods:

1.The colorimetric method for the determination of lead from soil;

2.Flame photometry atomic absorption method.

The experimental determinations were made by the spectrophotometric flame photometry atomic absorption method, on a VARIAN type apparatus. The method principle is based on the measurement by atomic absorption spectrophotometry of Pb concentration, from solutions obtained after samples mineralization in royal water prepared considering the present norms.[4].

The absorbances for standard samples and for soil and vegetation samples were determined at a wavelength of 217,0 nm, in a current of air- acetylene.

Results and discussions

For soils mineralized samples and for vegetation samples brought up to a volume of 100 cm^3 in marked flasks, there were determined absorbances at the atomic absorption spectrophotometer in the same conditions as for the standard curve at λ = 217 nm. From the standard curve there were extracted concentratios expressed as mg Pb/l for each sample and then, considering the sample quantity taken into account and the dilution, it was calculated the concentration as mg/kg of dried soil or mg/kg of dried vegetation. The expressed data and those calculated are presented in table 1.

Table 1. Experimental data for Pb determination in soils samples

No.	Sample no.	Measured absorbance	Conc. mg/l	mg Pb/kg soil (dried vegetation)
1.	Standard	-0,0005	-	-
2.	1 soil	0,0421	0,982	32,73
3.	2 soil	0,0169	0,394	13,13
4.	3 soil	0,0385	0,897	29,9
5.	4 soil	0,1637	3,790	126,33
6.	5 soil	0,0849	1,974	65,8
7.	1a	0,0018	0,042	1,4
8.	1b	0,0101	0,236	7,86
9.	1c	0,0028	0,066	2,2
10.	2a	0,0088	0,206	6,87
11.	3a	0,0053	0,123	4,1
12.	4a	0,0182	0,426	14,2
13.	4b	0,0018	0,041	1,37
14.	5a	0,0084	0,196	7,84
15.	5b	0,0009	0,022	0,73

In table 1 it is presented Pb content for soil and vegetation samples. It must be mentioned that the maximum admitted concentration (CMA) for a normal soil is 20 mg/ kg of dried soil, considering the present norms [4], but for vegetation there are not indicated the maximum admitted concentration. Correlation of Pb content from soil samples, chestnut-tree leaves and grass, taken from the five points are graphically illustrated in figures 1-4.

