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FREQUENCY DISTRIBUTION OF HEAVY METAL CONTENTS IN NATURAL, URBAN AND MINING LOCATIONS IN MONGOLIA

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As there are just a few researches on heavy metals in soil in Mongolia, the examination will be led to investigate the presence of any harmful metals in 22 samples with ICP-OES technique which is the most elemental analysis technique. Samples will be collected from mining area which is in the desert, urban area in the capital city and mountainous local city in Mongolia. The study will focus on determining the spread of heavy metal contents as well as its health risk assessment and contamination level. The results will be analyzed with Mongolian standard for toxic chemicals in soil. The modifications used to immobilize the pollutants may not be specialized for a certain metal, resulting in the release of a hazardous metal into the soil. Therefore, there will be a need for developing new methods that can effectively lead to removal of heavy metals from the contaminated soil. The dissertation will include: Introduction and aim, Literature survey, Materials and method, Result, Discussion, Recommendation and further tasks, Summary, Acknowledgement and References.

***Keywords**: distribution, heavy metal contents, natural, urban, mining locations, Mongolia*

INTRODUCTION

Because of the rapid rise of industry and agriculture and the disturbance of natural ecosystems caused by anthropogenic pressure connected to the human population increase, soil pollution with heavy metals poses a danger to the environment and food security. Pollution with heavy metals and human exposure are created by various anthropogenic activities such as mining, industrial production, and the usage of metal-containing chemicals in domestic and agricultural contexts. Also, there are different ways to pollute the cities and other locations with human beings even the people themselves can contaminate the local areas. Metal contamination is one of the leading problems in Mongolia. Furthermore, citizens living in polluted areas face healthy living shortages. It was found that the lack of right urban planning system, particularly in Ulaanbaatar (The capital of Mongolia), can increase the waste disposal materials, which may contribute to heavy metal contamination of soil. The hazards of polluted materials should be monitored frequently in various ecosystems such as hydrosphere, lithosphere, including the living systems too. This ecological investigation will provide helpful knowledge on how these hazard materials are frequently occurred in different habitats regarding to their fate and bioaccumulation and also, how these materials joined or transferred to the food web.

The primary heavy metals that pollute the topsoil in Ulaanbaatar are Zinc (Zn) and Chromium (Cr); which are originated from industrial waste, ger area chimneys, stove ash, waste, power plants, and fumes and ash from power plants, the operation of the market center. Exceeding the maximum allowable levels in the soil is harmful to the local environment and for living organisms. Ulaanbaatar has a high level of soil microbial contamination and a low overall level of heavy metal pollution in comparison with other Mongolian cities, but excessive pollution is observed in some areas for example, the ger locations. The leading causes of microbial contamination are ger areas pit latrines, open latrines, and household waste. To determine human health and environmental risks, it is required to analyze level of heavy concentrations in different investigated ecosystems.

PUBLIC HEALTH ASSESSMENT OF HEAVY METALS IN THE MONGOLIAN SOIL

The thesis work has investigated heavy metal contents in the capital city (Ulaanbaatar), mining field (Dundgovi), and one of the provinces (Arkhangai), while further study aimed to analyse the samples from 3 different major cities in Mongolia. All of the measured samples were collected from urban areas, and heavy metals in these areas affect the human body through respiration, consumption, and dermal ingestion. Few studies explain that one of the main factors polluting the biosphere is the influenced by human activities such as consumption of fuel, power station, power generation, household, pit latrines, etc. For example, lead, zinc, and copper are metals that come from traffic pollution, while nickel can be found in the environment, cadmium from industrial contamination, and chromium from the air. Accordingly, the determination of heavy metals would be the best scenario to consider public health as well as food safety. According to the Table 1, arsenic and lead were found very high in Ulaanbaatar city (capital city), while chromium and nickel elements were found in high amount in Erdenet. In Darkhan city, the arsenic content was lower than in other cities, while the content of other elements was higher. More specifically, arsenic content was the highest in all cities, while zinc was the lowest. Erdenet had a high content of heavy metals due to large-scale mining operations, while Darkhan may have had lower output than the other two cities due to less population and less transportation [2].

Table 21. Heavy metal concentration with their background values in the soil of three different cities in Mongolia (Source: [1])

City	Type of Indication	As	Cr	Pb	Ni	Zn
Ulaanbaatar	Concentration	28.04	16.56	43.11	21.26	106.11
	Background	14.17	13.04	37.91	14.74	114.10
Erdenet	Concentration	12.78	65.70	18.06	29.30	155.17
	Background	4.00	60.00	15.00	18.60	77.80
Darkhan	Concentration	3.33	31.90	20.90	19.49	67.26
	Background	3.33 [1]	38.20	46.66	12.73	52.30
	MPC	6.00	150.00	100.00	150.00	300.00

HEAVY METAL POLLUTION AROUND A COAL-MINING REGION

The study included heavy metals from Chinese coal mines: copper, lead, zinc, cadmium, chromium, arsenic, mercury and nickel. Nowadays, those metals which are main factors of plant growth and health are exceeding the limits which are affected by mining and natural alterations, affecting public health and soil quality. From the Table 2, it can be concluded that all 7 elements exceeded the standard [2].

