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An Analysis of Heavy Metal Content in Urban Soils of Moscow (Zinc , Lead and Copper)

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Abstract — Heavy metal pollution in soil and water arising from anthropogenic sources continue to pose a great challenge to human and animal population. Since heavy metals in the environment have continued to increase, there is need to determine their levels in the environment for efficient environmental management, hence the need to determine the levels of heavy metals in the soil in Moscow city. The heavy metals that were analysed included Zn, Pb, Cu. 18 soil samples were collected from different coenoses with diferent depths. The soil samples were prepared and analysed for heavy metals using atomic absorption spectroscopy. The researcher analysed the distribution of heavy metals in the urban soils of Moscow city in the northern administrative District of Moscow. The conclusions allow to reveal existing environmental irregularities, asses the content of heavy metals in urban soils, evaluate the peculiarities of background anomalies with regard to reduce man caused impact on the environment. The objective of this research was to investigate the distribution, content of heavy metals in urban area soils in the Northern Administrative District of Moscow city.

Keywords: *Lead, Copper, Zinc, Urban, Soils, Pollution Moscow, Absorption spectrometer, heavy metals.*

Introduction

Pollution is a worldwide problem and its potential in influencing health of the human population is great (Khan and Ghouri, 2011). The impact of pollution in the vicinity of overcrowded cities and from industrial effluents and automobiles has reached a disturbing magnitude and is arousing public awareness (Begum et al., 2009). Excessive levels of pollution are causing a lot of damage to human and animal health, plants including tropical rain forests as well as the wider environment (Khan and Ghouri, 2011). Pollution is the cause of many diseases, which affect not only the old but also the young and the energetic and all animals and plants (Kanmony, 2009). The most common environmental pollutants in the world are heavy metals (Papatilippaki et al., 2008). The presence of heavy metals at trace level and essential elements at elevated concentration causes toxic effects if exposed to human population (Fong et al., 2008). The knowledge of heavy metal accumulation in soils, the origin of these metals and their possible interactions with soil properties are a priority in many environmental monitoring (Qishlaqi and Moore, 2007). The accumulation of heavy metals in agricultural soils is of increasing concern due to food safety issues and potential health risks as well as its detrimental effects on soil ecosystems (Qishlaqi and Moore, 2007). Metal poisoning arise from heavy metals that have toxic properties leading to adverse effects on human and ecosystem health (Voet et al., 2008). Chronic exposure to heavy metals leads to accumulation in the food chain which leads to an increased stock in biota, therefore magnifying the human dose (Voet et al., 2008). The chronic problems associated with long term heavy metals exposure include; Serious hematological and brain damage, anaemia and kidney malfunctioning (Sonayei et al., 2009). Heavy metals such as Pb and Cd are lethal even in very small doses. Lead has a negative influence on the somatic development, decreases the visual acuity and auditive thresholds (Simeonov et al., 2010). Acute exposure to Lead causes brain damage, neurogical symptoms and could lead to death (Simeonov et al., 2010).

During the research the researcher carried out a number of experiments to measure the gross content of heavy metals in urban soils of Moscow city. For the experiment to be carried out, the researcher collected 18 soil samples of urban soils from different sites in Moscow city. The heavy metals that were analysed in urban soils were Zn, Pb and Cu. The study areas were chosen naturally in Phyto coenoses in the Northern Administrative District of Moscow city: Oaks Park, Timiryazevskaya Street, and Square on the Great Academic Street urbanozem, Koptevo Boulevard, Mezhdomovaya Territory of Timiryazev Street and Forest Experimental Cottage Garden.

The main research objective was to:

1. Assess the gross content and the level of contamination of Heavy Metals in urban soils of Moscow city.

In order to archive the main objective, the study had the following specific objectives:

1. Determine extent and magnitude of contamination by Lead, Copper and Zinc in urban soils in Moscow city

2. Understand the effect of heavy metals on urban soil pollution

Hypothesis Testing

Hypothesis

The Null-hypothesis stated that there is no significant difference of heavy metal concentration in Urban Soils of Moscow by sites and Elements (Lead, Copper and Zinc).

H_o: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6 = 0$ *(Sites)*

H_o: $\beta 1 = \beta 2 = \beta 3 = 0$ *(Elements)*

The alternative hypothesis stated that there is a significant difference of heavy metal concentration in Urban Soils of Moscow by Sites and Elements (Lead, Copper and Zinc).

