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PROBLEM OF POLLUTION OF SOILS HEAVY METALS

An important environmental issue today is the accumulation of toxic their metals in soils. On the basis of analyzed literary sources shown to be the most polluted territory of our state is the urbanized square of the central and the south-eastern regions. Among metal-pollutants of the soil are the most wide-spread and toxic nets, zinc, copper, cadmium, nickel and aluminum. Mobility and bioavailability heavy metals and aluminum is directly proportional to the acidity of the soil. Taking into account the potential hazard of toxic metals for living organisms The urgent task of scientists is to assess the biological risk these substances. The article analyzes the accumulation of lead compounds (Pb) and nickel (Ni) soil fields adjacent to the highway Kyiv-Odessa, on different distances from the source of pollution.

**lead compounds (Pb), nickel (Ni) compounds, toxicity, acetic layer,
concentration**

Scientific and technological progress, especially during the last has provided significant progress in all spheres of human life society — levels of machine building, transport, telecommunication systems, nicacies, organic synthesis, science, education, agrarian production, knowledge of nature and the exploration of space. Under the pressure of science and technology night progress and human activity, nature gradually retreats. In the global context, such changes are manifested in different directions.

The area of deserts on the planet is growing by 5—7 million hectares a year. Reduced the area of forests is 6 to 20 million hectares per year. Daily forever disappears more than three types of higher plants [15].

In our country, the situation is no less worrying. If two centuries that is why almost half of the country's area covered the forests, then today they

are left with shrubs and windbreaks only 16.6% [10]. Of these, adult forests are less than 4.0%. However, the forest actively continue to cut off and export in the form of raw materials.

For the needs of industry, transport and communal every year in Ukraine, loss of arable land is made up of donations 5—6 thousand hectares [10]. As a result of the predatory attitude to nature and to agricultural land is the area of eroded arable land in ours the country is constantly growing by 80 thousand hectares a year [7].

As a result of active human activity is intense silting and drying of rivers, especially small, active contamination fresh water in rivers and reservoirs, groundwater to the depths of 50 m and deep water industrial and municipal wastewater, mineral fertilizers and pesticides, significant and permanent man-made pollution of the environment: air, soil, water substances — pollutants [2].

Among the many varieties of pollution factors are specialattention deserves heavy metals. To heavy metals include more four dozen chemical elements that have an atomic mass more than 50 atomic units. According to N. Reuters's classification of heavy metals it is expedient to consider metals with a density of more than 8 g / cm^3 [11].

The notion of heavy metals is quite arbitrary, since the same hi quantitative elements in small quantities are very essential for biologicsystems are substances because they are components of active groups proteins — enzymes that provide normal biochemical processes metabolism at the level of cells, tissues and whole organisms [5]. By in the environment they are purposefully introduced in the form of microfertilizers.

Large quantities of relevant chemical elements: lead (Pb), Cobald (Co), Nickel (Ni), Chromium (Cr), and others that are able to exhibit negative influence the beneficial effect on all biological structures: from bacteria, algae to higher plants, animals and humans [13].

Sources of the arrival of heavy elements and their compounds into the arable layer the soil may be different: water extraction from rocks and metalime ores, as a result of mineralization of organic residues plants and animals, the transition to a soluble form of insoluble soil compounds, this is due to changes in the level of acidity (pH) of soil absorption complex, contamination as a result of human activity: industrial enterprises, motor transport, municipal wastewater, agricultural production, etc. [8].

Given the real threat to human health and normal functioning, the Ministry of Health and the Ministry Nature Conservation and Bioresources of Ukraine approved the indicators of the MAC the presence of each of the heavy metals in the air, water and products Nutrition, excess of which is inadmissible [9].

At the same time, the cultivation of food, feed and technical crops can not be carried out only on the arable land that is located at a great dis-

tance from industrial facilities, roads, settlements. Accordingly, the issues of translocation of matter-pollutants on arable land and their accumulation in the territories adjacent to such sources dirt, constantly getting worse. No less important is the question clearing of arable land from the presence of heavy metals for the on such areas of environmentally safe agricultural products. Ago the issues that were the target of the research carried out in 2016—2017 are relevant.

Methods and conditions of research. The studies were conducted on arachnidland in the Vasytkivsky district of the Kyiv region, which directly lie down to the Kiev-Odessa highway. Soils of the fields where the selection was made soil samples for analysis, dark gray podzolized, medium slurry forging on a carbonate forest, typical for the northern part of the forest-steppe of Ukraine.

Accounting areas of 25 m² in a 4-time repeat place shafts at a distance from the canvas of the highway: 5 m, 10 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1280 m. Soil samples were taken from an arable layer (0—30 cm) in five points on the sites of each repeat nya after a thorough mixing, a medium sample of soy 2 kg analysis of the content in the soil of heavy metals was conducted at the Institute Physiology and Genetics of the National Academy of Sciences of Ukraine. Elemental composition in the research The samples were determined by the method of the IRS-MS on an emission mass spectrometer Agilent 7700. The samples were dried to dry weight and insulated in nitrogen acid (osc) using Milestone microwave sampling Start D. The extract was adjusted to 50 ml with 1 st grade water (18 MOM) prepared on the Scholar-UV Nex water treatment system up 1000 (Human Corporation, Korea).

