Study on the soil pollution condition around the domestic wastewater

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Abstract. The rapid development in the population of the earth, the increase in the level of consumption of people leads to an increase in the amount of household waste from year to year, which, in turn, increases the negative impact on the environment of their collection and storage areas, that is, household waste landfills. From these studies, the state of contamination of the soil as scattered around the municipal landfill, the sources factors affecting the contamination were described. The main purpose of the conducted research is to determine the level of pollution of the soil under the influence of household waste. The researches were conducted in the soil scattered around the Tashkent municipal waste dump, located in the Ohangaron district were of the Tashkent province. The results showed that in the chemical pollution of irrigated typical gray soils, the domestic landfill is considered the main pollutant source, and the level of pollution decreases from the distance of 1.2 km from the landfill, and into according to the soil layers, it decreases uniformly from the top to the bottom, starting from the 70 cm layer.The soil scattered around the landfill is contaminated with organic pollutants, ash elements and heavy metals and other pollutants, including the total amount of Cd 3.1 times, As 4.39 times, Sb 2.46 times compared to the permissible limit share. , W 4.6 times and other heavy metals increased to different degrees.

1. Introduction

It found that the number of microelements, quartz and glauconitic from minerals, humus substances, and calcium and gypsum substances in plant residues changed in the soil of the household landfill [1]. Soil is the main source of nutrition for plants, acting as a natural medium for absorbing pollutants and influencing the condition of groundwater and air. Natural soils differ from soils affected by anthropogenic factors, and contaminated soils are considered unsuitable for plant growth [2].

Domestic wastes fall into the soil and create pollution processes and lead to soil pollution with chemicals such as Bi, Mo, Sb, Cu, Pb, Hg, Ag, As, Sn, Cr, Se, Zn contained in the wastes [3]. Household waste is a potential source of heavy metals-Cd, Pb, Zn, Cu and Cr pollution and pollutes water, soil and plants [4], the amount of heavy metals such as Cd, Pb, Cu, Ni, Zn increases in polluted soils [5, 6, 7], absorbed by the roots of and plants and causes the death of plants [8, 9]. The norm of heavy metals in healthy soils around the world: Hg - 35 mg/kg, Zn - 108 mg/kg, As - 11 mg/kg, Cr - 71 mg/kg, Ni - 43 mg/kg, Co - 18 mg/kg, Cu – 56 mg/kg, Mo – 3.1 mg/kg, Mn – 397 mg/kg, Ba – 496 mg/kg, V – 62 mg/kg. If the content of heavy metals in the soil on exceeds the above-mentioned norm, then these soils are included in the soil contaminated with heavy metals [10, 11, 12]. More than 40 elements with an atomic mass greater than 50, such as Cr, V, Cu, Mn, Co, Zn, Ni, Fe, Hg, Sn, Mo, Pb, Cd, Bi, metals with a specific gravity of 5 g/cm3 or more N. Heavy metals according to Reimes classification [12, 13]. The pollution of the soil scattered around the household waste dump has an effect on its physical and chemical properties, a significant difference in the chemical composition of the soil has detected, which causes the amount of heavy metals in the soil to exceed the specified norm. The concentration of heavy metals in landfill soils increased in the order of Fe> Pb> As>Zn>Cd [14].

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Household waste has a negative impact on the soil and is part of the products used by humankind in economic activities. For example, scientists noted that the content of heavy metals in the soil around the household waste this landfill has increased 5 times compared to FMSH, and this can lead to an ecological crisis [15, 16]. Also, the soil around the landfill established in the Balakovo region is contaminated with heavy metals such as Zn, Cu, and Ni, and dangerous forms of Zn and Cu are widespread in separate areas, high levels are recorded in the northeastern and southwestern edges of the landfill [17, 18]. Various hydrocarbon compounds observed in soil contaminated with household waste [19].