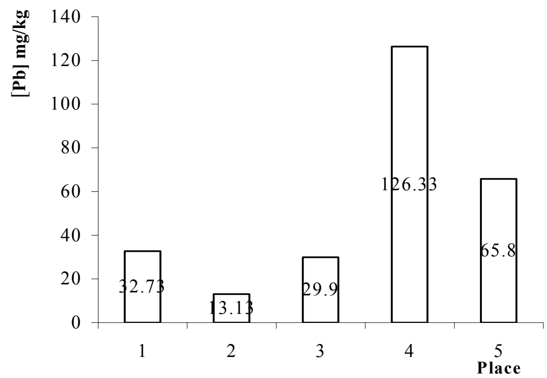

Fig1. Pb content for soil samples

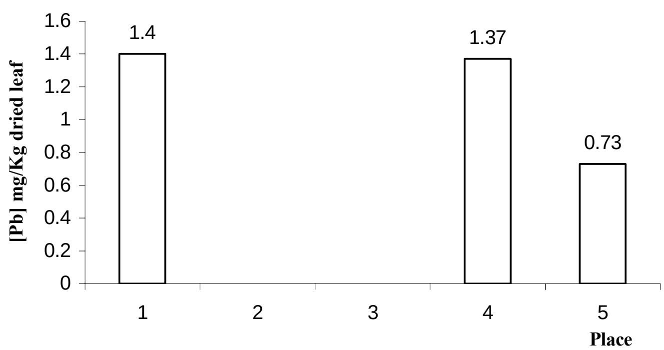

Fig.2. Pb content for chestnut-tree leaves from places of sampling

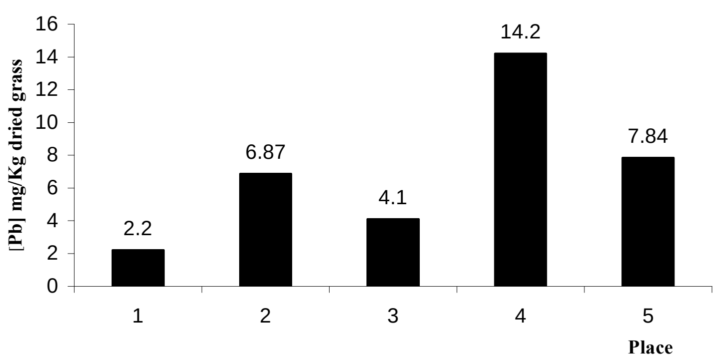

Fig.3. Pb content for grass samples from points of sampling

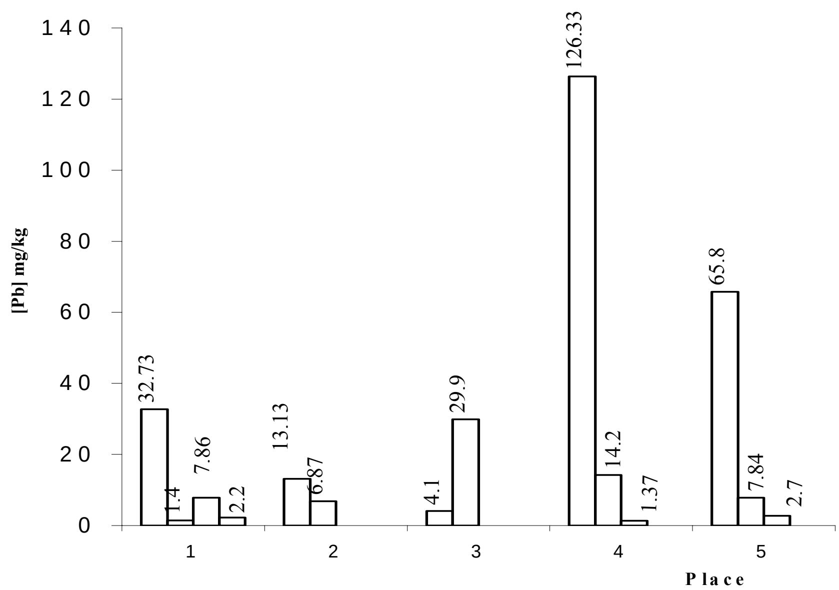

Fig. 4. Pb content for soil, chestnut-tree leaves and grass

In figure 1, it is represented the variation of Pb concentration from the drawn soil samples. It is observed the fact that in the point of sampling 4 (The Independence Avenue), it is reached the maximum concentration of Pb. At the sampling point no. 5 (St. John Cathedral), Pb concentration deacreases at half, followed by the point no.1 (Viisoara Cemetery). The smallest value is registered at point no. 2 (Metro).

It must be mentioned that sample no.1 was chosen as reference sample, being protected by the motor vehicles traffic. Although, the value of 32,73 mgPb/Kg of dried soil demonstrates that Pb is a pollutant which accumulates in soil and vegetation, exceeding the corresponding value for a normal soil (being a very old location). The same thing is demonstrated by the sampling point no. 2 (Metro), the giratory sense which functiones for about 3 years.

Pb content of sampled chestnut-tree leaves are presented in figure 2, where it can be observed that these leaves from the sampling points 1 and 4 have large values.

From figure 2 it may be observed that there exist a correlation between the taken samples of grass and Pb content from chestnut-tree leaves, so it must be accorded attention also to chestnut-trees age. It must be mentioned that in points 2 and 3 there are not chestnut-trees.

In figure 3 it is represented the variation of Pb concentration in grass samples from which it can be observed that the highest Pb content is found in the place of sampling no.4 and at sampling point no.1 Pb content for grass is the smallest (2,2 mg Pb/Kg of dried grass), because of the fact that grass is freshening yearly.

In figure 4 there are comparatively presented Pb contents of soils, chestnut-tree leaves and grass samples and it can be observed a direct correllation between Pb content for soil and vegetation; the smallest Pb content was observed for chestnut-tree leaves (between 1.4-2.7 mg/kg), then for grass (between 2.2-7.84 mg/kg) and the highest value was observed for soil (between 13.13-126.33 mg/kg). Pb content from vegetation represents about 10% from Pb concentration in soil.

Conclusions

By lead concentration supervising- for soil and vegetation- from the most circulated areas (motor vehicles and heavy transport), there are highlighted the following aspects:

● The most polluted area is the Southern Railway Station where there is registered an intense circulation of motor vehicles to Bucharest and to the city center.

● The center zone of the city, by the drawn samples from the St. John Cathedral Giratory Sense, indicates an important pollution.

● Although the sampling place no.1 (Viisoara Cemetery) is situated at a distance between 300 ÷ 400 m from the North Roadway, the determined Pb content is high.

● Zone 2 (Metro) is less polluted with Pb.

● The presented results in this paper represents a strong argument for the elimination of gasoline which contains tetraethyl-lead additives for vehicles engines.

● It is recommended for the high density inhabited zones to limit motor vehicles circulation which use gasoline with tetraehtyl-lead, because it is known that Pb is a pollutant which accumulates and it is harmful for human health.

References

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4. **** ISO 11466, *Mineralizarea probelor de sol cu apă regala*

Aspecte privind poluarea cu metale grele a solulurilor din Municipiul Ploieşti

Rezumat

În acestă lucrare ne-am propus o monitorizare în ce priveşte poluarea cu plumb a solului şi a vegetaţiei în zonele cele mai circulate din Municipiul Ploieşti. O contribuţie importantă la poluarea mediului înconjurător în zona marilor aglomerări urbane o are traficul rutier. Gazele de ardere rezultate de la motoarele autovehiculelor, prin compuşii conţinuţi, afectează toţi factorii mediului înconjurător. Ca urmare, au fost prelevate probe de sol şi de vegetaţie din zonele cele mai circulate cu autovehicule rutiere din orasul Poieşti, au fost uscate, mineralizate şi s-a determinat conţinutul de plumb prin metoda spectrofotometrică de absorbţie atomica, pe un aparat tip VARIAN (AA 240 FS).