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Research Article

Analysis of Heavy Metals and Other Elements in Soil Samples for its Physicochemical Parameters Using Energy Dispersive X-Ray Fluorescence (EDXRF) Techniques

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Abstract

The present study was conducted to determine the physico-chemical properties and the composition of trace elements of soil samples in agriculture lands. This study has been designed to analyze heavy metal contaminations in 12 soil samples collected at a depth 0-20 cm from the agriculture areas of Munshiganj using Energy Dispersive X-Ray Fluorescence (EDXRF) spectroscopy. This study revealed that the maximum Ca, Ti, Mn, Fe, Cu, Zn, Rb, Sr, and Pb contents in soil samples were 76293, 3911, 534, 44652, 57.50, 532, 101.45, 242.11 and 39.31 mg/ kg respectively. A physicochemical study of soil is based on various parameters like soil P^H, electrical conductivity (EC), TDS mg/L, Salinity. The value of soil P^H found to be 7.53 to 9.24, conductivity was ranging from 22.4-66.5 µs, Total Dissolved Solid (TDS) was ranging from 13.39-37.70mg/L and salinity was ranging 22.40-66.50 µs. Along with the experimental data, several environmental indices (Contamination factor, geo-accumulation index, enrichment factor, pollution load index, Quantification of Anthropogenic Concentration of Metal (QoC) have been identified for comprehensive assessment of our study site, which suggesting that these heavy metals Ca, Ti, Mn, Fe, Cu, Zn, Rb, Sr, and Pb might come in the samples due to anthropogenic activities.

Keywords: EDXRF; Heavy metal; Physico-chemical parameter; Pollution degree

Introduction

Bangladesh is a developing country which is largely depended on its modernization and enhanced industrial activities in many ways. As a result, it leads to the increased use of different fossil fuel in a large scale. This gives rise to air pollution in the city. So, concern about atmospheric particulate pollution in urban region is receiving growing importance worldwide [1]. The effect of soil contamination depends on soil properties since this control the mobility, bioavailability and residence time of contaminants [2]. The main anthropogenic sources of heavy metals are industrials areas, mine tailings, disposal of high metal wastes, leaded gasoline and paints, application of fertilizers, animal manures, sewage sludge, pesticides, waste water irrigation, coal combustion residues and atmospheric deposition from varied sources [3]. Industrialization, wars, mining and intensification in agriculture have aleft a legacy of contaminated soils around the world [4-8]. Since urban expansion, soil has been used as a sink for dumping solid and liquid wastes. It was considered that once buried and out of sight, the contaminants would not pose any risk to human health or the environment and that they would somehow disappear [9]. The main sources of soil pollution are anthropogenic, resulting in the accumulation of contaminants in soils that may reach levels of concern [10].

Heavy metals are the most persistent and complex kind of pollutants to remediate in nature. They not only degrade the quality of the atmosphere, water bodies, and food crops, but also threaten the health and well-being of animals and human beings. Metals accumulate in the tissues of living organisms because unlike most organic compounds they are not subject to metabolic breakdown. Among the heavy metals Zn, Ni, Co and Cu are relatively more toxic to plants and As, Cd, Pb, Cr and Hg are relatively more toxic to higher animals [11].

The soil profile refers to a vertical section of the soil down to and including the geological parent material. The nature of the profile is important in many aspects; plant growth including root development, moisture storage and nutrient supply. The profile is, therefore, the basic unit of study in assessing the true character of a soil. It usually displays a succession of layers that may differ in properties such as color, texture, structure, consistence, porosity, chemical constitution, organic matter content

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and biological composition. These layers, known as soil horizons, occur approximately parallel to the land surface. Each one of these layers has a designation called genetic horizons which express a qualitative judgement about development of the soil over time. Agricultural land and vegetables in sewage-irrigated areas were also found to be heavy metal and metalloid contaminated. Heavy metals are important from the viewpoint of their toxicity and essentiality and have been widely studied for their toxic effects and bio-accumulation in food chains. In addition to their essentiality for human nutrition, some micronutrients (e.g., Cu, Cr, and Ni) might be toxic at elevated concentrations [12]. Such activities have great impact on the ecology and agriculture as well as health and safety effects.

