

INFLUENCE OF HEAVY METALS (As, Pb, Cd) ON THE ENVIRONMENT

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ABSTRACT

Currently, the problem of soil contamination of man-made and agricultural areas with heavy metals is relevant. Heavy metals occupy one of the leading places among all environmental pollutants. Many representatives of this group of substances, such as lead, copper, zinc, cadmium, even in very small quantities, can cause immunological, cancer and other diseases. Result of research conducted by scientists from different countries proved that about 70 % of heavy metals comes from food in the human body. Rapid industrialization and intensive agricultural activities over the past few decades have led to the accumulation of various pollutants in the environment, especially heavy metals. Negative effects of heavy metal pollution on the environment pose a real threat to the biosphere. In recent years, with the development of the world economy, both the type and the content of heavy metals in the soil caused by human activity, gradually increased, which led to the deterioration of the environment, environmental Pollution in the country is of particular concern to its inhabitants. The analysis of currently available materials on the effect of different concentrations of heavy metals on human health. The levels of elements in the human body and their distribution on organs are presented. The toxic effect of high concentrations of a number of heavy metals on living organisms is considered.

Key words: heavy metals, soil, pollution, lead, cadmium, environment.

INTRODUCTION

Man's desire to protect his life is his natural need. Unfortunately, the world around a person has not only a positive, but also quite often a negative impact, which adversely affects the health and life expectancy. The negative effects of the surrounding world are eternal. They have had and are having a negative impact on man from the day of his appearance on Earth to the present day [1]. Heavy metals enter the environment with waste from virtually all human activities. Main sources of heavy metals are mainly industrial waste, energy, transport. The industry is represented by the following main industries: ferrous and nonferrous metallurgy, chemical, pulp and paper, construction, engineering, light and food, energy, petrochemical and oil refining. Enterprises of each industry produce waste, which is characterized by a specific set of pollutants[2]. Human economic activity leads to pollution of environmental components. One of these components is soil. Soil is not only an important component of landscapes and nature in General, but also the basis of socio-economic development. They are the focus of agricultural activities. With the degradation of the soil begins the degradation of the landscape and all living in it. The main soil pollutants are heavy metals[3]. Getting into the soil, heavy metals increase the mineralization of organic matter, causing negative changes in the soil-absorbing complex, due to the replacement of calcium and magnesium. The enzymatic activity of the soil decreases, as the viability of useful microorganisms decreases,

the number of fungi increases, the activity of many enzymes (catalase, etc.) is suppressed. This leads to degradation of soil fertility and reduces its ability to self-cleaning[4].

Lead is one of the main components of environmental pollution. This has long been known poison, and even among the many modern toxicants this substance is most noticeable. Typical signs of chronic lead poisoning are anemia, intestinal colic, and a dark "lead border" around the edges of the gums. Lead poisoning manifests itself as nonspecific symptoms: first, increased excitability and insomnia, later fatigue and depression. In medical practice, such poisoning is often diagnosed incorrectly, sometimes it is treated as a mental illness. More than 95% of the lead in the atmosphere comes from car exhaust. About half of the lead dust, once in the lungs, remains there, goes into the blood and deposited in the bones, liver, kidneys. Lead, trapped in the gastrointestinal tract with food, unlike lead, trapped in the lungs, more than 90% is excreted from the body. About 90-95% of the lead contained in the human body is concentrated in the bones, which creates a great danger of chronic intoxication. It is able to pass into the mother's milk. The persons at increased risk include newborns, pregnant women, children, people with kidney disease, patients with anemia. Lead mainly affects the hematopoietic, nervous, digestive system, kidneys. It promotes the development of atherosclerosis (chronic cardiovascular disease) and leads to a violation of the coordination of movement, the formation of abnormal red blood cells. As a result, among other effects, twilight vision deteriorates, which can have disastrous consequences for car drivers [4]. As a result of the action of lead reduces the life of red blood cells. With a small lead poisoning decreases intelligence, and the psyche becomes inhibited. Choleric turns into phlegmatic, and phlegmatic and does "fall asleep". And what is worse – there is a partial loss of control over behavior [5].

Cadmium is a dangerous toxicant (considered even more toxic than lead). This metal is classified by the world health organization as one of the most harmful to health. The content of cadmium in the human body is 10-4% by weight. It is concentrated in the kidneys, liver and bone tissue. The biological role of cadmium is to regulate blood sugar metabolism. With excessive intake, it, due to high chemical activity, replaces calcium in the bone tissue, while the bones become fragile and crumble. The increased content of this metal in food leads to a massive dental disease in children. The initial periods of toxicosis are dry mucous membranes, sweet taste in the mouth, headache in the palate, protein in the urine, dysfunction of the genitals, nervous system disorders, acute bone pain in the back and legs, decreased smell and the so-called "cadmium border"- Golden staining of the gums in the area of tooth necks. Unfortunately, the substance is almost impossible to remove from the natural environment. [4,2]Persons at increased risk for cadmium poisoning include women 40 years of age and older, pregnant women, nursing mothers, infants and young children, people with impaired phosphorus-calcium metabolism and kidney and liver disease. Smokers have more cadmium in their bodies than non-smokers (one cigarette contains about 2 mg of cadmium).