Heavy metals in the soil absorbed by plants are part of food products, and these are stored in food and fall into the soil as household waste [20]. As a result, on soil pollution, it was found that some heavy metals (Fe - 3.9; Cu - 34.6; Mn - 554.3; Cd - 122.2) exceeded the norm [21], additionally, as a result of another study, Zn 7-20 under the influence of soil pollution, Pb 2-16, Cu 4-9, Cd 2-3, and Cr and As were found to be 3 times higher than the FMSH indicator [1, 22]. As a result of heavy metal contamination of household landfill soils, the amount of fluorine in 1 g of soil increased so by 6.8 mg or 13.6% [22]. The increase of lead in the soil over 80 mg/kg had a negative effect on the activity of microorganisms, decreased their activity, and decreased the activity of actinomycetes by 20% [10, 23, 24]. Soil pollution with heavy metals and has caused a decrease in the content of organic matter, negatively affecting the movement of exchangeable cations, and an increase in the acidic environment [25].

Heavy metals Cd, Ni, Pb and As increased from FMSH in household landfill soils affected oxidation-reduction reactions, biologikal activity and productivity in the soil [26]. Heavy metals such as Hg, Pb, As, Cd, Zn, Cu, Cr, and Ni are among the first pollutants. They enter the human body and animal body with plants, air and water. The dangerus thing is that these heavy metals accumulate in the kidnays and liver of humans and animals [27]. The increase in the amount of heavy metals in the soil of the domestic landfill causes various physiological and genetic diseases as a result of contamination of food products grown on the crop land around the landfill and human consumption [28]. Today, 90% of the disease that occur in the human body are the result of an increase in harmful waste in the soil and air [29, 30].

The amount of humus in the soil around the household dump decreases from 5.72% to 5.59%, which is 2.3% of the total amount of humus. It also causes an increase in the concentration of hydrogen ions in the soil solution and change the pH value of the soil, the amount of organic matter, the electrical conductivity of the soil, and the number of exchangeable cations [24]. The amount of soil nutrients (NPK) almost does not change [31]. In resent years, because of improper use of agricultural land and excessive cultivation of crops, the soil's fertility has decreased dramatically. As a result, the amount of humus in most soils has decreased to 0.2-0.3% [24].

2. Methods

Household waste landfill of Tashkent city located in Ohangaron district of Tashkent region was selected as a research object. Hydrogeological conditions of Ohangaron district depend on climatic and geomorphological conditions, lithological composition of water-permeable rocks and structural fetures of the studied area. During the study period (March-April, 2019), groundwater is not opened to the surface at a depth of 50.0 m from the ground.

Soil samples taken in the main direction of the wind based on the Interstate standard GOST: 17.4.3.01-83, because soil pollution occurs mainly in the direction of the wind because of continuous burning of waste.

The object of research is the typical irrigated gray soils common around the household waste dump l. The soil samples were taken in laboratory conditions using soil science, microbiology, biochemistry, chemistry and sustanable methods given in the international standard.

41°05'32.5"N/69°28'48.8"E (0.1 km from the domestic landfill), 41°05'31.9"N/69°28'48.0"E (0.2 km from the domestic landfill), 41°05'26.7"N/69°28'45.8"E (0.4 km from the domestic landfill), 41°05'20.7"N/69°28'45.4"E (0.6 km from the domestic landfill km away), 41°05'19.0"N/69°28'31.8"E (1.0 km away from the landfill), 41°05'32.5"N/69°28'48.8"E (1.2 km from the landfill), 41°05'32.5"N/69°28'48.8"E (3.0 km from the landfill), 41°08'15.0"N/69 °26'35.0"E (6.0 km from the domestic landfill), 41°10'13.6"N / 69°24'49.0"E (10 km from the domestic landfill). «Compiled by the authors».

In the experiments, various properties of soils, the level of pollution with household waste, the description of the level of soil pollution by pollution areas - IBP (Inductively Coupled Plasma) mass-spectrometric method were determined. Inductively coupled plasma mass spectrometry (ICP-MS) is one of the mass spectroscopic analysis methods with high sensitivity and allows determination of metal and non-metallic elements in concentrations of 10-10%, i.e. one part in 1012.The method is based on the use of an indactivly coupled plasma as a source of ions and a mass spectrometer for their separation and detection. ICP-MS also allows isotopic analysis of the selected ion.

The irrigated areas of Tashkent region consist of brown, dark and typical gray soils, meadow-gray, gray-meadow, meadow and swamp-meadow soils in the area of typical and light gray soils. The irrigated soils of the region are developed in different lithological and hydrogeologikal conditions distributed in the subtropical mountain semi-desert region, the mountain clopes of the loess and alluvial deposits of the typical gray soils, and the geomorphological regions of the Chirchik, Ahangaron and Sirdarya rivers. The soils distributed in the region are mainly automorphic, semi-hydromorphic and hydromorphic soils, which consist of irrigated typical gray soils, irrigated gray-meadow, meadow-gray soils, irrigated meadow soils, and irrigated meadow-swamp soils genetic groups. It is planned to gradually expand the domestic landfill and to includes waste from the city of Tashkent for a long time.