Materials and Methods

Study Area

Munshiganj Sadar is an upazila of Munshiganj District in the Division of Dhaka, Bangladesh. It is a part of the Dhaka Division and borders Dhaka District. Total land area is 235974 acres (954 km^2), out of which 138472 acres (560 km^2) are cultivable and 5609 acres (23 km^2) are fallow land. 40277 acres (163 km^2) of land is irrigated while 26242 acres (106 km^2) of land is under river. It has 14 rivers of 155 km passing through. In this study samples were collected from Munshiganj are below:

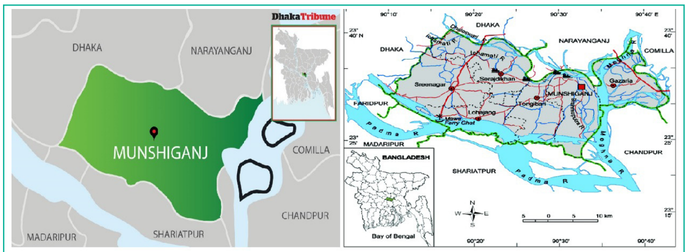

Figure 1: Map of the sample location Munshiganj district of Bangladesh.

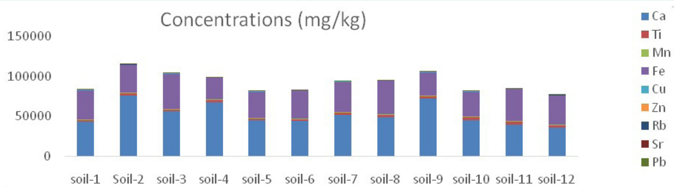

Figure 2: Stacked Column of heavy metals in different types of soil samples.

Table 1: Physico-chemical parameters of soil samples.

	Conductivity (EC) µS	TDS mg/L	Salinity µS	P^H
Control 1	**35.0**	**28.6**	**39.7**	**6.98**
1	53.0	31.8	52.7	8.97
2	51.3	30.7	51.0	8.88
3	44.9	27.1	45.0	9.09
4	54.4	32.4	54.0	7.98
5	22.4	13.39	22.4	8.78
6	66.5	37.7	66.5	9.24
7	55.7	32.9	55.3	8.97
8	49.0	29.4	49.4	7.53
9	40.2	24.6	38.6	8.69
10	24.6	14.75	24.6	7.92
11	34.3	20.2	34.2	8.66
12	34.4	20.8	34.8	8.38
Min	22.4	13.39	22.4	6.98
Max	66.5	37.7	66.5	9.24
Average	42.97	25.97	43.17	8.42

Preparation of Soil Samples

The soil samples after collection were sieved with a stainless-steel sieve to remove dirt. All samples were then taken into porcelain dishes separately. Each dish with the particular sample was placed in an oven at around 70 ºC until a constant weight was obtained. The dried mass of each sample was then pulverized to fine powder using a mortar and pestle, and preserved in a plastic vial with the identification mark inside a desiccator. Finally, the homogeneous powder was used to prepare pellet (7 mm dia. and 1mm thick using 10-ton pressure by a pellet maker (Specac, UK) for elemental analysis by Energy Dispersive X-Ray Fluorescence (ED-XRF).

Sample Irradiation and Method Validation

The experiments and sample irradiation have been done using EDXRF Spectroscopy System. The X-Ray beam of 22.4 keV from 109^{Cd} annular excitation source hits the target sample and the characteristic X-rays are produced. The [Si (Li)] detector (Canberra) having the resolution of 175 eV at 5.9 keV has been applied for the detection of characteristic X-rays. These detected X-Rays are converted into voltage pulses and amplified by the spectroscopy amplifier and processed in MCA having16K+channel. The energy resolution of a Si (Li) spectrometer system is a function of both the electronic noise and of fundamental statistical variations in the number of charge carriers produced within the intrinsic region for a given photon energy.

The irradiation and spectrum data acquisition are operated and controlled by a software package provided with the system. The standard materials were also irradiated under similar experimental conditions for construction of the calibration curves for quantitative elemental determination in the respective samples. The commercial software AXIL has been applied for the qualitative and quantitative elemental analysis.

