

DYNAMICS OF GEOCHEMICAL POLLUTION OF TIRASPOL URBAN ENVIRONMENT

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ABSTRACT. The problem of geographic landscapes has as basis the papers of the O.U.N. World Conference from Rio de Janeiro (1992) on Environment and Sustainable Development, but also the European Landscape Convention (Florence, 2000). The agreements reached at these events are applied across signatory countries in Europe and include natural, rural, urban and disturbed spaces, the main objective being the protection, management and planning of the degraded landscapes.

In this paper there are presented some results of study of some chemical elements of anthropic origin spreading in soils of Tiraspol city. The city was and still remains one of the most industrialized cities of the Republic of Moldova. The industrial infrastructure leads to chemical pollution and appearance of sectors with increased content of heavy metals. Within city limits 8 anomalous centers were recorded with increased content of Co, on 65% of the surface the anomalies with increased Cu content are registered. Along the roads with intense vehicle traffic the Pb content overpasses the republic background. One of the most pollutant elements was and still is Zn, with the content between 600-8500mg/kg. The most polluted are the surfaces within the perimeter of industrial and transport enterprises. In the paper there are presented the results of current researches on geochemical pollution and quantitative dynamics from the last decades.

Key words: *landscape, urban environment, soil, pollution, heavy metal.*

INTRODUCTION

The superior layer of lithosphere is the first component and support of the environment. Among other spheres of the geographical cover, lithosphere has the ability to accumulate and keep substances which are improper to it and which come from the social – economical activity.

In this paper, as an object of study serves the soil cover from the limits of Tiraspol city and its surroundings. All along the centuries the chemical composition of superficial layer of the lithosphere has suffered essential changes under the anthropic influence. In connection with the technogen pollution of the environment, the industrial cities often become objectives of ecological assessment. The establishment of the links between the enumerated aspects is possible only through the chemical composition

analysis of the sediments of substances coming from the social-economical activity from the city limits and from other regions (powder, emanations of polluting substances in gaseous and fluid state). Through the geochemical analysis there are found out the anomalous accumulations of the polluting substances.

The collection regions of the proofs were established corresponding to more standard requirements: plane surface without any inclination, rough and covered with spontaneous or multiannual cultural vegetation. The measurements were effectuated at "Spectroscan" apparatus. The purposes of the study were the following:

- 1) Determination of the spectrum of pollutant chemical elements of anthropic origin;
- 2) Emphasizing the regions with anomalies of accumulation of the polluting substances.

The acquired results pointed out the increased presence in the layer of earth of the chemical elements of anthropic origin in more regions of the city. The quantitative values of Zn, Pb, Cu, Ni, Cr, As vary in big diapasons. The content of these elements in the soil is directly correlated with their content from the palanquin, the bark of the trees and less it is accumulated in leaves.

METHODS AND MATERIALS

In the study of the heavy metals spreading in the environment are used different methods and materials. In this paper there are presented the acquired results through utilization of the spectral method with roentgen fluorescent rays for determining heavy metals in the soil proofs. The used methods are: the application of the method of proofs preparation in solid phase; the improvement of the parameters belonging to measurements; the utilization of the reference standards; the processing of the data obtained through measurement.

The soil proofs were collected from different regions of Tiraspol city corresponding to the work plan, which stipulated the covering of the whole urban surface. The proofs were collected from the superior layer of the pedological structure till the depth of 20 cm. For determining the polluting ingredients the proof is installed in the mounted room of the device and it is radiated with roentgen rays. In the result of the interaction of roentgen radiation with the substance which contains heavy metals, in proofs it is stimulated the secondary fluorescent radiation in which spectrum there are lines of elements of heavy metals. The registration of the spectrum and making a fresh computation of the concentration compared to that of standard lines is made in the electronic modulus of the connected device at computer. The measurements were effectuated with the help of "SPECTROSCAN MAKs" apparatus, produced by «НПО Спектрон» company from Sanct-Peterburg.

The basic priorities of this method of heavy metals determination compared to the spectrophotometric method of atomic absorption (Hovind, 2000; Москва-1992) are the following:

- Rapid possibility to acquire data concerning the heavy metals content in soil;
- Avoidance of the utilization of chemical reagents.

At the determination of the heavy metals concentration in the soil proofs, the errors are on the level of 10 – 20%. The acquired preliminary data shows us the efficiency of this method for determining the heavy metals in the components of the environment.

RESULTS AND DISCUSSIONS

Initially, investigations on accumulations of heavy metals, accumulated in the superficial layers of the soil in Tiraspol city, were effectuated on the territory of two industrial enterprises at the end of the last century. In the both cases there were found out regions where their concentration overran hundreds times the admissible maxim.

According to the data of the Geochemical and Technogenesis laboratory, in the limits of the city there were registered 8 centers with anomalous accumulations of Co with bigger concentration of 220 mg/kg in the industrial zone, but in the locative sectors from neighbourhood - 110 – 120 mg/kg. A very spread pollutant is Cu (65% from the surface of the city), which in the anomalous centers passes 20 times AMC (admissible maxim concentration). In the urban soil, the concentration of Zn remains to be high till nowadays, which in the period of the initial investigation had a sporadic spreading and its quantity was between 600-800 mg/kg. A spread element remains to be Cr, which was registered in 12 anomalies with outrunning of the AMC of 4-80 times.