3. Results and Discussions

An increase in soil pollutants (xenobionts, ecotoxicants, etc.) reduces its fertility properties, besides, the amount of heavy metals (Cd, As, Hg, Pb, Zn, Co, Cu, Ni) in the soil increases [32]. During the study of distribution of elements in the vertical section of the soil cover, it was noted that the amount of cobalt, chromium, iron, manganese, molybdenum, lead, vanadium, yttrium and zinc is higher in the upper layers of the soil (0-70 cm) than in the lower layers (70-200 cm) [33]. The development of the economy and the increase in the activity of industrial enterprises lead to soil pollution with heavy metals. In addition, household waste and vehicles have a great impact on soil pollution with heavy metals. The combined use of phytoremediation and microbial remediation methods in the treatment of soils contaminated with heavy metals gives good ecological results [31]. Among the heavy metals, Pb, Zn, and Cd have been found to be abundant around landfills, mines, and sewage plants, around residential complexes, and in agricultural fields [34]. Because of incineration on household waste, Cd (0.24 ± 0.16 mg/kg-1) is mainly accumulated in the upper layers of the soil, followed by Hg (0.13 ± 0.09 mg/kg-1) in the lower layer, and the accumulation of heavy metals such as Cd, As in the soil is harmful to humans [35, 36]. As a result of incineration of household waste, Cd (0.24 ± 0.16 mg/kg-1) is mainly accumulated in the upper layers of the soil, followed by Hg (0.13 ± 0.09 mg/kg-1) in the lover layer, and the accumulation of heavy metals such as Cd, As in the soil is harmful to humans [35, 36]. Soils contaminated with household wastes have been found to contain Cr, Mn, Cu, Pb and ammonium, nitrate, sulfate and phosphate salts [37]. Heavy metals inter the human body and cause deteroration of internal organs such as lungs, liwer and kidneys. Sources of soil pollution with heavy metals in clude: metal processing industry waste; industrial enterprises; fuel products; car smoke; includes chemicals used in agriculture and others [38]. In the Republic of Uzbekistan, by studying the indicators of heavy metal contamination of soils scattered around industrial enterprises, their forms of occurrence and the effect of soil microorganisms, N.E. Shukurov was engaged [39, 40]. Contamination of the soil cover of the Angren-Almalik industrial district with heavy metals had a negative effect on the world of microorganisms. As a result of the study of the amount of heavy metals and microorganisms in the soil, it was noted that the number microorganisms in the soil heavily polluted with heavy metals is significantly lower than in the less polluted soil. Various indicators of the ecosystem of microorganisms (total number of nematodes, respiration, C, N, microbial biomass, microbial coefficient) increased with distance from the sources of pollution with heavy metals [41].

As a result of the study of the soils scattered around the mining and heat energy industry enterprises (OKMK enterprises and Angren IES) located in Ohangaron district, it was noted that the amount of heavy metals is high near these enterprises, and relatively low as they move away from the industrial enterprises [39]. The order of Zn>Cu>Pb>Cr>Ni in terms of concentration of heavy metals was recorded in the soils of Almalyk city, and Zn>Pb>Cu>Ni>Cr in Angren city. The amount of heavy metals in the upper layers of the soil is somewhat lower than in the lower layers. It has been noted that man-made of heavy metals - toxicants in the soil sample take near OKMK enterprises and Angren IES are in the form of primary and secondary ore minerals of somevhat complex composition, as well as newly formed spherical man-made products.

In the soil sections take from the city of Almalyk, spherical particles containing pure copper and zinc, as well as sulphide minerals, their composition is as follows (%): Pb - up to 61.03, Zn - up to 73.49, Cu - up to 55.72, S - 26 up to .73. In the center of these spherical particles, dendrites with an iron content of up to 58% are noted, sometimes accompanied by coper. Man-made spherical particles scattered in the soil around Angren IES were mainly manifested in the form of iron oxides [39].

