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НАН РК сообщает, что научный журнал «Вестник НАН РК» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Вестника НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному мультидисциплинарному контенту для нашего сообщества.

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THE EFFECT OF BAIKONUR COSMODROME ON ENVIRONMENT COMPONENTS

Abstract. The development of modern society is directly related to the use of the surrounding environment, that is, all that is needed for the survival of human beings are taken from nature. In this sense, nature is an amazing phenomenon that provides our natural needs. The development of science and technology, the rapid development of industry, the widespread use of underground resources and the increase in the number of transportation vehicles are polluting the environment with various chemical compounds. Many of these chemical compounds have toxic and carcinogenic properties affecting biosphere equilibrium, climate change, reduced agricultural productivity and health deterioration of population.

Key words: toxins, carcinogens, dimethylhydrazine, humus, pollution, air, soil, water.

One of the sites polluting the environment with hazardous substances is the operation of military-industrial complexes that launch rockets into space. Toxic and carcinogenic compounds penetrate into the cell, affect the DNA molecule, break down the chromosomes and eventually reduce the vitality of the organism. Certainly, these compounds are known to have a certain effect on the human body by means of atmospheric air, soil, water and vegetation. According to the main environmental issues list of the Ministry of Defense, pollution of nature by space rockets takes the third place after the destruction of military equipment and weapons and radioactive contamination [1-3].

The study purpose is to analyze the mechanical composition of soil layer of Baikonur Cosmodrome and its humus content and make comparative conclusion according to the general analysis data.

"Baikonur" is one of the cosmodromes that launch spacecrafts. In accordance to many studies, air humidities and a sudden change in temperature over the course of a year are due to the spacecraft work.

It is well-known that in the areas closest to the cosmodrome "Baikonur", where powerful space flight is launched, the weather is sharply changed and a massive sandstorm is slammed for 3-4 days and the temperature decrease up to 0-60 ° C is often observed.

Despite experts working in this field over the past 30 years have proved that there is no significant adverse effect on the atmospheric emissions from the waste of the rocket engines running with chemical fuels, their harmful effects can be clearly seen in the data collected over the last 40 years.

Therefore, we will consider the fuel used for the engines of the rocket carriers, which is launched from the cosmodrome, more specifically:

Unsymmetrical dimethylhydrazine (UDMH) with nitrogen tetroxide (NT) and nitric acid (NA) oxidizers [4-7].

Carbon fuel (RT-1, RG, T-1) with hydrogen peroxide and liquid oxygen oxidizers; this compound is converted into the oxygen and hydrogen by evaporating during the collapse of the particles that have been completed the work. RT-1 and other compounds of this kind impact on the environment as kerosene and benzene, and unsymmetrical dimethylhydrazine (heptyl) is a chemical toxic compound which belongs to the first class hazards.

More specifically, the "heptyl" is a nitrogen organic compound included in the component of the liquid rocket fuel component belongs to hydrazine derivatives. Unsymmetrical dimethylhydrazine is an

active oxidizer which is easily oxidized in various oxidizing agents and is converted into tetramethyl tetrazene (TMT), nitrosodimethylamine (NDMA), dimethylmethylenhydrazine (DMMG), dimethylamine (DMA) and formaldehyde (FA), water, nitrogen, ammonia and other products.

The rapid oxidation of unsymmetrical dimethylhydrazine and its alkylgromics depends on the type and concentration of oxidizers. These oxidants (water, air, soil, temperature) include active metals as Cu, Fe, Cr, Mn and their oxides, passive metals as Al, Ni, Mg. It is important to note that the soil of this region is rich in these metals.

Objects and methods of the research

Objects. Soil samples taken from 5-10 km distance from "Baikonur Cosmodrome" were obtained as objects of research.

Methods: The mechanical composition of the soil layer was determined by the wet method, while the amount of humus by I.V. Tyurin's method [8-12].

The humus of the soil samples tested by airborne soil conversion method (figure 1-3) is based on the oxidation in the solution of potassium bicarbonate in sulfuric acid.

Figure 1 – Preparing the soil sample

Figure 2 – Solution of potassium bicarbonate conversion method in sulfuric acid

a b c

Figure 3 – Determination of soil germination

Results and their analysis

Humus is the main determinant of soil fertility. Humus is influenced by climate change, soil biodiversity and anthropogenic factors.

Humus in the soil varies depending on soil diversity. For example, the humus in the desert zone is 0.5-1.0%, while in meadow steppe soils its size reaches up to 10%.

Soil humus is important in the nutritional chain. It consists mainly of carbon, hydrogen, protein, fat and proteins. It contains nitrogen (N), phosphorus (F), sulfur (S) and other essentials for plant life. The humus content of Baikonur Cosmodrome is very low (0.4%) (table 1).