HEAVY METALS IN SURFACE SOIL BASED ON SEMIVARIOGRAM

To provide more scientific knowledge about soil quality around the mining area, it is necessary to investigate and analyse the distribution and investigating the locations of heavy metals. Heavy metals from mining activities are enriched to specific levels, resulting in soil contamination. With the improvement of Information Technology, the study had access to do the investigation with geo-statistics in GIS while traditional investigations mainly focused on laboratory analyses. But these methods are both work effectively to examine heavy metal distribution. A spatial distribution plays key role in cleaning pollutants and preventing from upcoming errors. [3].

In Inner Mongolia, which is located in China has severe problem with heavy metal pollution because it has big source of mining. This study was focused on open-pit mining which collects a large collection of solid waste that has included heavy metal ions which might leak into soil through erosion and rainwater runoff. The coefficient of variation method indicated that zinc has small fluctuations while other elements (chromium, copper, manganese and nickel) had moderate fluctuations which mean the soil around the mining area got polluted by human activities. In this study, Maximum Difference Analysis has determined that copper and zinc contents are higher than the standard limitation in Inner Mongolia. A stepwise regression model was used in the study to provide more quantitative data. Overall, the statistical analysis can effectively summarize the distribution of metals but also supplements the traditional research techniques of soil properties. As a result, the heavy metal content in the center of the mining area was the highest in comparison with east and north side of the studied area. The effect of diffusion is also one of the considerations of heavy metal distribution. Because there is no river around the area, the distribution of heavy metal could change the content of the metals in soil [3].

Table 2. Heavy Metals content of the soil (Source: [2])

Statistical parameter of HMEs	Hg	Cd	As	Cu	Pb	Ni	Zn
Maximum	0.17	0.56	11.30	42.61	63.52	49.77	129.29
Minimum	0.01	0.03	4.21	9.82	19.66	13.24	31.32
Mean	0.03 ± 0.003	0.20 ± 0.016	8.99 ± 0.168	26.55 ± 0.753	27.62 ± 0.798	29.61 ± 0.644	66.68 ± 2.7
Median	0.02	0.18	9.16	26.09	26.38	29.83	64.50
Standard deviation	0.02	0.12	1.28	5.74	6.07	4.91	21.17
Variable Coefficient/%	66.67	60.00	14.24	21.61	21.99	16.57	31.75
Soil background value of Shandong Province, China	0.019	0.084	8.6	24.0	25.8	25.8	63.5

INFLUENCE OF DIFFERENT URBAN STRUCTURES ON METAL CONTAMINATION

Metals pose a threat to public health because they can have various adverse health effects. Metal toxicity is caused by the potential production of highly reactive species, such as reactive oxygen species (ROS) and other free radicals, which can cause DNA damage, protein depletion, and lipid peroxidation. Although some metals, such as Copper (Cu), Zinc (Zn), and Chromium (Cr), are necessary for human nutrition, an excess of them poses several health and environmental risks. Cr, for example, is classified as a human carcinogen by the International Agency for Research on Cancer (IARC) due to its potential mutagenic properties. Furthermore, Cr toxicity has a significant impact on plant biological processes. Some metals, such as Lead (Pb) and Aluminium (Al), have no known beneficial effects on living organisms. On the other hand, Pb is classified as possibly carcinogenic to humans by the IARC. Chronic exposure to Pb causes infertility, paralysis, mental retardation, brain and kidney damage, and other health problems. Al is known to cause a variety of human diseases, including Alzheimer's. As a result, metals rehabilitate pollutants in the environment and living organisms. Metals are produced by various anthropogenic and natural processes, such as weathering the Earth's crust, industrialization, and mining. However, heavy traffic is a significant source of metals in urban areas. Metals associated with dust are transported away from the sources of generation by wind and settle in urban areas. As a result, metal exposure risk in various metropolitan cities has become a significant concern for public health practitioners. Each town has a distinct urban structure and land use pattern, resulting in varying contaminant exposure levels for its residents. The arrangement and relationships of the arrays of services, goods, and residents create a distinct urban structure for each metropolitan city, which changes over time. The impact of urban design and land use distribution patterns on the environment is poorly understood [4].