According to researches, the main source of municipal waste contamination of irrigated typical gray soils is haushold waste landfill. Landfill and waste transportation processes established in settlements are a partial source of pollution. Waste transportation processes are also a source of partial pollution. Because a certain amount of waste is left in the process of transportation of household waste from setlements by means of special vehicles.Garbage dumped on roadsides is carried by the wind and deposited on cultivated fields. As a result of the plowing of cultivated fields using various techniques, waste falls into the lower layers of the soil, were it accumulates and begins to rot. Various useful and harmful substances in the waste enter the soil and harm the flora and fauna through the soil.

The source of soil pollution with household waste is divided into two types: these are permanent and mobile sources. Permanent sources include household waste, waste collection deports established in city centers. Mobile sources include waste transport vehicles and people. Most of the pollution is caused by permanent sources. Mobile sources, on the other hand, cause a small amount of pollution.

In our republic, irrigated, agricultural lands and the domestic waste dump located in the bordering area with them affect the soil as a source of pollution. As a result of householding waste bloving away in the landfill, cultivated fields are polluted. Household waste can also be recognized as a source that plays a major role in the significant pollution of the 0-30 cm layer of the soil, because the land becoming unfit for agricultural use is also mainly found in the distance of 2-5 km around the landfill.

Moke and ash particles produced by the burning of waste are blown into the atmosphere by the vind and cause air pollution. As fly ash is a light product, it is carried by wind to the crop fields around the landfill. As a result, the cultivated fields around the landfill were also polluted. As a result of precipitation, various toxic gases formed in the atmosphere pollute the soil.

As a result of burning household waste, various toxic gases (SO_2, CO_2, CnHn, NO_2) are released into the atmosphere. These gases enter the lungs as a result of human breathing and damage them. Today, most of the outbreaks of respiratory diseases and lung cancer are caused by people breathing in air polluted with various toxic gases. Biological processes taking place in landfills, toxic gases of various levels produced as a result of their burning have a harmful effect on human health and living organisms of the environment.

According to the conducted studies, the main source of pollution of the studied irrigated typical gray on soils with domestic waste is the domestic landfill, and waste transportation processes are partially included of the source of pollution. Almost all processes (collection, wind dispersion, incineration) take place in a landfill.

Waste transportation processes are also a source of partial pollution. Because a certain amount of waste is left in the process of transportation of household waste from settlements by means special vehicles. Garbage dumped on roadsides is carried by the wind and deposited on cultivated fields. As a result of the plowing of cultivated fields using various techniques, waste falls into the lower layers of the soil, where it accumulates and begins of rot. Various useful and harmful substances in the waste enter the soil and harm the flora and fauna through the soil.

The location of the pollutant source is extremely important in soil pollution, and the pollution limits correspond to the area limits developed for a domestic landfill (Table 1).

Table 1. Territorial boundaries of soil pollution by sources of pollution (for Tashkent municipal landfill)

Areas	Distance from landfill, km
Protected area	0.75–1.0
I area	1.0–2.0
II area	2.0–4.0
III area	4.0–6.0
IV area	6.0–9.0
Background	9.0–10

According to the results of the conducted studies, it was scientifically justified that it is not appropriate for a domestic landfill, and the protection area for a domestic landfill was defined as 0.75–1.0 km. According to the results of the research, the protection area and distances were modified. Conducted studies have shown that the I-zone has changed to a distance of 1.0-2.0 km in the soil around the landfill, which determines the impact was on the soil around the landfill. Zones II and III are treated as pollution zones, where the highest indicator extends to a distance of 2.0-4.0 km. Zones III and IV are extended to 4.0-9.0 km and pollution is reduced due to the fact that there is no area adjacent to the landfill.In the background area, the distances are smaller. It can be seen that the main source of pollution in the soils scattered around the domestic landfill is the highly polluted soils of zone I, and the scale of pollution decreases in zones II and III. There is no soil contamination in Zone IV and backgrounding areas. The high level of pollution in Zone I and partly in Zone II is explained by the fact that these zones are adjacent to the household waste dump. The main part of all microbiological and biological processes takes place in these areas.

The ecological situation in areas I and II differs from areas III-IV due to the formation of large amounts of ash piles as a result of the burning of waste after bringing it, the ash elements being blown away by the wind and polluting healthy soils, the fact that the area around the landfill is separated from cropland by fences, the landfill due to the non-compliance with the construction instructions, waste products are blown to distanting areas, in addition, it can be explained by the smoke generated as a result of the burning of waste spread over long distances due to the influence of the vind.

