

## Materials of Conferences

**A CITY OF STAVROPOL'S  
BIOGEOCHEMICAL INDICATION OF THE  
ECOLOGICAL STATE**

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The urban regions and its areas are being experienced the various influence level of the anthropogenic flows of matter, depending on their functional and proper purposes, and per consequent, they have the different scales of the environmental pollution, in comparison with the natural pollution and the background contamination. The biogeochemical indication is one of the most reliable methods of the cities' and towns' ecological state evaluation. The plants (as the accumulating and depositing objects) by their chemical composition are sufficient precisely being indicated the prolonged pollution and contamination, and they are being permitted to consider the main tendencies of the cities' and towns' ecological changes.

The plants' geochemical sampling (e.g. more, than 50 tests) for the purpose of the levels setting of the heavy metals (HM) content in the vegetable cover has been conducted on the territory of the functional zones in the city of Stavropol. The vegetable cultures' selection has been carried out at the private plots of a land, attached to the houses. The representatives of the various life forms and biological spectra have been studied among the plants. So, the plants' tests have been analyzed by the atomic – absorptive method. The similar plants' species on the territory of the "Tatarskoe Gorodishche" (e.g. the Tatar site of the ancient

settlement and a very large city with its ruins) culture preserve have been taken, as the background urban standards.

The studied vegetable patterns (e.g. foliage, branches of the wood and shrub species (or in one word decidulignosa), and the hay crops of the lawn's cereals) have shown the level rise of the HM concentration in them. Zinc and lead have the highest levels of the contents, in comparison with the background. The final results analysis of the plants' chemical composition is being carried out by us by the functional zones, taking into consideration the environmental conditions homogeneity and the anthropogenic loadings uniformity.

The industrial zone plants are usually characterized by the biggest levels of the HM concentration (see Table No.1). Zinc is being achieved its the maximum concentrations (e.g. 86,7 mg/kg), the following values are being registered for the other metals: lead – 33,2 mg/kg, cadmium – 0,8 mg/kg, copper – 83,8 mg/kg. The given values are being exceeded more, than in 2 – 10 times the background levels, which are typical for all these plants, having grown at the considerable distance from the industrial waste sources.

In the residential zone, it has been registered the zinc and lead content rise in the lawn's cereals and the wood species (see Table No.2). Copper has the reduced values in the herbage along the streets of the city's central part. It is characteristic, that copper is being accumulated by the plantain (e.g. 12,1 mg/kg). The cadmium concentration in the plants of the residential zone is being varied in the range of 0,19 – 0,3 mg/kg.

**Table 1.** The Microelements Content in the Herbaceous Plants of the Various Functional Zones in the City's of Stavropol, mg/kg oven – dry matters

Plants Species	Functional zone	cadmium	copper	zinc	lead
couch – grass	background	0,17	4,0	14,6	1,1
	woodland park	0,16	4,3	27,9	1,2
	residential	0,19	3,0	19,4	1,5
	historical centre	0,19	3,3	23,1	2,9
	industrial	0,29	4,5	22,1	3,1
plantain	residential	0,3	12,1	23,8	3,8
	industrial	0,9	10,5	22,3	3,6
milfoil	residential	0,3	6,4	22,3	2,9
	industrial	0,4	5,8	24,2	4,5
moss	background	0,4	8,2	23,1	1,8
	woodland park	1,5	8,5	46,6	12,6
	residential	0,3	7,3	34,3	30,7
	historical centre	0,4	8,3	40,6	15,3
	industrial	0,8	83,8	86,7	33,2

**Table 2.** The Background and Maximum Heavy Metals Content in the Lignosa and Shrub Vegetation in the City's of Stavropol, mg/kg oven – dry matters

element	background	oak	maple	pear	hawthorn	elder
cadmium	0,2	0,18	0,25	0,16	0,37	0,35
copper	3,9	6,0	8,8	4,6	6,1	5,8
zinc	20,4	76,4	23,1	10,6	19,0	30,7
lead	2,3	3,1	3,1	2,4	1,4	1,2

The city of Stavropol historical centre by the contamination level by cadmium (e.g. 0,4 mg/kg), copper (e.g. 8,2 mg/kg), and zinc (e.g. 40,6 mg/kg) is quite comparable with these metals content in the residential zone. However, the large transport loading of the city's central part is resulting in the considerable accumulation of lead in the lawn's cereals (e.g. in 2 times higher, than the background), and in the mosses (e.g. in 7 times higher, than the background). Not high accumulation level of lead, copper, cadmium is quite typical for the plants of the woodland park (see Table No.1), and the zinc concentrations, – in average, 30 mg/kg, – are being observed rather high, in comparison with the background in the parks and public gardens plants.

The HM content is strongly being varied, depending from the plant's species. The heavy metals (HM) increased levels are usually observed at the mosses and plantain that is said on the definite species biochemical specialization of the plants. The HM accumulation is quite typical for the maple and oak from the arboreal species. The microelements content levels in the plants, to a large extent on, are being assigned of their belonging to the various functional zones. The highest metals content has been determined along the large superhighways, and traffic interchanges of the industrial zones.

By data of N.C. Kasimov (1995), there is the enough steady connection between the elements – pollutants accumulation and the functional zones. For all this, the anthropogenic pollutants' delivery is playing the largest role in the vegetable cultures contamination. The city of Stavropol data fully confirm this conformity to the natural laws. The highest values of the HM concentrations in the vegetables are being observed in the residential region of the Tashly river's valley. Here, the growing vegetables have their MPC maximum established exceedings (by cadmium – in 4 times, by zinc – in 1,5 times, by lead – in 5 times). The trans – eluvial, super – aqueous, and aqueous landscapes, having the subordinated and accumulating values, have been developed on this territory. For all this, the anthropogenic pollutants' delivery is being carried out by the prevailing western winds from the western industrial zone (Prokuronov et al., 1992).

The prolonged influence of the numerous household pollution sources in the old (central) residential city's part has been resulted in to the considerable zinc content in the vegetables. The average mi-

croelements content in the vegetable cultures of the suburban plots, having situated directly within the precincts of the city, are not being exceeded MPC. On the background garden and vegetable plots, having situated in 50 km off the city (e.g. the Izobilnensky region), the growing vegetables are being contained in 2 times less cadmium, and lead, in 3 times less copper, and zinc, in comparison with the most contaminated vegetable crops in the city of Stavropol.

In the total of the received results, it is quite possible to make the following conclusions:

1. The city of Stavropol is being experienced rather considerable anthropogenic impact, that has been resulted to the total pollution level rise of the urban environment by the various enterprises' wastes, and the motor transport's emissions etc.

2. The industrial zones' vegetable cover, the city's historical centre are the most contaminated by the heavy metals (HM).

#### References

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#### PUPILS' KEY SKILLS FOR SURVIVAL IN A MEGA POLIS

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In successful solving of often unpredictable, current and future environmental problems of a megapolis, human key competencies play a decisive role. Development of these skills stays on national curriculum in many European countries. In Russia, a new federal educational standard is being prepared, which would also target an active approach. Its basics were developed by Russian teachers and psychologists: L. Vygotsky, S. Rubinstein, V. Davydov et al. However,