Arsenic is a diffuse element. The average content of arsenic in the earth's crust (Clark) $1.7 \cdot 10^{-4}\%$ (by weight), in such quantities it is present in most igneous rocks (the substance can occur in the native state, has the form of metallic shiny gray shells or dense masses consisting of small grains). Small amounts of arsenic are necessary for life. However, in the areas of arsenic deposits and the activities of young volcanoes, soils in some places contain up to 1% arsenic, which is associated with diseases of livestock, vegetation death. The accumulation of arsenic is especially characteristic of the landscapes of the steppes and deserts, in soils where arsenic is inactive. In a humid climate, arsenic is easily washed out of the soil. The intensity of arsenic deposition in the areas of industrial centers is 40 kg/km² per year [6]. South Kazakhstan region is one of the industrialized and densely populated regions of our country. The growth of anthropogenic impact on the environment of the region is

associated with the intensive development of industry in the second half of the last century. By the beginning of 1987 there were more than 170 industrial enterprises in the region. In connection with the priorities established to ensure the gross volume of production, significant miscalculations were made in the design of industrial facilities. There were no design requirements for the provision of circulating water supply and water return systems for industries whose activities are associated with high water consumption, no detailed calculations were made to determine the possible total load of harmful substances to the environment coming from a large concentration of smoke emissions of industrial enterprises.

In determining the spatial isolation of industrial zones and places of storage of waste and ash dumps of industrial enterprises, possible rates of development of settlements and the proximity of surface water sources were not taken into account. As a result of these miscalculations, at present the industrial and sanitary protection zones of the majority of large industrial enterprises are located in the territory of large cities and settlements of the region and are chronic sources of environmental pollution. In this regard, currently the problem of soil purification, the territory of industrial zones from heavy metal ions has become one of the acute environmental problems of the region.

MATERIALS AND METHODS

South Kazakhstan center of Hydrometeorology presented information on the state of air pollution in the city. It was compiled according to 19,932 observations of concentrations of harmful substances. Harmful substances in the atmosphere come from the petrochemical industry, power industry, nonferrous metallurgy. However, the analysis showed that to date, emissions of pollutants from mobile sources account for more than 70% of total gross emissions. Landfills of household waste are also one of the problems of the city. Toxic substances from rotting waste, various carcinogens are formed in the landfill, in Addition, toxic substances that cause a lot of diseases are released during the burning of garbage. Therefore, all household garbage must be disposed of.

The population living in the areas adjacent to industrial enterprises has an increased level of cancer and endocrine diseases.

At this time, it is of particular importance to assess the impact of changes in the environmental situation on the human body and the development of methods of prenosological diagnosis of these effects. Shymkent is one of the largest industrial centers of Kazakhstan. According to the results of monitoring for 2018 by Kazhydromet service, Shymkent was classified as an increased level of pollution.

Table 1 - Dynamics of the level of air pollution in Shymkent for 2016-2018

| The air pollution index (API-5) | | | |
|---------------------------------|------|------|------|
| | 1 | 2 | 3 |
| Period | 2016 | 2017 | 2018 |
| API5 | 8 | 10 | 10,6 |

The level of pollution of the city increases every year (table 1). Every day millions of tons of garbage are thrown into landfills, and the atmosphere is poisoned by a mixture of toxic substances. According to the world health organization, more than 92% of the world's population breathes polluted air. Scientists have proven that dirty air can contribute to premature aging, is the cause of low weight children and even adversely affects the moral appearance of people. But the worst thing is that every year about 3 million people die because of air pollution. That is, every ninth death is associated with this. Kazakhstan, like

many other States, is firmly entrenched in the list of countries with extremely negative environmental trends. Kazpravda.kz. The study involved 130 residents of the city of Shymkent living near the area of the enterprise "Yuzh-Polymetal", a zone with an increased level of soil contamination with heavy metals. The control group included 110 people, residents of the T. Ryskulov village, living in the so-called "clean zone", with a low level of soil pollution by industrial emissions.

RESULTS AND DISCUSSION

There was a questionnaire survey was carried out selection of candidates, not abusing alcohol, not Smoking, not standing at the dispensary with any diseases. The criterion of exclusion was the presence of diabetes mellitus, hypertension stage 2 and higher, previously verified chronic kidney disease [7].