The sources and factors of soil pollution around the landfill with household waste are different from other types of pollution, high temperature (+42^{o}C) due to the accumulation of waste affects the growth of various biological processes and the reduction of other processes, and the decrease in temperature has the opposite effect on this process. A decrease in air temperature leads to a decrease in biological processes in the soil and a slowdown in the activity of microorganisms.

The temperature factor pollutes the atmosphere by releasing gases (CO_2, NH_3, CH_4) that are dangerous for human life as a result of various processes taking place in the landfill. Various natural and anthropogenic factors affect soil pollution with waste products and are the main means of environmental damage. Due to the influence of wind and temperature factors, soils are more polluted in the areas near the landfill. These factors take an active part in soil pollution with house hold waste, and smoking, ash elements, etc., generated as a result of waste burning, spread in different directions in the direction of the wind.

The level of soil pollution increases with distance from the domestic landfill, and decreases from zone IV, and almost no pollution observed in the background area. The level of pollution is observed at the end of Zone I and the beginning of Zone II. The highest level of pollution in terms of soil layers is in the 0-30 cm layer. An increase in wind speed also causes an increase in pollution levels.

At this point, it should be said that the land up to 1 km around the landfill is treated as a protected area, and the soil of this area is highly polluted. As a result of conducted field observation and laboratory analysis, it can be said that wind and temperature factors are the main factors of pollution by household waste products.

Contamination of the environment, including soils, with heavy metals as a result of man-made effects is one of the urgent in environmental problems of today. The solution to such problems is first revealed in the in-depth study of the influence of the sources of pollution and in the research of the distribution characteristics of heavy metals.

Soil pollution with heavy metals is second only to pesticides in terms of danger level, sulfur dioxide is more dangerous than carbon. The main reason for soil contamination with heavy metals is their direct use in the manufacturing industry.

Today, almost all large cities have landfills around them, where solid waste is dumped, stored and partially destroyed. Storage and disposal of household waste (mainly by incineration) can have a negative of impact on the changes in the structure and properties of the soil cover spread around the landfill, on the productivity indicators and on the agro-ecological condition of the soils.

Ashes produced during waste incineration processes in the household landfill and adjacent areas are mainly collected in the 0-30 cm layer of the soil. During our research, the chemical composition of ash substances was determined. According to this, the ash content contains SiO_2-25.06%, Al_2O_3-19.94%, CaO-3.56%, Fe_2O_3-3.44%, Na_2O-1.97%, K_2O-0.43%, MgO-2.01%, P_2O_5-0.02%, BaO-0.04%, SrO-0.04%, Mn_2O_7-0.1%, CuO-0.006%, As_2O_7-0.009%, Mo_2O_7-0.003%, LiO-0.028 is %.

The type and extent of soil contamination varies depending on the types of contaminants. In the case of household waste pollution, the scale of pollution is small, and mainly the areas near the landfill is heavily polluted. The scale of pollution decreases as you move away from the landfill. It can be seen that the amount of heavy metals has been changed to different degrees when the soils are analyzed by layers 1 km away from the landfill (Fig. 1)