In the last decades the industrial activity was reduced considerably, but the content of some microelements accumulated in the soil layer of the city is still high. In the table 1 there are presented the results of the latest investigations, effectuated in the limits of Tiraspol city, where there are emphasized cases of high content of heavy metals – Pb (20 AMC), Zn (4.5 AMC), As (2.6 AMC) and Cr. In tables 2 and 3 there are presented data about cancer malady and morbidity dynamics in Transnistria Administrative Unit, which in a big measure reflects the ecological situation in Tiraspol city, too (2/3 from the TAU is concentrated in Tiraspol city).

Table 1. *The results of the spectral analysis of the soil proofs in Tiraspol city (2009), mg/kg*

Nr.	Address	Heavy metals						
		Pb CMA-30	Zn CMA-100	Cu CMA-55	Ni CMA-85	Cr CMA-100	Co CMA-50	As CMA-2
1.	West District	<CMA	62.41	4.485	30.84	74.15	18.31	0.514
2.	Frunze str.	<CMA	63.03	10.05	28.02	76.64	28.81	6.553
3.	Mecinicov str.	<CMA	84.68	45.83	35.43	88.70	20.06	3.181
4.	Tsetkin str.	<CMA	83.19	13.62	31.63	86.01	18.69	13.31
5.	North District	611.5	98.46	42.18	29.14	79.51	39.12	52.02
6.	East District	<CMA	79.99	14.30	35.55	92.02	16.67	9.888
7.	South District	1.35	76.89	10.88	29.18	104.50	19.29	10.17
8.	Center District	57.37	456	21.04	33.80	78.88	25.43	18.67

ENVIRONMENT AND HUMAN HEALTH

Since 2006 Transnistria Territorial Administrative Unit is within "Monitoring socio-hygienic" program, which was imposed by the worsening health status. The concept of monitoring organization corresponds to the recommendations of European Office of World Health Organization "Health 21 - health for all". So far in the Republic of Moldova and Transnistria TAU cancer morbidity remains high. In the Republic of Moldova there are about 40 000 cancer patients and their number increases annually by 7 to 7.5 thousand cases of disease. Only 58.6% of patients receive full medical assistance.

The number of cancer patients in Transnistria TAU is 6 per 1,000 inhabitants. Systematic investigations in recent years show that cancer morbidity increases continuously.

Table 2. *Dynamics of cancer pathologies increasing in Transnistria TAU in the last years*

	2000		2001		2002	
	Total number	Number per 100 thousand inhabitants	Total number	Number per 100 thousand inhabitants	Total number	Number per 100 thousand inhabitants
Morbidity	1441	221.1	1533	238.6	1553	245.1
Patients	7571	1161.6	7789	1212.3	7937	1252.7

An important indicator for assessing the processes of morbidity and cancer pathology status in the region is the index of mortality provoked by cancer tumors. The data shows a high level of mortality, and tend to increase (tab. 3) (Gutu and Bradic, 2007; Mereuta et al., 1999; Gutsuleac, 2007).

Table 3. *Comparative assessment of cancer mortality in Transnistria TAU in the last years*

	Number of deaths per 1000 inhabitants							
	1995	1996	1997	1998	1999	2000	2001	2002
Total number of deaths	11.8	11.9	12.2	11.6	11.4	11.8	12.0	12.7
Deaths from cancer	1.6	1.5	1.5	1.5	1.6	1.6	1.8	1.9

Late twentieth and early twenty-first century for Transnistria TAU is a period accompanied by unfavorable political and social events for stabilization and development of environmental conditions. At present in the region is reducing the number of inhabitants. The data presented in this paper shows the high degree of environmental pollution with heavy metals and radionuclides. On their background it can be observed a high frequency of cancer morbidity and cases of death.

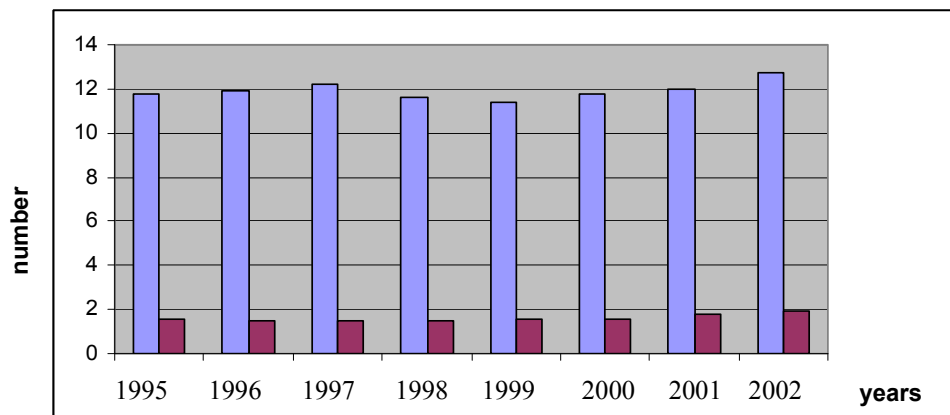


Fig. 1. Comparative assessment of cancer mortality in Transnistria TAU in the last years

A decisive factor in creation of current ecological situation in cities of Tirspol, Tighina and Ribnita represent the transport sources. In the past 2 years the rate of emissions of harmful substances from automobile units made up 63% in Tiraspol and 78% in Tighina cities. The most spread substances with harmful properties, reaching the atmosphere of Transnistrian region are carbon oxides, lead compounds, slate powder, mercury and other metals. Environmental pollution has negative effect on the inhabitants' health state, especially upon the children. In the investigated region in the last 5 years, the birth rate decreased by 30% and the mortality increased by 15%. Only 23% of children remain healthy to the age of 7 years old.

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