SOIL POLLUTION

Soil is one of the most important factors in human life on earth, but it is often polluted by human activities. [6] Many human activities, such as waste disposal, industrial waste, military training, and farming reduce soil quality with high levels of toxicants [7]. There are various types of pollution, one of which is heavy metal pollution, caused by toxic levels of heavy metal pollutants [8]. Heavy metal pollution has received the attention of researchers worldwide, mainly due to its health effects on living beings [9]. Human biology is full of instances where heavy metal toxicity has led to mass deaths [10]. Heavy metals are toxic to living organisms at excessive concentrations, but some are essential for no plants' average healthy growth and reproduction at low but critical concentrations [8]. The heavy metals important in trace elements to plants include Co, Cu, Fe, Mo, and Zn, and for animals are Cr, Ni, and Sn. The heavy metals Cd, Hg, and Pb are not essential for plants or animals [9]. The objective of this study is to monitor and analyze the levels of heavy metal in the examined areas which required for measuring the rate of contamination and describe the way of controlling. In Mongolia, there are just a few researches dealing with the survey of heavy metals in soil in the mining area (Gobi desert), where the examination investigated the presence of 17 harmful metals (As, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Sn, W, V, Y, Zn, and Zr) in samples collected from five areas of three cities with Inductively Coupled Plasma Mass Spectrometry (ICP-OES) which is the most elemental analysis technique. Samples were collected from three different cities like: Ulaanbaatar (ger and garden areas), Arkhangai (mountain and river-side), and Dundgovi (mining area: Gobi desert).
This type of examination can be used to evaluate the health quality of the biosphere in the investigated areas. The present study is focused on the determination and the how these toxic elements are spread what are their effects on the quality of the investigated ecosystem areas. Depending on the results, I can particularly suggest the way to remove such contaminations from the ecosystems in the investigated areas. Under the conditions mentioned above, it must undertake health of local population and the protection rate in the ger area.

MATERIALS AND METHODS

Samples collection and locations

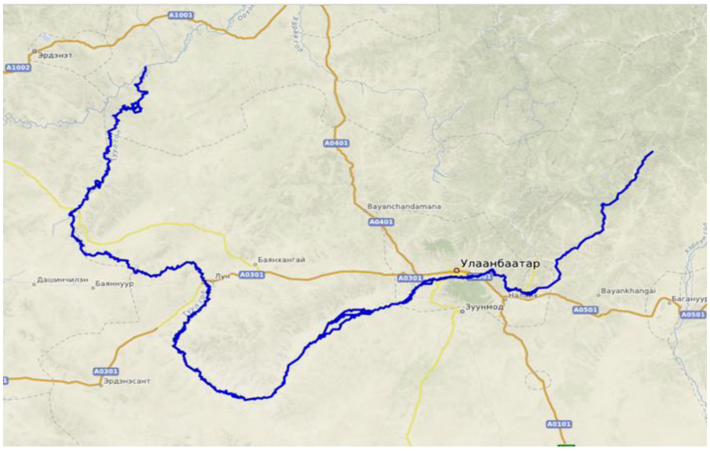


Figure 1. The position of Ulaanbaatar

In this geographical region, the characteristics classification of soil this region is included within the Khentii subrange inside the Khangai range, and darkish-brown (Kastanozems) and mountain darkish-brown soil (Mollic Cambisols) which cover most of the area. Two different soil samples were collected from Ulaanbaatar city (Figure 2): 1. Garden in an urban area and 2. Ger district
The population of Ulaanbaatar is about 1.5 million, with ger districts housing which occupy more than half of the houses (193,529) according to the statistics of 2019. A ger household consumes around 1 million tons of raw coal (as energy source) annually, which obtains from the coal mines of Baganuur and Nalaikh. In each year, about 200,000 tons of coal ash is disposed in unauthorized and unregulated locations such as public rubbish sites and ravines around the ger region due to a lack of control for coal

ash disposal in the ger area. Accordingly, coal ash has become one of the main sources of soil pollution in Ulaanbaatar's ger district. When compared to other geological materials, coal ash includes high levels of heavy metals because the concentration of heavy metals is enriched 4 to 10 times after burning and it has bad influencing on the public health in the investigated area. The toxic impacts of these heavy metals are easily conveyed by air and can negatively affect the population health throughout ingestion, inhalation, and skin contact. Furthermore, these heavy metals quickly pollute the ecosystem environment, including soil and water. Arkhangai aimag (Figure 2) is a province located slightly in the West of Mongolia. Agriculture, particularly animal husbandry, is the primary source of income. The soil samples were collected from mountainous and riverside areas. Last but not least, samples were also collected from the mining area (Figure 2) to investigate the frequent content of heavy metals in the soil samples. Erdenes Silver Resource LLC (the name of the company) is located in Dundgobi Aimag, the middle segment of the Gobi desert.

Figure 2. Collection points of the soil samples

The mining area

Open-pit mining is a surface mining technique that extracts minerals from an open pit. One of the most common methods used worldwide for mineral mining and does not require extractive methods is Open-pit mining. This surface mining technique is used when mineral or ore deposits are relatively close to the Earth's surface. The steps of an opencast mining operation are done as following: 1. Drilling 2. Planning 3. Blasting 4. Hauling 5. Crushing. These operations need to be carefully planned for proper mine planning and design to prevent extra loads such as operating costs, environmental footprints, etc. Erdenes Silver Resource LLC is committed to minimizing the negative impact of mining operations on the project area (Figure 3), avoiding and preventing any adverse environmental effects. The company follows the principle of ensuring and supporting the participation of local people in the implementation.