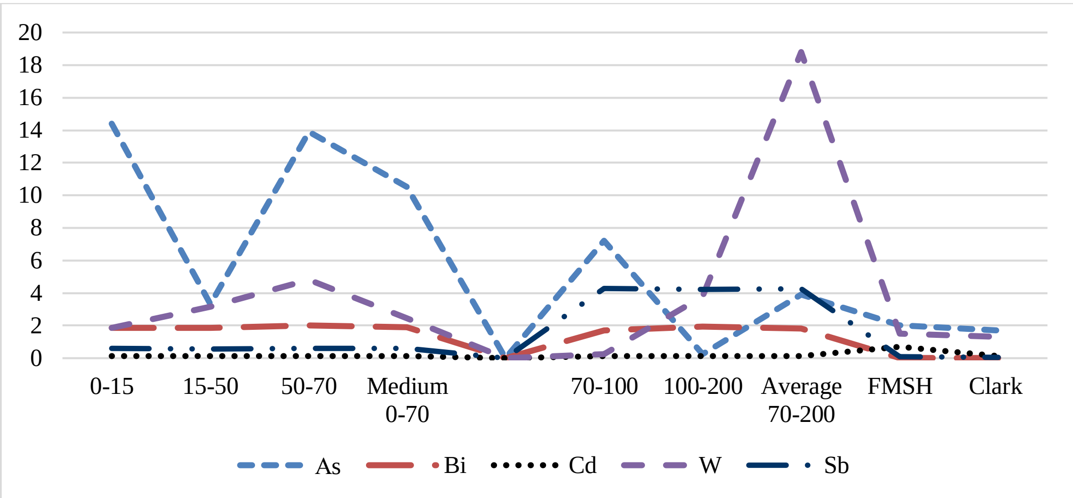

Fig. 1. Changes in the state of pollution with distance from the domestic landfill

When layers analyzed the amount of heavy metals, it noted that the accumulation coefficient of heavy metals is higher in the upper layer of the soil, i.e. in 0-70 cm, than in the lower layer of 70-200 cm. As a result of farming in the areas adjacent to the landfill and the blowing of waste ash by the wind, it mixes with the arable layer and causes pollution of the upper layer of the soil. According to the results of the research, it was found that the amount of As, Bi, Cd, W and Sb in the soil decreased from top to bottom. Characteristics of distribution of heavy metals in soils obtained because of research N.E. The results obtained by Shukurov [42] prove. N.E. In Shukurov's researches, industrial enterprises located in the area (OKMK enterprises and Angren IES) were noted as a source of heavy metal contamination of soils scattered in the Angren-Almalik mining industry region. In this N.E. Shukurov (2006) found that as a result of studying the concentration of heavy metals in the soil, the highest amounts of heavy metals in the soil are observed around the sources of pollution (industrial enterprises), and the amount of heavy metals in the soil decreases as you move away from them [43].

Dispersion of heavy metals in household waste in the soil layers depends on the period of establishment of the landfill. The spread of soil contamination with heavy metals further away from the study area is related to their movement characteristics and chemical properties in the earth's crust. It was found that the amount of heavy metals (except for arsenic and bismuth) decreased with distance from the household landfill (Fig. 2).

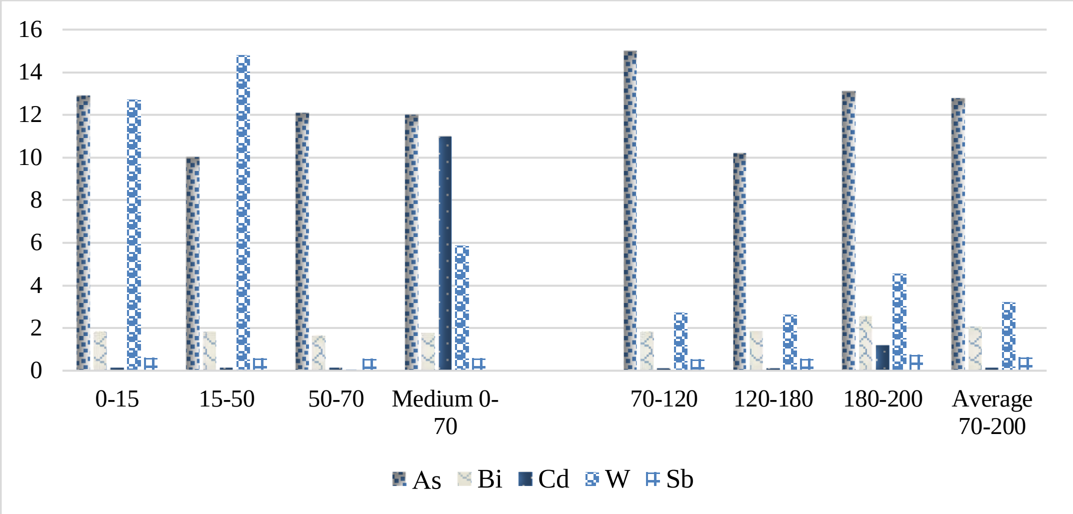

Fig. 2. Variation of heavy metal content by layer in a soil sample taken near a municipal landfill