Concentration Calibration

A direct comparison method based on EDXRF technique was used for elemental concentration measurement [13]. The energy of the peaks is indicated with the position of the x-axis and the relative intensities are represented by the length of the indicator line in y direction. That some lines are split although there is only one peak visible. The programme does separate between the K-A1 and K-A2 lines. After selecting the appropriate type of calibration curve. As the analysis is based on direct comparison the standards of similar matrices were used to construct the calibration curve in order to avoid any matrix effect. Three soil standards (Soil-7 /IAEA, Montana-1/2710a, Montana-2/2711a) were used for the construction of calibration curves for carrying out elemental analysis in soil. The calibration curve for each element was constructed based on the K X-ray intensities calculated for the respective elements present in standard samples. The curves were constructed by plotting the sensitivities of the elements as a function of their atomic number. The validation of the calibration curve constructed for elements present in the standards was checked through analysis of standard reference materials (Montana-1). The results obtained for elements of interest and certified values for corresponding elements are shown in the Table 2. All results in respect to certified known values were found to vary within the acceptable range of error.

Physicochemical Properties of Soil

The P^H EC, TDS and Salinity texture of the soil were measured. The soil/deioonized water was mixed (1 gm soil & 50 ml)

Table 2: Comparison between present results and the certified values of standard reference materials (mg kg^{-1}).

Elements	Soil (Montana- 1)					
	Results Obtained	± SD	Certified Values	Relative Error	(%) Error	%CV
K	21113	2.12	21700	0.027	2.71	0.01
Ca	9136	61.52	9640	0.052	5.23	0.67
Mn	2128	82.02	2140	0.006	0.56	3.85
Fe	39685	180.31	43200	0.081	8.14	0.45
Ni	8.67	0.33	8.0	-0.084	-8.38	3.83
Cu	3409	70.71	3420	0.003	0.32	2.07
Zn	4179	48.08	4180	0.000	0.02	1.15
As	1441	75.66	1540	0.064	6.43	5.25
Se	1.2	0.14	1.0	-2.00	-20.00	11.79
Pb	5382	38.18	5520	0.025	2.50	0.71

Table 3: Concentration of heavy metals in different types of soil samples.

Sample ID	Concentrations (mg/kg)								
	Ca	Ti	Mn	Fe	Cu	Zn	Rb	Sr	Pb
Soil-1	43241	2628	534	37219	52.20	236	89.21	199	19.23
Soil-2	76293	3126	502	34541	49.34	451	99.01	223	39.31
Soil-3	56128	2523	478	44652	54.39	520	85.90	209	30.41
Soil-4	67381	3301	516	27450	49.48	438	77.67	239	37.20
Soil-5	45394	2475	517	33287	44.35	428	88.76	242	28.54
Soil-6	44092	2774	428	35541	57.50	502	79.98	187	34.27
Soil-7	52188	2627	522	38292	51.00	387	86.56	189	26.50
Soil-8	49265	2976	501	42163	48.44	476	82.91	182	23.06
Soil-9	72153	3423	494	29879	42.19	532	94.76	195	29.03
Soil-10	45721	3911	498	31564	51.87	498	93.30	198	22.21
Soil-11	40231	3723	465	40287	53.01	389	101.45	215	18.09
Soil-12	36435	3251	519	36431	40.22	467	87.45	211	21.04
Max	76293	3911	534	44652	57.50	532	101.45	242	39.31
Min	36435	2475	428	27450	40.22	236	77.67	182	18.09
Average	52377	3062	498	35942	49.50	444	88.91	208	27.41
Background values	15000	26000	270	40000	13	45	68	87	22

stirred with a glass rod and allowed to equilibrate for 18 hours. The P^H was measured using a P^H meter (Jenway, 3051, UK). To measure Electrical Conductivity (EC), 1 gm soil sample was taken in 50 ml biker and 50 ml deionized water was added to the biker. Properly, biker was moved with glass rod for 5 minutes. The EC, Salinity, TDS was used using the EC meter (Hanna Instruments, HI 8033, UK). Before measuring P^H and EC, salinity, TDS, both meters were calibrated with the standard solutions [14].

Determination of Heavy Metals Contamination Status through Indices for Soil

The degree of soil pollution was measured by calculating the Enrichment Factor (EF), Geo-accumulation index (Igeo), Contamination Factor (CF), and Pollution Load Index (PLI) as per [15]. The equation used to calculate the contamination indices are:

EF=(Me/Fe) Sample/(Me/Fe) Background (1)

Where , EF refers to enrichment factor , (Me/Fe) sample refers to the ratio of concentration between the studied metal and Fe in the sample of interest; (Me/Fe) background is the natural background value (control soil in this case) of measured metal to Fe ratio [16]. However, EF lies in the classes as EF =1, crustal materials or natural weathering processes, EF <2 (Deficiency to minimal enrichment), 2≤ EF <5 (Moderate enrichment), 5≤ EF<20 (Significant enrichment), 20≤ EF<40 (Very high enrichment), EF ≥40 (Extremely high enrichment).