Results of experiments were processed statistically, according to the standard these methods [1, 12], using the program Exel and with the mathematical data processing using a professional software package for Statistical analysis of Statistica 8.0.

Discussion of research results. The road is spea source of environmental pollution. Regular transport moving along the roadway, as a result of engine operation internally It combusts combustion products into the surface layer of air fuel. Air streams from combustible materials from roads are worn on the square and gradually settled on the surface of the soil and linen in the form of dust, gases. In products of combustion of fuel and technological the additive that is present in it, into the surface layer of the atmosphere various compounds of heavy metals (VM) come in, first of all in the form tetraethyl lead (TET) deposited on the arable land area.

Due to exhaust gas and air polluted by the inhabitants and field workers at a short distance from the automotive masterslei inhale up to 90 µg per day of lead compounds (Pb), including in form of TES (tetraethyl lead — (C₂H₅)₄Pb). Lead comes in (Pb) and its compounds in the human body

and with water and products, them in the adjacent territories to intensive roads motor vehicle movement. The amount of such revenues may reach 250–300 μg / day [4].

Lead compounds (Pb), especially TES, are readily soluble in organic solvents, fats and lipids, where they can accumulate. Tetraethyl lead is very poisonous and belongs to 1 class of dangerous substances, is a carcinogen.

As a result of research and analysis, it has been proved that the content lead compounds in soil samples, depending on the distance to the road, were unequal.

The highest concentration of lead compounds (11.402 mg / kg) was It is fixed just 5 m from the road cloth (table).

1. Level of contamination of arable land with heavy metals (μg / kg of soil) from the Kyiv-Odessa motorway in 2016–2017

BM	Location of sampling of soil from road cloth, meters								
	5	10	20	40	80	160	320	640	1280
Pb	11,402	7,864	8,205	7,721	7,355	7,374	7,539	7,221	6,845
Ni	11702	10,568	10,922	10,765	10,125	9,954	9,950	10,237	9,473

In soil samples taken at a distance twice as high as the the original version (10 m), the concentration of lead compounds was less — up to 7.864 mg / kg, that is, 68.9% of the previous one. The most dusty particles of combustion products of automotive fuel containing lead boulder, stands directly next to the road cloth. Less than the size of the solid particles and gaseous substances entering into wind currents as a result of the operation of internal combustion engines, show a high level of sailing. Such particles are very light and powerful the gravity manifests the influence on the trajectory of their motion very weakly. Convection the air flows are able to move them over long distances.

Analyzes of the following soil samples from the arable layer, which were selected at a distance from the road consecutively at 40 m, 80 m, 160 m, 320 m and 640 m, were found the concentration of lead compounds in the range of 7.721–7.221 mg / kg. That is on such distances from the source of contamination of the deposition of lead compounds, primarily in the form of small dust particles, from air currents occurs relatively evenly. Only at a distance of 1280 m from the canvas highways value of accumulation of lead compounds in soil samples on arable land showed a tendency to decrease. In an arable layer, the essence of such compounds was 6.845 mg / kg or 60% of the maximum indicators in the experiments.

The presence of lead compounds in the arable layer of soil is not regulated by official indicators of the MAC, because the availability of such the dirt of arable land is not necessarily manifested in plants that on it

vegetate. The presence of lead compounds in the form of sulfites, sulphates and carbonates, which is traditionally high in terms of performance the pH level of the soil aqueous solution is insoluble the state poses only a potential threat to plants, animals and humans. However, on acid soils (soil pH is less 5,5), lead compounds are capable of passing into a soluble state (real solutions or colloids) and through the soil absorption complex over go to plants and engage in cycles of the cycle. Especially the dangerous compound is tetraethyl lead (C_2H_5)₄Pb. That's it lead compounds in the first place are a source of pollution of the territories arable land adjacent to highways.

Tetraethyl lead has a high toxicity and good acumucous in the human body: in bone tissues, liver cells and kidney even under intense treatment, withdrawal of the compound lead from the human body is very slow. MAC for tetraethyl lead in water, air and food for a person — it is full of the essence, ie the presence of TET in water, air and food is not allowed.

The second important element that was the object of research in the soil on the arable land near the freeway was nickel (Ni) and its compounds.

In nature, the compounds of nickel are traditionally present in the form of iron nickel or sulfide-copper-nickel ores. In soils, nickel (Ni) may be present together with the common substances-hydroxides Iron (Fe), together with calcium carbonates (Ca), in deposits of clay and glynasal particles, in organic matter of plants and animals and their remains. In the solution of the soil absorption complex, a nickel compound capable of being dissolved in the form of colloids in complexes with humic fulvic acids and amino acids. It is these substances available for the inclusion of nickel in the cycle of cycles [14].