Figure 3. Mining area

Sampling

- Twenty-two soil samples were collected from:
- Ger district,
- Garden in an urban area,
- Mining area,
- River-side, and
- Mountainous area for three cities:
- Ulaanbaatar city
- Arkhangai province
- Dundgovi province
- The collection of soil samples was conducted through the following steps (Figure 4):
- Selecting sampling spot
- Removing the surface litter at the sampling spot
- Making "V" shaped cut to a depth of 15-20 cm in the sampling spot
- Collection of soils
- Mixing the soil samples thoroughly
- Removal of materials like stones, gravel, and roots
- The thoroughly mixed sample is quartered by dividing it into four equal parts.
- The remaining quarters are mixed after discarding two opposite quarters.
- Collecting the sample in a polyethylene bag
- Labelling the samples

Figure 4.. Collection of samples

Approximately 750-800 gr of surface soil (20cm depth) samples were obtained with a shovel from each area, and placed in plastic bags. The collected soil samples were transported to the laboratory of Khanlab LLC, Ulaanbaatar, Mongolia for further analysis using the sample-box cab.

Khanlab LLC

Khanlab LLC is a mineralogy and environmental analysis laboratory based in Mongolia. The company operates according to national standards, conducts mineral research and analysis by more than 100 methods and techniques of selective chemical and instrumental analysis, and accurately identifies more than 70 elements and compounds.

Applied Method

The aqua regia was used to extract the total heavy metal content of the soil samples according to Mongolian standard test method for soil. For each soil sample, the extraction was performed in triplicate. Inductively coupled plasma - optical emission spectrometry (ICP-OES) is a technical method using plasma and a spectrometer to detect the composition of elements in liquid-phase samples. Since 1974, the procedure has been commercially accessible. It has become frequently used in systematic research for more particular analytical goals due to its dependability, multi-element choices, and fast throughput. The technical procedure of the detection is shown in Figure (5). Figure (5) summarized the principle routine work with ICP –OES [W-1]

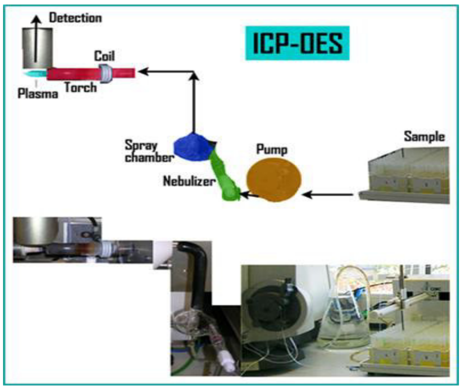


Figure 5. ICP-OES (Source: W-1)

STATISTICAL ANALYSIS

The values in the showing figures are the average of three replicates and the histograms show the standard deviations at all treatments. Linear registration was used to determine the relationship between the metal concentrations in different locations, and also R^2 was calculated for each metal.

RESULTS AND DISCUSSION

Comparison Between Heavy Metal Contents In Different Samples

The following Figures from 6 to 17 show comparisons between results of heavy metal content in different samples with standard limitations in Mongolia.

Evaluation of arsenic in different soil samples

Inorganic arsenic compounds are more hazardous than organic arsenic compounds. High doses of arsenic can be fatal, especially if taken in a short time. While long-term exposure to low quantities of arsenic has no immediate consequences, exposed persons can develop cancers of the skin, bladder, liver, lungs, and kidneys. Arsenic levels in drinking water can cause ulcers or discoloration of the skin on the feet, hands, and chest. Children are especially vulnerable to contamination because they put items in their mouths, ingest dirt, and spend more time outside. Inorganic arsenic is a carcinogenic chemical. The health risk caused by arsenic-contaminated soil is determined by the toxicity of Arsenic and the amount of arsenic to which humans are exposed through soil contact. According to research on the toxicity of arsenic and the possibility for individuals to be exposed to arsenic in soil, arsenic-contaminated soil may constitute a public health risk in some polluted locations. Arsenic poisoning can have a wide range of adverse health consequences

Figure 6 indicates that arsenic levels in all categories are more significant than the threshold, particularly in the ger district. Aside from the ger district, the mining result shows a larger quantity than the standard limits. The sample from the mountainous location has the lowest impact, although it is still higher than the standard.