H_o: $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5 \neq \mu_6$ *(Sites)*

H_o: $\beta_1 \neq \beta_2 \neq \beta_3$ *(Elements)*

Materials and Methods

Research Methods

To characterise the general properties of the investigated soils, individual soil samples were determined: pH $_{H_2O}$ at a ratio of soil: water = 1:

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2.5, hydrolytic acidity, exchange of Ca^{2+} and Mg^{2+} by Turina method using 1M NaCl solution as a displacer, the degree of base saturation was found by calculation as well as the method of particle size distribution of pyrophosphate.

The total content of heavy metals was measured after incineration of the soil sample with acids. The content of heavy metals in the extracts was determined with an atomic absorption spectrophotometer. Analytical determinations of repetition - 3-fold. The researcher used the recipe analysis set out in the relevant manuals (Arinushkina E.V, (1970), Workshop ..., (1986); L.A Vorobiev, 1998).

Experimental Part

This chapter describes the results of the studies investigated, the general properties of the soil and the gross content of Lead (Pb), Zinc (Zn) and Copper (Cu) in urban soils under various coenoses.

General properties of the soils studied

Characteristics of physical, chemical properties and particle size distribution of the tested soil is given in Table 1.

Table 1. Properties of Urban Soils

site	Horizon, depth, cm	pH_{H_2O}	Exchangeable Cations		Hg	Ca: Mg	V, %	P < 0.01 mm, %
			Ca^{2+}	Mg^{2+}				
			Mg – Eq per 100 g Soil					
W	U_h 2-14	5.89	26.4	9.6	3.33	2.8	92	29.7
	U_{II} 14-55	7.10	21.6	14.4	0.48	1.5	99	28.6
	U_{III} 55-86	7.50	12.8	11.2	0.33	1.1	99	29.3
S	U_{II}16-47	7.36	30.0	8.0	0.32	3.8	99	21.4
	U_{III} 47-74	7.49	29.6	12.4	0.29	2.4	99	29.8
	U_{III} 64-88	7.72	30.4	9.6	0.21	3.2	100	24.9
	U_{II}16-47	7.39	18.6	3.4	0.31	5.5	99	12.4
G	U_h 3-14	6.55	30.8	9.2	1.56	3.3	96	23.4
	U_{II} 14-54	7.86	27.2	18.8	0.14	1.5	100	22.7
	U_{III} 54-86	6.89	24.4	5.6	0.89	4.4	97	29.0
X	U_h 2-12	7.19	37.2	6.8	0.40	5.5	99	30.2
	U_{II} 12-18	7.82	19.2	6.8	0.15	2.8	99	23.3
	U_{III} 18-67	7.70	23.6	20.4	0.20	1.2	100	17.7
F	U_h 0-11	7.37	45.2	12.8	0.43	3.5	99	30.6
	U_{II} 11-26	5.81	13.2	12.8	2.46	1.0	91	10.3
	U_{III} 26-64	7.31	12.8	9.2	0.36	1.4	98	25.7
Q	A_1 2-15	4.94	6.4	2.6	10.5	2.5	46	23.2
	A_2 15-36	4.83	4.3	1.2	5.7	3.6	49	21.4
	A_2B 36-65	5.03	5.4	1.5	4.8	3.6	59	24.1
	B 65-115	5.15	7.2	1.9	4.6	3.8	66	27.6
	C> 152	5.17	3.5	0.8	2.1	4.4	67	15.8

Therefore, the letters in table 1 above stands for the following study sites,
Q - Forest Experimental Cottage Garden
G - Square on the Great Academic street
X - Koptevo Boulevard
From the presented data in table 1 above it is evident that sod Podsolic soil in Experimental Forest Cottages characterised acidic medium and low content of exchangeable bases. pH_{H_2O} varies 4.83-5.17, exchangeable calcium content of 4.3 to 7.2 mg - eq / 100 g soil and the lowest amount was stated in Podzolic horizon. The magnesium content of the exchange and much less range from 0.8 to 2.6 mg - eq / 100 g soil. The ratio of Ca: Mg is the lowest in the horizon A1 - 2.5, and increases in the lower horizons profile to 3, 6-4, 4.

For the humus horizon is characterized by relatively high value of hydrolytic acidity - 10.5 mg - eq / 100 g soil. In the lower depths of the soil profile value hydrolytic acidity is reduced to 2, 1-5, 7 mg - eq / 100 g soil. The degree of base saturation in horizons A_1 and A_2, less than 50% in the lower horizons it increases to 59-67%.