Table 2 - Results of soil samples analysis in Shymkent according to observations in spring and autumn 2018

| Place of selection | Mixture | Spring | Autumn | Average per year |
|--|---------|--------------------------------------|--------------------------------------|--------------------------------------|
| | | Q, maximum permissible concentration | Q, maximum permissible concentration | Q, maximum permissible concentration |
| district of CJSC "Yuzhpolyimetal" (distance from the source of pollution 0.5 km) | Lead | 37.0 | 28.4 | 32.7 |
| district of CJSC Yuzhpolyimetal (distance from a source of pollution of 0,9 km) | Lead | 22.2 | 13.7 | 17.9 |
| School district № 9 | Lead | 4.3 | 3.8 | 4.05 |
| The area of the square Ordabasy | Lead | 2.4 | 1.1 | 1.75 |

According to the results of the study (table 2), the content of lead cations in the second group living in the territory, the main pollution factor of which is the intensive release of "Yuzhpolyimetal", the concentration of lead cations in this group was $41.9 \pm 0.4 \mu\text{g/dl}$, and was 11 times higher than the data of the control group $3.8 \pm 0.03 \mu\text{g/dl}$. <https://moluch.ru/conf/med/archive/253/13998/>

Table 3 - Permissible levels of toxic elements in different groups of food raw materials and food products

| № | Food group | Permissible levels of toxic elements in different groups of food raw materials and food products in mg/kg | | |
|---|--|---|----------|-----------|
| | | Pb | As | Cd |
| 1 | Meat, meat products, poultry, eggs | 0.5-1.0 | 0.1-1.0 | 0.05-1.0 |
| 2 | Milk and dairy products | 0.1-0.5 | 0.05-0.3 | 0.03-0.2 |
| 3 | Fish, non-fish products and products derived from them | 0.5-10.0 | 1.0-5.0 | 0.2-2.0 |
| 4 | Grain (seeds), flour, cereals and bakery products | 0.035-0.5 | 0.15-0.3 | 0.07-0.1 |
| 5 | Sugar, confectionery | 0.5-1.0 | 0.3-1.0 | 0.05-0.5 |
| 6 | Fruits and vegetables | 0.3-1.0 | 0.1-0.3 | 0.03-0.2 |
| 7 | Oilseeds and fat products | 0.1-1.0 | 0.1-0.3 | 0.03-0.2 |
| 8 | Drinks | 0.03-0.3 | 0.05-0.2 | 0.001-1.0 |
| 9 | Other product | 0.2-10.0 | 0.1-3.0 | 0.1-1.0 |

CONCLUSION

Thus, the relationship between the increased content of lead in the blood and the level of atmospheric pollution by heavy metals was established. It is determined that the level of pollution with heavy metals in Shymkent exceeds the permissible standards and such pollution has a direct impact on the body of the inhabitants of the "dirty zones". This issue requires further study to develop measures to diagnose and prevent the effects of such exposure[8].

Pollution of objects of the biosphere, including food raw materials, both plant and animal origin, with salts of heavy metals, given their high toxicity, the ability to accumulate in the human body, to have harmful effects even in relatively low concentrations, can have a number of serious consequences for human health, causing the development of so-called environmentally-related diseases (table 3). Uncontrolled pollution of the environment with heavy metals threatens 191 human health. Reception of toxic substances leads to irreversible changes in internal organs. As a result, incurable diseases develop: disorders of the gastrointestinal tract, liver, renal and hepatic colic, paralysis. Frequent deaths [9].



Fig. 1 – All heavy metals found in the human body

A person is forced to breathe contaminated air, drink contaminated water, to use food containing contaminants. (Fig. 1). Where do heavy metals accumulate in the body? It all

depends on what kind of metal you are talking about. Cadmium – kidneys, liver, copper - brain, Nickel - skin, lead - bones. And that's not all. All these heavy metals are used in industry and in any production that is available in the city. Then through water, air, food enters the body and accumulates there, which can produce to various mutations of the body [11].

Various methods of cleaning contaminated soils from heavy metals are used. Special attention is paid to bioindication as an assessment of environmental changes caused by anthropogenic impacts. The relevance of bioindication is also due to the simplicity, speed and low cost of determining the quality of the environment. For example, if soil salinity in the city of Linden leaves turn yellow at the edges, until the onset of autumn. You can identify such areas by simply inspecting the trees. In such cases, bioindication can quickly detect the most polluted habitats [10].

The earth does not forgive indifference, it pays back our negligence by various ecological catastrophes which negatively affect health of each person on the planet. Human dishonesty is the biggest problem in the interaction of living beings with nature. The only way to restore the health of our planet is the correct spiritual education of their children, in good faith to their own needs, awareness of the universal problems of each individual. The land is proud, so the neglect does not forgive. Not like indifferent. But I believe that the right attitude to nature will be revived in human souls and each of us will appreciate what our planet gives and has.

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