CF= Cm sample / Cm background (2)

Where, CF is the contamination factor; Cm sample is the concentration of a given metal; $Cm_{back\ ground}$ is the background value of the metal (control soil) [18]. CF is categorized [17]. as CF <1 (low contamination), 1≤ CF <3 (moderate contamination), 3≤ CF <6 (considerable contamination) and CF ≥6 (very high contamination).

$PLI= (CF_1 \times CF_2 \times CF_3 \times CF_n)^{1/n}$ (3)

Where, PLI is the pollution laod index; n is the number of metals to be analyzed and PLI is categorized by (29) as PLI <1 denotes perfection; PLI=1 denotes baseline levels pollutants; PLI >1 indicates deterioration of site quality.

Index of Geo –Accumulation (Igeo):

Index of Geo –accumulation (Igeo) has been used extensively to assess of heavy metal contamination or pollution in soils [19]. The Igeo of heavy metals in soils is calculated using the formula [20-21].

Igeo =Log2 [Cmetal/1.5 Cmetal (control)] (4)

Where Cmetal is the concentration of the heavy metal in the soil sample; Cmetal (control) is the concentration of the metal in the control sample; and the factor 1.5 was introduced to minimize the effect of possible variations in control values which may be attributed to natural sources [21]. The degree of metal pollution is assessed in terms of seven contamination classes based on the increasing numerical value of the index as follows: [22-23].

Quantification of Anthropogenic Concentration of Metal (QoC)

This model gives information on the percentage of metal concentration in putted by anthropogenic activities. This is calculated using the equation below:

Quantification of Anthropogenic Concentration of Metal (QoC) =X-Xc/X×100 (5)

Where x=concentration of the metal in the soil samples; and xc= concentration of the metal in the control samples [24].

Results and Discussion

Physicochemical Properties of Soil Samples

The quality of soil depends both on its physical properties (colour, texture, moisture contents, $P^{H,}$ etc). The physical and chemical properties largely determine the suitability of a soil for its planned use and management requirements to keep it most productive to a limited extent, the fertility of a soil determine its possible uses and to larger extent its yields [25].

Soil properties such as P^H, Electrical Conductivity (EC), Total Dissolved Solid (TDS) and Salinity particle size distribution are known to influence the interactions, adsorption and desorption process of heavy metals within the soil matrix [24]. The P^H of the soil samples in this work ranged from 7.53 to 9.24 (Table 1).

Soil pH ranges was reported by [26] as follows; <5.5 (strongly acidic); 5.5-5.9 (medium acidic); 6.0-6.4 (slightly acidic); 6.5-6.9 (very slightly acidic); 7.0 (neutral); 7.1-7.5 (very slightly alkaline); 7.6-8.0 (slightly alkaline); 8.1-8.5 (medium alkaline); and >8.5 (strongly alkaline). Thus the soils pH can be range from medium alkaline to strongly acidic pH. The minimum P^H of Sampling Point 8 (7.53) very slightly alkaline and Maximum pH of sampling point -6 (9.24) strongly alkaline. The electrical conductivity of soil samples (Table 1) ranged from Min to Max 22.4 to 66.5 µS and the mean of the EC 42.97 µS and same way to the samples of TDS ranged from 13.39 -37.7mg/L. The mean value of Salinity 43.17 µS and ranged from min to max value 22.4 µS to 66.5 [27].

Concentration of the elements (Ca, Ti, Mn, Fe, Cu, Zn, Rb, Sr and Pb) in soil samples are presented in Table 1. Maximum concentration of Ca was found in the sampling site Soil-2 (76293 mg kg-1) and Minimum concentration was found in the sampling site Soil-12 (36435 mg kg-1), whereas concentration of Ca according to world average value is 15000 mg kg-1. And same way, Maximum concentration of Pb was found in the sampling site Soil-2 (39.31 mg kg-1) and Minimum concentration was found in the sampling site Soil-11 (18.09 mg kg-1), whereas concentration of Pb according to world average value is 22 mg kg-1. other elements viz: Ti, Mn, Fe, Cu, Zn, Rb and Sr was found 2475-3911, 428-534, 27450-44652, 40.22-57.50, 236-532, 77.67-101.45 and 182-242 mg kg-1 respectively. Average concentrations of most of the elements are more or less identical to the World average value Pendias, et al [28] with an exception of Ti and Fe.