Forming rocks has loamy sand particle size distribution, whereas the entire upper thick granulometric composition relates to a light loamy, and physical distribution of clay fractions of soil profile is uneven. The least of all the particle size is <0.01 mm which is contained in horizon A_2 – 21,4%, and the most is in the illuvial horizon B - 27.6%, due to their redistribution under the influence of the podzolic process.
Thus, the experimental forest garden soils that operates in urban environments under forest woody vegetation, characterised by the features typical of the zonal sod-podzolic soils.
Urbanozem formed in urban areas under various coenoses has its own specific

W - Oaks Park
S - Timiryazevskaya street
F - Mezhdomovaya Territory of Timiryazev Street
properties, they greatly differ from the zonal sod-podzolic soils. In most cases, they are characterised by neutral pH, as the researcher can refer from the pH_{H_2O} which is in the range of 5, 89-7, and 39. The individual layers of urbanozem (U_{III} Oaks Park, U_{II} U_{III} Timiryazevskaya Street, U_{II} Square on the Great Academic street urbanozem, U_{II} U_{III} Koptevo Boulevard) are slightly in the alkaline reaction medium, according to pH_{H_2O} = 7,50-7,86.

Typically, urbanozem replantozem are characterized by low acidity hydrolytic value not exceeding 0.5 mg - eq / 100 g soil. In rare cases the individual layers of urban soils of humus horizons the hydrolytic acidity values are greater than 1.5 mg - eq / 100 g soil (U_h Oaks Park, U_h Square on the Great Academic street urbanozem, U_{II} Mezhdomovaya Territory of Timiryazev Street). Further urbanozem replantozem are characterized by high metabolic calcium and magnesium ions. Thus, exchangeable calcium content ranges from 12-13 to 30-45 mg - eq / 100 g soil, the content of exchangeable magnesium from 3-7 to 20-21 mg - eq / 100 g soil. In this case, if the exchangeable calcium content in most cases decreases from top to bottom, and often quite substantially - by 2-3 times, in the distribution of exchangeable magnesium in the profile of urban soils general law is not observed. The ratio of Ca: Mg varies within a wide range from 1.0 -1.2 to 5.5. And if we compare the humus horizons of urbanozem on the other hand and the horizon A1 of Sod Podsolic soil with the other urbanozem with broader ratio Ca: Mg - 2,8-5,5, whereas Sod-Podsolic soil is at 2.5.
In accordance with the composition of the exchangeable cations is the saturation exponent

bases. In urban soils presented urbanozem base saturation is at a very high level. Within all of the soil profile it does not fall below 90% and usually close to 100%.

Thus, urbanozem has a qualitatively different characteristic soil absorbing complex compared with zonal sod Podzolic soils. The grain size distribution in urbanozem varies from medium sandy loam to uniform particle size distribution within the soil profile which does not always occur. For example, the Square on the Great Academic street has a particle size distribution with loamy fluctuation content fraction and physical clay from 23.4% in U_h horizon to 22.7% in the layer U_{II} and to 29.0% in U_{III} layer. Oaks Park urbanozem has fairly homogeneous particle size distribution. In all layers of the granulometry loamy, wherein the physical quantity of the clay particles remains practically unchanged in the profile being within 28, 6-29, 7%. Loamy particle size distribution within the profile is marked on urbanozem lawn along Timiryazev Street.

The particle size distribution may vary within the profile of urbanozem. For example, urbanozem Koptevo Boulevard U_h has a Loamy horizon which is characterised by particle size distribution. In the layer $U_{II,}$ the distribution size changes from light loam and in layer U_{III} sandy loam is observed. A different picture is observed in urbanozem Mezhdomovaya territory of Timiryazev Street. The U_h horizon has a medium loamy size distribution while the underlying layer U_{II} - sandy loam, and layer U_{III} has a particle size distribution of loamy.

In general, it can be assumed that the formation of the particle size distribution in urbanozem is primarily due to human activity, which resulted in a variety of particle size distribution of the different types of urban soil profiles that where analysed.

The Gross content of heavy metals in urban soils

From the atmosphere into the soil, heavy metals fall usually in the form of oxides and gradually dissolved into hydroxides, carbonates, exchangeable cations, etc. Therefore, data on gross content of heavy metals is only possible to characterize the overall degree of contamination of the soil, but they do not allow us to estimate the mobility of elements and their availability to plants. However, their content is important for the overall evaluation of the environmental situation. Determination results of gross amounts of Pb, Zn and Cu are shown in table 2.