There was a tendency to decrease the amount of heavy metals in the soil with distance from the landfill. Accumulation and migration of heavy metals in the upper layer of the soil is active under the influence of medical and anthropogenic factors. The amount of As (8.78 g/t) and Bi (2.05 g/t) in the soil 0-30 cm did not change with the distance from the landfill, that is, a high amount was recorded in all sections. This can be explained by their background of quantities.However, the amount of arsenic compared to the amount of FMSH can be seen to be 3.6-7.2 times higher in almost all sections. bismuth, cadmium content is higher than FMSH content in all sections. It was noted that the amount of tungsten in landfill ash increased 8 times compared to FMSH. The amount of Tungsten in the soil sections is slightly higher than the amount of Clark (10-88 times) and FMSH around the dump (13.57 g/t). The obtained results to showed that the amount of other elements (cadmium and antimony) was higher than FMSH. The amount of Cd, W and Sb has a tendency to decrease with distance from the landfill.

Table 2. The amount of heavy metals found in the soil around the landfill

Soil sampling points	Sn	Ni	Mn	Mo	Pb
41°05'32.5"N/69°28'48.8"E	5.52	35.8	670	14.8	16.8
41°05'31.9"N/69°28'48.0"E	2.31	30.8	733	6.63	14.4
41°05'26.7"N/69°28'45.8"E	2.7	26.9	888	11.2	12.4
41°05'20.7"N/69°28'45.4"E	6.62	29.7	682	5.79	13.1
41°05'19.0"N/69°28'31.8"E	3.96	25.8	837	9.19	15
41°05'32,5"N/69°28'48,8"E	2.54	30.8	620	6.07	15.5
41°05'32,5"N/69°28'48,8"E	3.51	26.8	639	9.53	12.7
41°08'15.0"N/69°26'35.0"E	3.86	27.4	818	6.02	21
41°10'13.6"N/69°24'49.0"E	3.53	25.8	618	6.23	13.1

According to the scale of pollution and impact on cultivated land, heavy metals have a special place among pollutants. Heavy metals contained in household waste accumulated in the soil as a result of biological processes accelerated during the accumulation of waste and ash products formed as a result of burning. In cultivated fields, the main mass of heavy metals accumulates in the 0-30 cm layer.

It can be seen that the amount of heavy metals such as Sn, Ni, Mo, Pb, Nb in the soil around the landfill increased in the soil near the landfill and decreased further away. It was found that the amount of tin in the earth crust is 2.5, and in the soil of the research area it is 5.52 mg/kg in the area adjacent to the household dump, while its amount decreased to 3.53 mg/kg 10 km away from the object. In addition, the amount of metals such as nickel, molybdenum, lead and

niobium are Ni-35.8, Mo-14.8, Pb-16.8, Nb-15.7 mg/kg in the area adjacent to the landfill. Ni -27.4, Mo-6.02, Pb-21, Nb-14.5 mg/kg at 9 km and Ni -25.8, Mo-6.23, Pb-13.1 at 10 km, it was found that Nb is less than 11.9 mg/kg.
From the results presented above, ash residues formed because of incineration of household waste caused an increase for heavy metals in the soils of the areas near the landfill under the influence of natural and anthropogenic factors. It can be said that their number of decreased as they moved away. Microorganism activity and deterioration of chemical properties are observed in soils contaminated with heavy metals. We will provide information about this in further studies.

4. Conclusion

The results of the conducted studies showed that the soil scattered around the municipal waste storage dumps is a source of heavy metal contamination. High concentrations of heavy metals are characteristic for magnesium, zinc, copper, molybdenum, selenium, bismuth and other elements. Much higher amounts compared to FMSH are characteristic for copper, mercury, sulfur, slightly higher amount for zincThe amount of zinc, lead, chromium, copper, and tin decreases with distance from the landfill. The amount of heavy metals in the vertical cross-section of the soil cover is slightly higher in the upper layers of the soil compared to the lower layers, explained by the fall of waste ash rich in heavy metals into the soil cover through the atmosphere during the process of burning waste and storing it in an open manner.The amount of zinc, lead, chromium, copper, and tin decreases with distance from the landfill. The amount of heavy metals in the vertical cross-section of the soil cover is slightly of higher in the upper layers of the soil compared to the lower layers, explained by the fall of waste ash rich in heavy metals into the soil cover through the atmosphere during the process of burning waste and storing it in what an open manner.The amount of zinc, lead, chromium, copper, and tin decreases with distance from the landfill.
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