At the same time, nickel compounds are present in the soil and in the form of insoluble compounds: carbonates, cyanides, sulfides, hydroxides. Nickel dependent from the pH level of the medium is able to manifest itself at different levels of lency. Traditionally, in neutral or acidic medium, atoms Nickel has a level of valency II, but in an alkaline environment Nickel compounds traditionally have valency III.

Significant presence of nickel compounds in the arable layer is potential a threat to biological systems and human beings including. Real the storm depends essentially on the level of presence of such substances in the solution soil absorption complex, because only in the dissolved state Nickel compounds are able to penetrate through the biological membranes of the root hairs in plants and other organisms. Most nickel compounds (II) with increasing pH, especially under conditions that the medium becomes alkaline, from the gel (dissolved state) becomes soil (it becomes active and passes into a sieve). Insoluble compounds become inert and in biological cycles are almost not included. Accordingly, the level of pikes pollution of plant products on arable land directly depends not only on the level of contamination by their pollutants, but also on the indications of the acidity of such soils.

Nickel compounds have a significant effect on health. Significant presence in water, food and air is able to initiate respiratory diseases, suppress the hematopoiesis, proto show carcinogenic effect on people. Nickel compounds are enough common in the earth's crust. In pure surface waters, the content of compounds Nickel is 0.8—10 $\mu\text{g} / \text{dm}^3$, in seawater — up to 2 $\mu\text{g} / \text{dm}^3$ [15]. Nickel ions (with valency II) are twice as toxic as compared to its complex compounds.

For drinking water, the MPC compounds of nickel are 0.1 mg / dm^3 (general sanitary).

As a result of soil samples analysis, taken from the arable layer on 5 meters from the road cloth, found the presence of nickel compounds in the amount of 11.702 $\mu\text{g} / \text{kg}$ (see Table). In the samples that were selected at a distance of 10 m from the road cloth, the content of nickel (Ni) compounds was less than the previous samples and reaching 10.568 $\mu\text{g} / \text{kg}$ or 90.3%; in samples taken at a distance of 20, 40, 80 m from the road, was located from 10.922 to 10.125 $\mu\text{g} / \text{kg}$, or decrease in the accumulation of compounds such heavy metal ranged from 93.3% to 86.5% of the maximum the indicator in the experiments.

With increasing distance of sampling of soil from the canvas av thisters from 160 to 1280 m recorded a decrease in pollution levels anion layer by the compounds of nickel (Ni) from 9.954 to 9.473 $\mu\text{g} / \text{kg}$, or from 85.1% to 80.9% of the highest in the experiments of the pollution indicator. To then decrease the level of accumulation of nickel compounds as a result of growth the distances of translocation of pollutants are very small. Distributed the dispersion and dispersion of such compounds by air flows occurs on large distances from sources of pollution (road cloths).

If polutany anthropic origin, including compounds lead and nickel can not be neutralized at the point of production of pollution, then it is necessary to apply the ways of their disposal on the arable land, where they were transferred. These techniques include:

- optimization of pH parameters of the arable layer for the purpose of transformation the compounds of lead and nickel are insoluble and biologically inert compounds;
- increase in the content of organic substances (organic carbon compounds) in the soil, which are adsorbent of these compounds and thereby exclude them from the exchange reactions in the soil absorbing the complex;
- systemic extraction of compounds and nickel from the arable layer cultivation of crops and plantings of phytomeliorative crops, not for food and feed purposes.

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Иващенко А.А., Иващенко О.О., Андреев В.А. Проблема забруднення ґрунтів важкими металами

Важливою екологічною проблемою сучасності є накопичення токсичних металів в ґрунтах. На підставі проаналізованих літературних джерел показано, що найбільш забрудненими територіями нашої країни є урбанізовані площі центрального і південно-східного регіонів. Серед металів-поллютантов ґрунту найбільш поширеними і токсичними є свинець, цинк, мідь, кадмій, нікель і алюміній. Мобільність і біодоступність важких металів і алюмінію прямо пропорційна кислотності ґрунту. З огляду на потенційну небезпеку токсичних металів для живих організмів, невідкладним завданням учених є оцінка біологічного ризику цих речовин. У статті проаналізовано накопичення ґрунтами, прилеглих до автостради Київ-Одеса, сполук свинцю (Pb) і нікелю (Ni) на різних відстанях від джерела забруднення.

Иващенко А.А., Иващенко А.А., Андреев В.А. Проблема загрязнения почв тяжелыми металлами

Важной экологической проблемой современности является накопление токсичных металлов в почвах. На основании проанализированных литературных источников показано, что наиболее загрязненными территориями нашей страны является урбанизированные площади центрального и юго-восточного регионов. Среди металлов-поллютантов почвы наиболее распространенными и токсичными являются свинец, цинк, медь, кадмий, никель и алюминий. Мобильность и биодоступность тяжелых металлов и алюминия прямо пропорциональна кислотности почвы. Учитывая потенциальную опасность токсичных металлов для живых организмов, неотложной задачей ученых является оценка биологического риска этих веществ. В статье проанализированы накопления почвами, прилегающих к автостраде Киев-Одесса, соединений свинца (Pb) и никеля (Ni) на различных расстояниях от источника загрязнения.