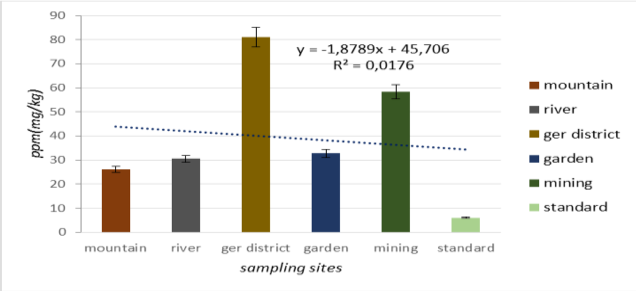


Figure 6. Evaluation of arsenic in different soil samples

The widespread use of arsenic in industrial and agrochemical applications has been identified as one of the few causes of groundwater and sediment arsenic contamination in the environment, with far less severe effects than natural causes. In the physical approach, the concentration of arsenic in the soil can be reduced by using biological meaning such as bioremediation or phytoremediation [13], by cultivating hyper-accumulating plant.

Determination of chromium in different soil samples

Chromium (Cr) contamination is a major environmental problem that negatively influences our environment and natural resources, particularly water and soil. Excessive exposure might increase accumulation levels in human and animal tissues, resulting in harmful consequences. Several studies have found that chromium is a hazardous element that interferes with plant metabolic functions, limiting crop development and production and lowering vegetable and grain quality. Chromium exposure can occur by inhalation (breathing it in), ingestion (eating or drinking it), or direct touch (getting it on your skin). Air, food, drink, and polluted soil and groundwater can all be sources of exposure. In all places, the level of chromium in soils from different areas is lower than the requirement.

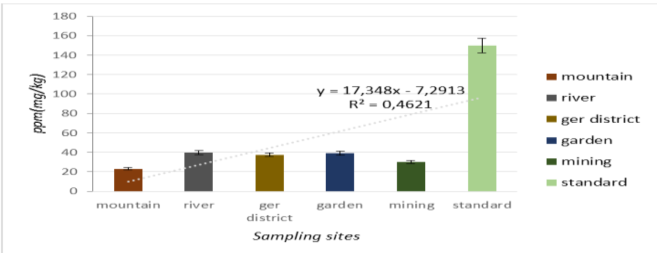


Figure 7. Determination of chromium in different soil samples

Measurement of copper in different soil samples

When copper (Cu) enters the soil, it forms strong bonds with organic substances and minerals. As a result, it does not move far after being released and seldom reaches groundwater. Copper may travel long distances in surface water, either suspended on sludge particles or free ions. Copper may disrupt soil activity by negatively influencing the action of microorganisms and earthworms. Because of this, organic matter decomposition may be significantly slowed. When farming soils become contaminated with copper, animals absorb levels that are harmful to their health. Copper poisoning mainly affects sheep since the effects of copper emerge in low quantities. Copper poisoning in plants can reduce iron absorption and limit development. Excess copper in the soil might hinder seed germination. Excessive use of copper-containing fungicides and industrial activities can result in high soil copper levels (such as mining). Copper also demonstrates that all results are less than the standard limitation in the Figure (8).

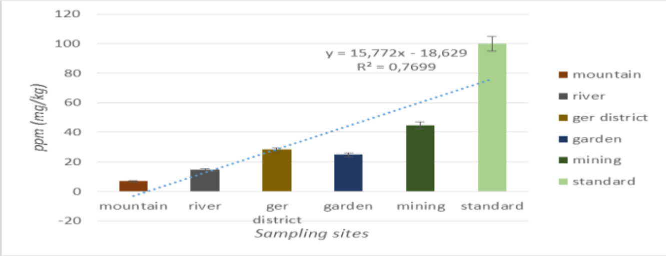


Figure 8. Measurement of copper in different soil samples

Detection of iron in different soil samples

Soil typically contains between 1% and 5% iron (Fe), but because most of this iron is inaccessible, determining an appropriate level for soil is challenging. According to some estimations, the ground should hold at least 0.001 g of iron per 100 g (or 10 mg/kg). The Figure (9) below illustrates no substantial variance in iron levels across different zones.

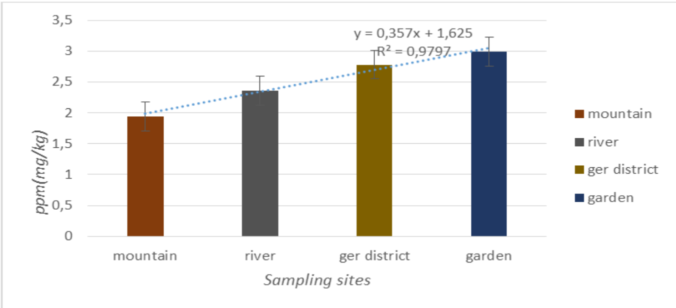


Figure 9. Detection of iron in different soil samples

Estimation of cobalt in different soil samples

Because cobalt (Co) is extensively distributed in the environment, individuals may be exposed to it by breathing air, drinking water, or eating cobalt-containing food. Skin contact with cobalt-containing soil or water may potentially increase exposure. Cobalt is seldom free in the environment, but when cobalt particles are not attached to soil or sediment particles, absorption by plants and animals is increased, and accumulating in plants and animals may occur. As indicated in the graph, the cobalt concentration in the Ger district is the highest compared to the others. However, overall data suggest that cobalt levels in various places are lower than the statutory limit (Figure 10).