Table 2. The gross content of heavy metals in Urban Soils, mg / kg

Table 2

Soil Sample	Horizon, depth, cm	Pb	Zn	Cu
Forest Experimental Cottage Garden (Sod-Podzolic)	A_1 2-15	8.8	16.1	6.9
	A_2 15-36	1.9	11.6	1.1
	A_2B 36-65	3.6	25.2	4.3
Oaks Park (urbanozem)	U_{h1} 2-14	20.1	104.4	52.6
	U_{h2} 14-55	25.2	87.8	37.6
	U_{III}	16.8	32.2	14.8
Timiryazevskaya street (urbanozem)	U_{h1} 0-16	98.7	307.2	68.2
	U_{h2} 16-47	40.5	42.3	21.5
	U_{III} 47-74	40.8	47.9	27.8
Mezhdomovaya Territory of Timiryazev Street, urbanozem	U_{h1} 0-11	43.9	42.6	29.0
	U_{h2} 11-26	9.8	39.7	19.4
	U_{h3} 26-44	51.6	122.4	87.4
Square on the Great Academic street urbanozem	U_{h1} 3-14	7.8	38.6	15.7
	U_{h2} 14-54	23.4	56.7	35.6
	U_{III} 54-86	6.8	28.4	4.2
Koptevo	U_{h1} 2-12	30.3	64.1	34.8

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Boulevard urbanozem	U_{h2} 12-18	23.6	62.0	22.6
	U_{h3} 18-67	30.2	99.7	35.9

According to the results in table 2, the data shows that soil differ from each other's gross content of Pb, Zn and Cu.

Sod Podzolic soil Forest Experimental Cottage Garden comprises 8.8 mg / kg of Lead in the horizon A_1 and A_2 and A_2B horizons reduced to 1.9 and 3.6 mg / kg. The Zinc content in the horizon A_1 is equal to 16.1 mg / kg, in horizon A_2 is reduced to 11.6 mg / kg, and in the horizon A_2B increased to 25.3 mg / kg. The copper content in the horizon A_1 equal to 6.9 mg / kg and reduced to horizon A_2 to 1.1 mg / kg and increases again in the horizon A_2B to 4.3 mg / kg. It is evident that in the sod-Podzolic soil contains Zinc most of all horizons, then it goes to Lead and the least copper.

The Least concentration of Lead, Zinc and Copper are in the Podzolic horizon A_2, from the A_2 horizon they are carried under the influence of the Podzolic process. Lead and Copper are mostly in the horizon A_1 where they are bound in Organic Matter, most Zinc in the horizon A_2B is leached from the upper horizons of the profile and fixed by clay minerals. The content of these elements in all soil horizons are considerably less than 0.5 Optimum Concentration.

In urbanozem Oaks Park the Lead content in the upper layer U_{h1} is equal to 20.1 mg / kg. In the lower depths lead content increased to 25.2 mg / kg for U_{h2} horizon and decreased to 16.8 mg / kg in the horizon U_{III}. The differences in Lead content in horizons U_{h1} and Uh_2 it's due to its movement from the upper horizon. The Zinc content in the horizon U_{h1} equal to 104.4 mg / kg and reduced to 87.8 mg / kg and horizon U_{h2} to 32.2 mg / kg in the horizon U_{III}. The same distribution along the soil profile is observed for copper. The copper content in the horizon Uh1 equal to 52.6 mg / kg and reduced to 37.6 mg / kg in the horizon U_{h2} and 14.8 mg / kg in the horizon U_{III}.

This implies that most of the Zinc contained in the soil in the uppermost horizon was greater than 0.5 optimum concentration, while in other depths less than 0.5 optimum concentration. In second place was copper content and the least of all the soil contained Lead but less than 0.5 optimum concentration.

Results obtained from Oaks Park soil samples was significantly more contaminated with heavy metals as compared with sod Podsolic Forest Experimental Cottage Garden Soils. According to the content in the upper layer Lead was 2 to 3 times, Zinc was 6 to 5 times and Copper was 7 to 6 time's greater than sod Podsolic. In the lower horizon Lead in the urbanozem was greater by 4 to 7 times, Zinc from 1 to 3 times of and Copper 3 to 4 times.