Table 1 – Soil classification according to humus size

Provision level	Humus size, %
Very low	<2,0
Low	2,1-4,0
Medium	4,1-6,0
Higher	6,1-8,1
High	8,1-10,0
The highest	>10

This is due to the saturation of the soil layer with oil products, including dimethylhydrazine and the consequence of changes in its chemical composition, properties and structure. First of all, it has a direct destructive effect on the soil humus: carbon in the soil layer increases immediately, which leads to the deterioration of soil properties that are a nutrient substrate for plants. Hydrophobic particles of dimethylhydrazine hinder the transfer of moisture to the roots of the plant and lead to their physiological changes. Transformation products of dimethylhydrazine change soil humus content. At the initial stages, these changes are due to the fatty and acidic components, and then it leads to the increase of the humus that is soluble on the account of the dimethylhydrazine carbonate. As a result, the oxidation and reduction conditions in the soil profile change.

Mechanical composition of the soil of Baikonur cosmodrome. Mechanical composition is an important agronomic characteristic of soil. Mechanical composition also reflects the level of its fertility. The mechanical properties of the soil depend on all the physical properties of the soil (density, displacement, water capacity, water permeability, water lifting, air and heat regimes, etc.).

Though an instrument is not used in the wet method, the result is very reliable.

A conclusion about the mechanical composition of the soil is made based on the shape of the threads and rings (figure 4).

Figure 4 – Soil sample necessary to detect mechanical composition by the wet method

The thread diameter is 1 mm. On the basis of the thread diameter and the ring shape, the mechanical composition of the soil is concluded (table 2).

The essence of the mechanical composition of soils increases, especially in technogenic contaminated soils. That is, the indicator of the ratio of large sand to medium sand is an indication of the soil's technogenic pollution.

Table 2 – Classification of soil types by the wet method

The name of the mechanical element	Particle diameter, mm	
Stone	> 3	Physical Sand
Crushed stone	3-1	
Large sand	1-0,5	
Medium sand	0,5-0,25	
Small sand	0,25-0,05	
large dust	0,05-0,01	
Medium dust	0,01-0,005	Physical mud
Small dust	0,005-0,001	
Sediment	< 0,001	
Colloids	< 0,0001	

Conclusion.

1. The saturation of the soil layer with dimethylhydrazine causes the changes in chemical composition, properties and structure, which primarily results in an increase in carbon dioxide in soil so that it degrades the soil properties which are a nutritional substrate for plants. Hydrophobic particles of dimethylhydrazine prevent the transfer of moisture to the plant roots and cause physiological changes. Transformation products of dimethylhydrazine change soil humus content.

2. The mechanical composition of technogenically contaminated soil studied by the wet method is 1 mm thread diameter, respectively, which indicates the priority of large sand particles in the physical sand fraction, and is the reason for the decline in the ratio of large sand and medium sand, which is an indicator of the change in the soil surface due to technogenesis.

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ҚОРШАҒАН ОРТА КОМПОНЕНТТЕРІНЕ БАЙҚОҢЫР ҒАРЫШ АЙЛАҒЫНЫҢ ӘСЕРІ

Аннтотация. Қазіргі кездегі қоғамның дамуы айналадағы қоршаған ортаны пайдаланумен тікелей байланысты, яғни адамзат тіршілігіне қажетінің барлығын табиғаттан алады. Бұл жағынан алғанда табиғат – табиғи қажеттілікті қамтамасыз ететін таңғажайып құбылыс. Ғылым мен техниканың жетілуі, өндірістің қарқындап дамуы, жерасты қазба байлықтарын кеңінен пайдалану, транспорт түрлерінің көбеюі қоршаған ортаны түрлі химиялық қосылыстармен ластауда. Мұндай химиялық қосылыстардың көбінің токсиндік және канцерогендік қасиеттері биосфералық тепе-теңдіктің бұзылуына, климаттың өзгеруіне, ауылшаруашылық өнімдер өнімділігінің төмендеуіне және халықтың денсаулығының нашарлауына әсерін тигізеді.

Түйін сөздер: токсиндер, канцерогендер, диметилгидразин, қарашірік, ластану, ауа, топырақ, су.

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ВЛИЯНИЕ КОСМОДРОМА БАЙКОНУР НА КОМПОНЕНТЫ ОКРУЖАЮЩЕЙ СРЕДЫ

Аннотация. Развитие современного общества напрямую связано с использованием окружающей среды, то есть всего того, что необходимо для выживания людей берется от природы. В этом определении природа – это удивительное явление, которое обеспечивает наши естественные потребности. Развитие науки и техники, быстрое развитие промышленности, широкое использование подземных ресурсов и увеличение количества транспортных средств загрязняют окружающую среду различными химическими соединениями. Многие из этих химических соединений обладают токсическими и канцерогенными свойствами, влияющими на биосферное равновесие, изменение климата, снижение производительности сельского хозяйства и ухудшение здоровья населения.

Ключевые слова: токсины, канцерогены, диметилгидразин, гумус, загрязнение, воздух, почва, вода.

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