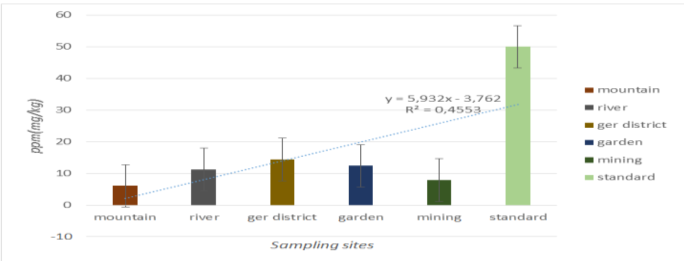


Figure 10. Estimation of cobalt in different soil samples

Content of manganese in different soil samples

Manganese (Mn) is an important element which has a role in normal physiological properties of humans and animals. Low concentration of Mn is important in the food and has nutritive value for humans. Meanwhile the excess of Mn concentration has a chronic effect to human health [11]. The higher concentration of Mn is harmful to the human life [12]. The high concentration of Mn can cause a syndrome called manganism [11]. Also, Mn is an important element for plant growth, but it is toxic at higher level. Various crops have different tolerant regarding to the toxicity of Mn. Soil acidity is response to form the Mn^{2+} ions into the soil solution. The following chemical reaction illustrates this process:

$$\mathrm{Mne}^- + 4H^+ + 2e^- \rightarrow \mathrm{Mn}2^+ + H_2O$$

(solid Mn, not available to plants) (soluble Mn, readily available for plant uptake)

Figure 11 summarizes the Mn content in all areas is higher than the standard limit while the sample from the ger district hit the peak.

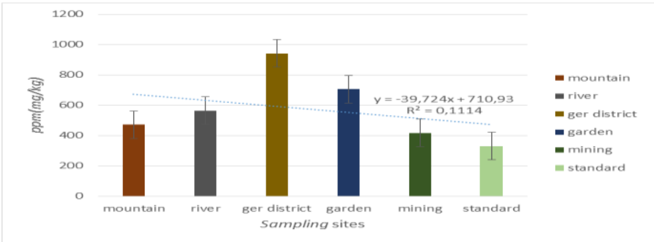


Figure 11. Content of manganese in different soil samples

Distribution of nickel in different soil samples

Nickel (Ni) is a potentially harmful element that pollutes land and water, jeopardizes food and water security, and impedes global sustainable development. Nickel pollution may be caused by industry, liquid and solid fuels, and municipal and industrial waste. Nickel exposure can result in several adverse health impacts, including allergies, cardiovascular and kidney illness, lung fibrosis, and lung and nasal cancer. The results in this basic Figure (Figure 12) do not differ much, and they are all below the limitations.

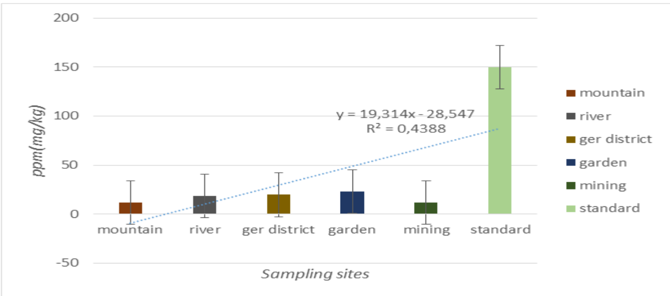


Figure 12. Distribution of nickel in different soil samples

Detection of lead in different soil samples

Lead (Pb) in soil is bound to the clay surfaces and particles of organic materials. The results showed that Pb content in samples collected from garden, mountain, and river-side is lowest, compared with its concentration in ger district which is highest and exceeds the standard limit. In addition, the Pb concentration in the mining region sample is the second highest after in the ger district (Figure 13).

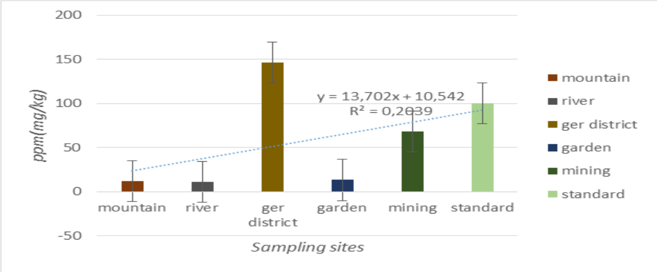


Figure 13. Detection of lead in different soil samples

Analytical measurement of vanadium in different soil samples

Vanadium (V) is a trace element that is abundant in the Earth's crust. Vanadium levels in bare rocks and minerals are naturally high, notably titaniferous magnetite. Anthropogenic sources of vanadium include the burning of fossil fuels and waste such as steel-industry slags. Vanadium contamination can disrupt ecological systems and cause animal poisoning and human sickness. The Figure below shows that the heavy metal distribution in different areas is below the standard limit. In contrast, rich metal content in the garden shows the highest result compared to others (Figure 14).