In urbanozem lawn on Timiryazevskaya Street the Lead content in the upper horizon U_{h1} was equal to 98.7 mg / kg. In the lower depths the Lead content is reduced to 40.5 mg / kg and horizon U_{h2} to 40.8 mg / kg in the horizon U_{III}. The differences in the content of lead between the horizons U_{h1}, U_{h1} and U_{III} may be associated with its main accumulation in the upper layer due to emissions of road transport and fixing soil organic matter. The Zinc content in the horizon U_{h1} was very high and equal to 307.2 mg / kg and 1 to 7 times the optimum concentration and is greatly reduced to 42.3 mg / kg and in horizon U_{h2} while horizon U_{III} reduced to 47.9 mg / kg. Lead accumulated mostly in the humus horizon.

The same distribution along the soil profile was observed for copper. The copper content in the horizon U_{h1} was equal to 68.2 mg / kg and reduced to 21, 5 mg / kg in the horizon U_{h2} while the researcher observed the slight increase to 27.8 mg / kg in the horizon U_{III}. In this case, copper is also mostly accumulated in the humus horizon. In the upper horizon Copper and Lead is more than 0.5 the optimum concentration and in horizons U_{h2} and U_{III} Lead, Copper and Zinc the researcher observed the concentration of these elements below 0.5 optimum concentration.

The results obtained from urbanozem Soils in Timiryazevskaya Street are significantly more contaminated with heavy metals as compared with Sod Podsolic Experimental Forest soil cottages. According to the content in the upper layer it was observed that lead was higher by 11 to 2 times, Zinc by 19 times while Copper by 9 times. It was further observed by the researcher that in the lower horizon the lead in urbanozem was higher by 11 to 3 times. For Zinc it was higher by 1 to 9 times and copper by 6 to 5 times.

In urbanozem lawn Mezhdomovaya Territory Timiryazev Street lead content in the upper horizon U_{h1} equal to 43.9 mg / kg. In the lower horizon U_{h2} lead content is greatly reduced to 9.8 mg / kg and in the U_{III} horizon is increased to 51, 6 mg / kg. The Zinc content in the horizon U_{h1} was equal to 42.6 mg / kg and reduced to 39.7 mg / kg in the horizon U_{h2} and greatly increased to 122.4 mg / kg in the horizon U_{III}. In this profile the researcher observed the main accumulation of lead occurring in the humus horizon and the lowermost layer. The same distribution along the soil profile is observed for copper. The copper content in the horizon U_{h1} equal to 29.0 mg / kg and reduced to 19.4 mg / kg in the horizon U_{h2} and greatly increased to 87.4 mg / kg in the horizon U_{III}. In this case, copper is also the most accumulated in the humus horizon and the lower layer

From the results, soil urbanozem Mezhdomovaya Territory Timiryazevskaya Street is much more contaminated by heavy metals in comparison with the Sod-Podzolic Soils from the Experimental Forest Cottage. The researcher observed that in the uppermost horizon it was more than 5 times higher in Lead content while for Zinc it was 2 to 6 times and for Copper it was 4 to 2 times higher. In the lower horizon Lead in urbanozem soils was recorded more than 3 to 14 times while Zinc 4 to 9 times and 3 to times for copper.

Urbanozem soils in Square on the Great Academic Street contained 7.8 mg / kg of Lead in U_{h1} horizon. The horizon U_{h2} Lead content increased to 23.4 mg / kg, and in U_{III} horizon it decreased to 6.8 mg / kg. The Zinc content in the horizon U_{h1} recorded 38.6 mg / kg while in horizon U_{h2} in the upper layer contained 56.7 mg / kg and in the lower layer which is horizon UIII it reduced to 28.4 mg / kg. The copper content in the horizon U_{h1} was equal to 15.7 mg / kg and increased in U_{h2} horizon to 35.6 mg / kg and reduced in horizon U_{III} to 4.2 mg / kg. It is evident that in this place urbanozem Zinc was contained in most of all horizons and then go to upper levels of copper and lead in the bottom.

It was observed by the researcher that mostly the Lead, Copper and Zinc accumulated in the second horizon U_{h2} of the soil profile. The content of these elements in all horizons of urbanozem soils was less than 0.5 minimum allowed limits.