Contamination Factor (CF)

The level of metal contamination can be expressed by the contamination factor (CF). CF is the ratio between the metal content in the soil to the background value of the metal. It is an effective tool for monitoring the pollution over a period of time and defined as

CF = C metal / C background value (1)

The CF was classified into four groups: (a) CF <1 denotes as low contamination, (b) 1≥ CF <3 denotes as moderate contamination (c) 3≤ CF <6 denotes as considerable contamination and (d) CF >6 denotes as very high contamination.

CF was determined using Eq. (1) and it was observed that the CF value for Ti and Fe was found to below 1, indicating a low contamination rate (Figure 2). In case of Ca, Mn, Cu, Rb, Sr, and Pb the values of CF were (1<CF<3), which indicates moderate contamination of soil samples. However, finally the CF values for Zn were (3<CF<6), which indicates Considerable contamination of soils. At last, the CF values of all heavy metals were found in the decreasing order as Zn>Cu>Ca>Sr>Mn>Rb>Pb>Fe>Ti in Figure 3.

To determine the soil quality in the study area, Pollution Load Index (PLI) was calculated using the equation 3 developed by [29].

PLI= $\sqrt[n]{Cf1 \times Cf2 \times Cf3}$ (1)

Where, n is the total number of metals studied, and Cf is calculated as described in the ear

where, n is the total number of metals studied, and CF is calculated as described PLI provides a simple, comparative means for assessing a site or estuarine quality a value of 0 indicates perfection, a value of 1 indicates only base line levels of pollutants present, and values above 1 would indicate progressive deterioration of the site and estuarine quality [29]. PLI values are categorized into 3 levels as shown in Figure 4. The Pollu-

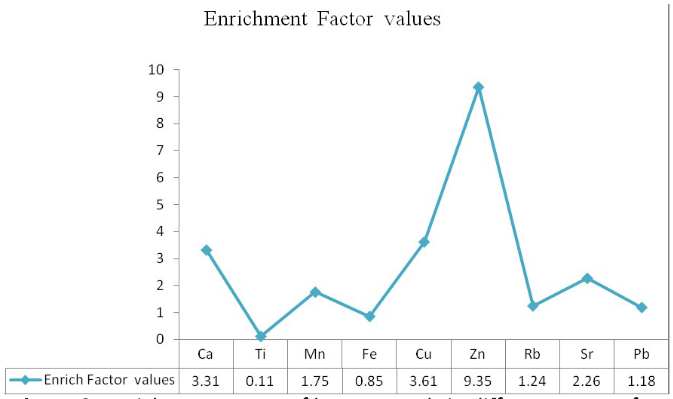

Figure 3: Enrichment Factor of heavy metals in different types of soil samples.

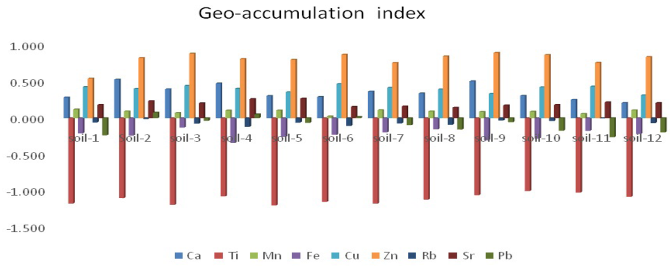

Figure 4: Geo-accumulation (Igeo) Index of heavy metals in soil samples.

Table 4: Assessment of degree of pollution by the heavy metals in soil samples.