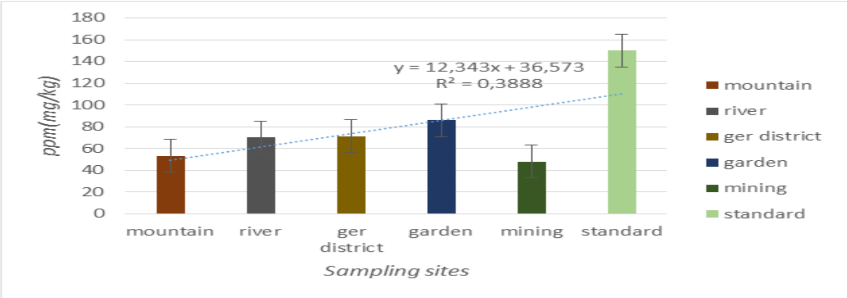


Figure 14. Analytical measurement of vanadium in different soil samples

Illustration of yttrium in different soil samples

Yttrium (Y) is rare in nature because it exists in tiny amounts. Yttrium is typically found exclusively in two types of ores. Because of its suitability for producing catalysers and polishing glass, the usage of Yttrium is still expanding. Because damps and vapours may be breathed with air, Yttrium is most harmful in the workplace. This can result in lung embolisms, especially if exposed for an extended period. When breathed, Yttrium increases the odds of developing lung cancer in humans. Finally, when it accumulates in the human body, it might endanger the liver. Yttrium is discharged into the environment, mainly by the petroleum industry. It can also enter the environment when home items are discarded. As Mongolian standard limitation of Yttrium has not been founded, the graph analyzed the yttrium content in 5 different samples. From the chart, Yttrium content in the garden soil sample was the highest compared to others.

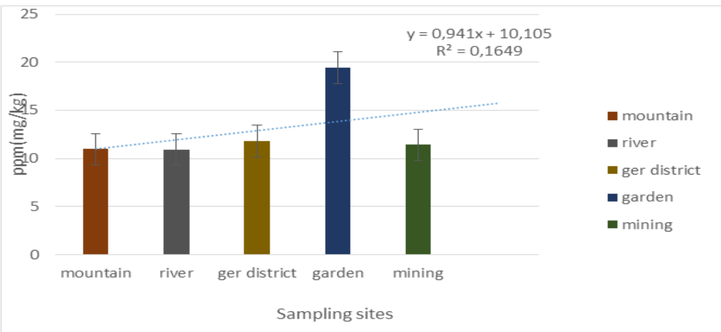
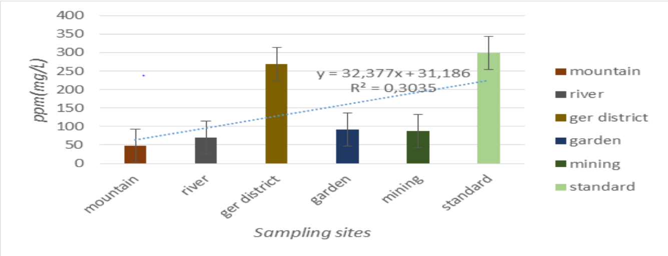


Figure 15. Illustration of yttrium in different soil samples

Examination of zinc in different soil samples

It is estimated that 17.3% of the global population is at risk of zinc (Zn) deficiency. Approximately half a million children under the age of five die each year from causes related to Zn malnutrition. As shown in the chart, Zinc content in the ger district was the highest compared to the rest; on the other hand, all results were below the standard limit (Figure 16).



Quantification of zirconium in different soil samples

There was no significant difference for the Zirconium (Zr), except the metal amount in a sample from the riverside was a bit higher than the others (Figure 17).

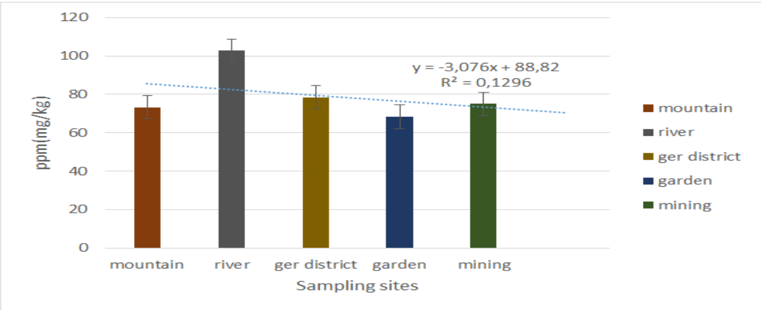


Figure 17. Quantification of Zirconium in different soil samples

Examinations of Cadmium, Molybdenum, Antimony, Tin, and Tungsten in different soil samples