With reference to the Data it was observed by the researcher that the urbanozem Soils in the Square on the Great Academic Street was significantly more polluted with heavy metals in comparison with the Sod-Podzolic soils of the Experimental Forest Cottage. According to the content in the upper layer in urbanozem Soils the Zinc was higher by 2 to 4 times while Copper by 2 to 3 times. In the lower horizon the Lead in urbanozem soils was higher by 1 to 9 times while Zinc by 1 time. Comparing the results with results in other soils, it is evident that the soil is less polluted.

In urbanozem lawn Koptevo Boulevard Lead content in the upper layer U_{h1} was equal to 30.3 mg / kg. The underlying horizon U_{h2} the lead content reduced to 23.6 mg / kg while in horizon U_{III} it increased to 30.2 mg / kg. The Zinc content in the horizon U_{h1} was equal to 64.1 mg / kg. Like in the upper layer Zinc reduced to 62.0 mg / kg in the horizon U_{h2} and again increased to 99.7 mg / kg in horizon U_{III}. Here, we have the distribution of Lead accumulation in the humus horizon and the lowermost layer. At the same time the same distribution along the soil profile is observed for copper. The copper content in the horizon U_{h1} equal to 34.8 mg / kg and reduced to 22.6 mg / kg in horizon U_{h2} and again increased to 35.9 mg / kg in the horizon U_{III}. In this case, Copper is also accumulated mostly in the humus horizon just like Lead metal and also in the lower layer U_{III}.

According to the content in the upper layer the Lead in urbanozem soil is higher by 3 to 4 times while Zinc by 4 times and Copper by 5 times. In the lower horizon in urbanozem Lead was higher over 4 to 8 times, 4 times zinc, copper 3 to 8 times.

Statistical Analysis

Analysis of variance (CRBD-*ANOVA-Test Result)*

This Complete Randomized Block Design Analysis of Variance (CRBD-ANOVA) test resolves the question whether there is a significant difference in concentration of heavy metals by sites and elements (lead, copper and Zinc) in urban soils of Moscow.

The Null-hypothesis stated that there is no significant difference of concentration of heavy metals (elements) by sites. While the alternative hypothesis stated that there is a significant difference of concentration of heavy metals by sites.

Table 3 *ANOVA*

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Sites	8014.515	5	1602.903	7.13943	0.004355	3.325835
Elements	6741.521	2	3370.761	15.01358	0.000973	4.102821
Error	2245.141	10	224.5141			
Total	17001.18	17				

Table 3 above shows the results output form Excel on ANOVA. After conducting the CRBD-ANOVA test, the results showed that there is enough evidence to reject the Null-Hypothesis since F = 7.13943 is greater than $F_{critical}$ = 3.325835 by Sites and F = 15.01358 is greater than $F_{critical}$ = 4.102821 by Elements. Also, in terms of the P-value = 0.004355 is less than the significant level $\alpha = 0.05$ by sites and the P-value = 0.000973 is less than the significant level $\alpha = 0.05$ by Elements. Based on the results above it is evident enough to conclude that there is a significant difference of Heavy metal concentration by both sites and elements (Lead, Copper and Zinc) in urban soils of Moscow.

Depending on the sites in which samples were taken (null hypothesis rejected). Mathematically the information is tabulated below:

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Table 4. Anova: Two-Factor without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
Q	3	26.5	8.833333	58.14823
W	3	130.5	43.5	785.89
S	3	231.17	77.05667	2372.55
F	3	139.9	46.63333	350.3522
G	3	72.4	24.13333	227.7192
X	3	134.4	44.8	698.6719
Pb	6	161.27	26.87833	378.9588
Zn	6	409.16	68.19333	1489.738
Cu	6	164.44	27.40667	183.2343

Therefore, the letters in table 4 above stands for the following sites,

Q - Forest Experimental Cottage Garden
W - Oaks Park
S - Timiryazevskaya street
F - Mezhdomovaya Territory of Timiryazev Street
G - Square on the Great Academic street
X - Koptevo Boulevard,

While the elements stand for,

Pb - Lead
Zn - Zinc
Cu - Copper

Conclusion

After critical data analysis it was concluded in this study that the medium gross content of heavy metals in the urbanozem was significantly high as compared to zonal Sod Podsolic Soil: Zn was five times higher, Pb 9 times higher while Cu was about 13 time higher in urbanozem. At the same time, it was noted that the medium sum of the content of Zn, Pb and Cu in many cases were higher in urbanozem of about 8 to 9 times higher than in the Zonal Sod Podsolic soils while in urbanozem of Timiryazevskaya Street was higher by 12 times.

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