Sample ID	Enrichment Factor (EF)								
	Ca	Ti	Mn	Fe	Cu	Zn	Rb	Sr	Pb
Soil-1	2.73	0.10	1.88	0.88	3.81	4.98	1.24	2.17	0.83
Soil-2	4.83	0.11	1.76	0.82	3.60	9.51	1.38	2.44	1.69
Soil-3	3.55	0.09	1.68	1.06	3.97	10.96	1.20	2.28	1.31
Soil-4	4.26	0.12	1.81	0.65	3.61	9.23	1.08	2.61	1.60
Soil-5	2.87	0.09	1.82	0.79	3.24	9.02	1.24	2.64	1.23
Soil-6	2.79	0.10	1.50	0.84	4.20	10.58	1.12	2.04	1.48
Soil-7	3.30	0.10	1.83	0.91	3.72	8.16	1.21	2.06	1.14
Soil-8	3.12	0.11	1.76	1.00	3.53	10.04	1.16	1.98	0.99
Soil-9	4.56	0.12	1.74	0.71	3.08	11.22	1.32	2.13	1.25
Soil-10	2.89	0.14	1.75	0.75	3.79	10.50	1.30	2.16	0.96
Soil-11	2.54	0.14	1.63	0.96	3.87	8.20	1.42	2.35	0.78
Soil-12	2.30	0.12	1.82	0.86	2.94	9.85	1.22	2.30	0.91
Sample ID	Geo-accumulation (Igeo) Index								
	Ca	Ti	Mn	Fe	Cu	Zn	Rb	Sr	Pb
Soil-1	0.284	-1.171	0.120	-0.207	0.428	0.544	-0.058	0.183	-0.235
Soil-2	0.530	-1.096	0.093	-0.240	0.403	0.825	-0.013	0.234	0.076
Soil-3	0.397	-1.189	0.072	-0.128	0.446	0.887	-0.075	0.205	-0.035
Soil-4	0.476	-1.072	0.105	-0.340	0.404	0.812	-0.118	0.263	0.052
Soil-5	0.305	-1.197	0.106	-0.256	0.357	0.802	-0.060	0.268	-0.063
Soil-6	0.292	-1.148	0.024	-0.227	0.470	0.871	-0.106	0.157	0.016
Soil-7	0.365	-1.172	0.110	-0.195	0.418	0.758	-0.071	0.161	-0.095
Soil-8	0.340	-1.117	0.092	-0.153	0.395	0.848	-0.090	0.144	-0.156
Soil-9	0.506	-1.057	0.086	-0.303	0.335	0.897	-0.032	0.175	-0.056
Soil-10	0.308	-0.999	0.090	-0.279	0.425	0.868	-0.039	0.182	-0.172
Soil-11	0.252	-1.020	0.060	-0.173	0.434	0.761	-0.002	0.218	-0.261
Soil-12	0.209	-1.079	0.108	-0.217	0.314	0.840	-0.067	0.209	-0.195

Table 5: Quantification of Anthropogenic Concentration of Metal Samples.

Sample Id	Ca	Ti	Mn	Fe	Cu	Zn	Rb	Sr	Pb
Soil-1	65.311	-889.346	49.438	-7.472	24.904	80.932	23.776	56.246	-14.399
Soil-2	80.339	-731.734	46.215	-15.804	26.347	90.022	31.318	61.065	44.029
Soil-3	73.275	-930.519	43.515	10.418	23.901	91.346	20.840	58.396	27.660
Soil-4	77.739	-687.640	47.674	-45.719	26.273	89.726	12.450	63.629	40.862
Soil-5	66.956	-950.505	47.776	-20.167	29.315	89.486	23.391	64.066	22.918
Soil-6	65.980	-837.275	36.916	-12.546	22.609	91.036	14.982	53.527	35.806
Soil-7	71.258	-889.722	48.276	-4.460	25.488	88.372	21.445	54.024	16.975
Soil-8	69.552	-773.656	46.108	5.130	26.838	90.546	17.979	52.178	4.605
Soil-9	79.211	-659.568	45.344	-33.873	30.815	91.541	28.242	55.450	24.222
Soil-10	67.192	-564.792	45.783	-26.727	25.061	90.964	27.114	56.137	0.946
Soil-11	62.715	-598.362	41.935	0.712	24.525	88.432	32.973	59.616	-21.628
Soil-12	58.831	-699.754	47.977	-9.797	32.321	90.364	22.242	58.786	-4.543
Average	69.86	-767.74	45.58	-13.36	26.53	89.40	23.06	57.76	14.79

tion Load Index (PLI) was found to index calculated of pollution by heavy metals in contaminated soil in figure 4. The values of sampling point soil-1 (596.06), soil-2 (755.16), soil-3(711.36), soil-4 (712.16), soil-5 (655.96), soil-6 (670.83), soil -7 (658.98), soil-8 (663.28), soil-9 (706.52), soil -10 (676.74), soil-11 (657.03) and soil-12 (633.06). Pollution Load Index (PLI) of heavy metals are getting the maximum values the sampling point 2 and minimum values sampling point sampling point 12. This study revealed that mean EF values of Ca, Ti, Mn, Fe, Cu, Zn, Rb, Sr and Pb followed the increasing order of Ti (0.11) <Fe (0.85) <Pb (1.18)) <Rb (1.24) <Mn (1.75) <Sr (2.26) <Ca (3.31) <Cu (3.61) <Zn (9.35). The EF values of 5 (five) heavy metals was reported to be <2 at sampling sites, and the minimal enrichment in the area.