Cadmium (Cd), Molybdenum (Mo), Antimony (Sb), Tin (Sn), and Tungsten (W) were also tested in five different samples, but the results were below what the ICP-OES could detect. The results of this research work are to some extend agree with the recent studies for example: metal ions act as essential raw materials for applied methods and valuable intermediates in element extraction. Recent studies concluded that pollution of heavy metals is a good risk to reduce the health of different environment [14]. Also, it was found that there is a little information about the effect of heavy metals from urban regions on the ecosystem in Mongolia [15]. Ulaanbaatar which is the capital of Mongolia is also acts as the center of socio-economical, and is characterized as the central city for industrial, and transport activity in Mongolia [15]. In Mongolia, several locations are highly located by high human density e.g., as in Ulaanbaatar and these locations have minimum industrial efficiency during the recent years, and has highly polluted with heavy metals that affect the urban life. During the present study, it was found that contamination of detected heavy metal indicated the rate of pollution in Mongolian soil which affects the human life-style. In Mongolian capital city, it was mentioned that the As pollution was high due to its origin from three power plants in the city as well as the traffic activity which increase the concentration of in Pb pollution [16]. The results of the present diplom work agree with the authors regarding to the contamination of the capital city with As and Pb. Batjargal et al. [16] mentioned that the level of the concentrations of As, Cd, Cr, Cu, Ni, Pb, and Zn in soils close to the major roads in Ulaanbaatar and the level of Pb concentration in the topsoil was slightly higher than the standard in case of samples collected from ger. These results are agreed with our results too.

Battsengel et al. [17] studied the distribution of heavy metals and their effects on the human health in ger region in the capital of Mongolia using the same method of extraction and method of detection. They mentioned that Mo and As were the most enriched elements compared with the other elements. But my results showed that the As was detected also in higher concentration but Mo was at low as the can not detected. Also, they mentioned that Zn and Pb have higher pollution indexes and more toxic element due to the ecological risk. I have obtained similar results.

CONCLUSION AND FURTHER TASK

Metal distribution in soil samples is one of the most important characterizations of soil quality as well as the environmental health too. Climate and meteorology, soil parent material, terrain, landscape, plant covering, human activities, and other factors influence soil formation and quality. Large-scale of mining operations result in land occupancy which can cause plant damage, soil layer damage, and other behaviors such as in air pollution, etc.

In Mongolia, there are just a few researches dealing with the survey of heavy metals in soil in the mining area (Gobi desert), where the examination investigated the presence of 17 harmful metals (As, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Sn, W, V, Y, Zn, and Zr) in samples collected from five areas of three cities with Inductively Coupled Plasma Mass Spectrometry (ICP-OES) which is the most elemental analysis technique. Samples were collected from three different cities like: Ulaanbaatar (ger and garden areas), Arkhangai (mounting and river-side), and Dundgovi (mining area: Gobi desert).

Depending on my investigation, I have to mention that he results of this study showed that the detection of the heavy metals were as following:

1. Concentration of Ar was higher in ger and mining than other habitats as well as the standard limit too.
2. Concentration of Cr was very low in all investigated ecosystems which similar to Cr, Co, and Ni.
3. Concentration of Fe was not found in mining, but its concentration was higher in garden and ger than in mountain and river-side.
4. Concentration of Mn was higher than the standard limit in all investigated habitats but the highest value of concentration was detected in ger followed by in garden and the lowest level was detected in mining.
5. Regarding to Zn and Pb, their concentrations were all lower than the standard limit given by the government in all locations except in case of ger area.
6. Concentration of V was detected in all examined locations in lower values than the standard limitation given by the government. The highest level of V was found in garden without any significant differences with its values in riverside and ger area.
7. Concentration of Y was found at highest concentration in garden soil and its concentration in other analyzed locations was not significant.
8. Concentration of Zr was found to be higher in river-side than in any other location.

The mine operation is estimated for a total of 5 years. The relevant professional organization and its laboratory will conduct environmental monitoring and analysis related to open-pit mining. An annual ecological action plan should be developed for the open pit project.

The current state of urban development and socio-economic growth, scientific and technological progress, recent changes, and the future shorten development policy issues based on urbanization trends; the medium and long term requires planning and implementation. Mongolia's long-term development policy - 2050 is detailed in the document.

The following significant steps are estimated to be taken:

- Implement a person-centered development policy, develop capable, ethical, and responsible citizens
- Ensure equal participation and support for businesses through government policies to increase employment
- The city has become a unified standard for citizens to study and work safely to create favourable living and travel conditions in the environment
- Introduce environmentally friendly, advanced techniques and technologies for air, soil, and environmental pollution
- Optimal planning for the city's future and the proper urban planning policy implementation is the basis of urban development and is scientifically based

- Reflects modern policies and solutions that have an accurate budget estimate to develop and implement planning
- Creating a diversified and intelligent public transport network, zones connecting the city with satellite cities

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