The EF values for Sr (2.26), Ca (3.31), Cu (3.61) moderate enrichment in the area and remains between 2 and 5. The significant enrichment factor value in the area except for Zn (Table 4). This present study was found the Enrichment Factor (EF) values of maximum of Zn (9.35) and showed the Figure 5. Heavy metal inflow through sukhabuspur area, Munshiganj which cannot be severe in the future.

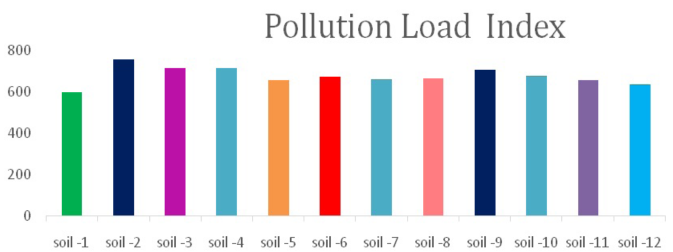

Figure 5: Pollution Load Index (PLI) of heavy metals in soil samples.

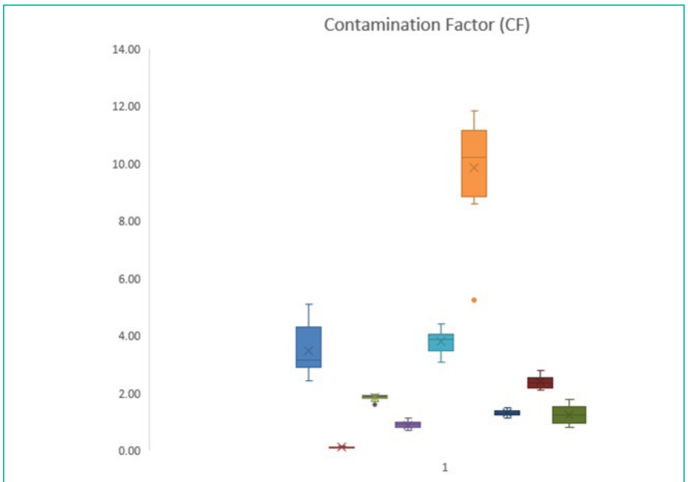

Figure 6: Contamination factor (CF) values of heavy metals in soil samples.

Quantification of Soil Contamination

Quantification of the anthropogenic input of heavy metals in soil is as presented in Table 5. The quantification of heavy metals obtained for the agricultural site below:

Zn>Ca>Sr>Mn>Cu>Rb>Pb

Zn	Ca	Sr	Mn	Cu	Rb	Pb
89%	70%	58%	45%	26%	23%	15%

There is anthropogenic input in soil of the study area. This is in indication that these metals are derived from the waste generated from the agricultural site. The degree of anthropogenic pollution is high for Zn (89%) Ca (70%), Sr (58%), Mn (45%), Cu (26%), Rb (23%) and Pb (15%) [30].

Conclusion

This present research showed that the physicochemical properties of the soils within the study areas. Soil samples were collected from twelve locations at Munshiganj area in the Division of Dhaka, Bangladesh. They were analyzed for Ca, Ti, Mn, Fe, Cu, Zn, Rb, Sr, and Pb by ED-XRF Spectrometer. The concentration of heavy metals in the samples were all higher than the control samples except Ti values. Thus, the study areas were not polluted as a result of anthropogenic activities. The results for average concentration revealed that the world average value has the lowest overall metal concentration in soil samples. All metals had higher concentrations than their background value except for Ti and Fe in soil samples. The calculated results of Contaminations factors (Cf) of heavy metals revealed the order of Zn>Cu>Ca>Sr>Mn>Rb>Pb>Fe>Ti respectively. The quantification of heavy metals obtained for the agricultural site are decreasing of metals Zn>Ca>Sr>Mn>Cu>Rb>Pb. The significant enrichment factor value in the area except for Zn maximum values. Such, the present study will provide sufficient knowledge to evaluate the significance of the problem related to especially environment as well as human beings.

Author Statements

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