TRACE ELEMENTS ANALYSIS OF SEDIMENT IN DOTHTAWADY RIVER FROM MANDALAY REGION

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Abstract

In this paper, Dothtawady River Sediments samples 1(RS-1), River Sediments sample 2(RS-2), River Sediments sample 3 (RS-3) and River Sediments sample 4 (RS-4) were collected from Mandalay region and analyzed to determine the elemental concentration by using Energy dispersive x-rays fluorescence (EDXRF) analysis. It was found that there are 14 element oxides such as Al_2O_3, SiO_2, Fe_2O_3, SO_3, K_2O, CaO, TiO_2, Cr_2O_3, MnO, Fe_2O_3, CuO, ZnO, SrO, ZrO_2 in the three River Sediment samples, the value of pH and conductivity were also measured. These result values were compared and discussed.

Keywords: EDXRF (Energy Dispersive X-Ray Fluorescence), pH, conductivity

Introduction

Sediment is a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water, or ice, or by the force of gravity action on the particles. Sediments are most often transported by water (fluvial processes), but also wind (Aeolian processes) and glaciers. Beach sands and river channel deposits are examples of fluvial transport and deposition, though sediment also often settles out of slow-moving or standing water in lakes and oceans. Rivers draining densely populated and industrialized areas carry huge loads of heavy metals fixed to their suspended matter.

The behavior of these heavy metals in the transition from fresh water to sea water is not well understood. In the euphotic zone of the marine environment, the photosynthetic planktonic population comes into contact with some part of these solids, the composition of which again is not well yet worldwide basis. Eventually, these inorganic solids together with a proportion of the biomass settle out and are incorporated in to marine sediments. Investigations of sediments in estuaries and rivers have been stepped up in recent years in order to study mobilization and mixing effects and to trace down the extent and distribution of heavy metal contamination. Both with respect to environmental and geochemical problems, the suspended phase are a very important component of estuaries and oceans. Heavy metals, which are often concentrated in the particulate phase, belong doubtlessly to the most toxic pollutants in the environment.

Aquatic ecosystems are affected by several health stressors that significantly deplete biodiversity. In the future, the loss of biodiversity and its effects are predicted to be greater for aquatic ecosystems than for terrestrial ecosystems. Sediments form a natural buffer and filter system in the material cycles of water. Sediment in our rivers is an important habitat as well as a main nutrient source for aquatic organisms. Sediment strata serve as an important habitat for the benthic macro invertebrates whose metabolic activities contribute to aquatic productivity. Sediment is also the major site for organic matter decomposition which is largely carried out by bacteria. Important macro-nutrients are continuously being interchanged between sediments and overlying water. Furthermore, sediment has an impact on ecological quality, because of their quality, or their quality, or both. It is observed that continuous accumulation of pollutants due to biological and geochemical mechanisms, and cause toxic effect on sediment dwelling organisms

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and fish, resulting in decrease survival, reduced growth, or impaired reproduction and lowered species diversity. Alkalinity may be caused by dissolved strong bases such as sodium hydroxide or potassium hydroxide (and other hydroxide containing compounds), and it may also be caused by dissolved carbonates, bicarbonates, borates and phosphates.

Materials and Method

Dothtawady River Sediment samples: River Sediment sample 1 (RS-1), River Sediment sample 2 (RS-2), River Sediment sample 3 (RS-3) and River Sediment sample 4 (RS-4) were collected from Mandalay region area. River Sediment sample 1 and sample 2 were collected from near the Shwesaryan pagoda, Pyin Oo Lwin Township in Mandalay region. River Sediment sample 3 and River Sediment sample 4 were collected from away from the Myitnge Bridge, Myit nge Township in Mandalay region.

River Sediment samples were collected in good quality glass container of (50) grams capacity without any air bubbles. The glass container were cleaned with nitric acid and dried. The glass container were tightly sealed after collection and labeled. Each River Sediment samples were prepared for energy dispersive X-rays fluorescence (EDXRF) analysis. The X-ray Fluorescence analysis system consist of Si (Li) detector with personal computer and X-rays analysis software and also used preamplifier and amplifier are used in experimental measurement. The value of pH and Conductivity were determined using pH meter and conductivity meter (Ecoscan Con 5) at Department of Chemistry, University of Mandalay.

Figure 1 The collection sites Dothtawady River from Mandalay Environ

Figure 2 The photograph of sample collection

Figure 3 The photograph of sample collection

Experimental Results and Discussion

The concentrations of the elements of the Sediment samples were determined by EDXRF technique. The results were shown in following tables.

Table 1 The element oxides present in two kinds of samples (Pyin Oo Lwin)

No	Elements Oxide	Concentration (%)	
		RS-1 (Sample 1)	RS-2 (Sample 2)
1	SiO_2	71.998	70.124
2	Al_2O_3	12.123	15.800
3	Fe_2O_3	3.112	3.842
4	K_2O	1.749	1.823
5	CaO	1.118	1.504
6	SO_3	0.545	0.719
7	TiO_2	0.784	0.832
8	Cr_2O_3	0.054	0.063
9	MnO	0.041	0.064
10	NiO	ND	0.028
11	SrO	0.019	0.027
12	CuO	0.019	0.009
13	ZnO	0.006	0.004

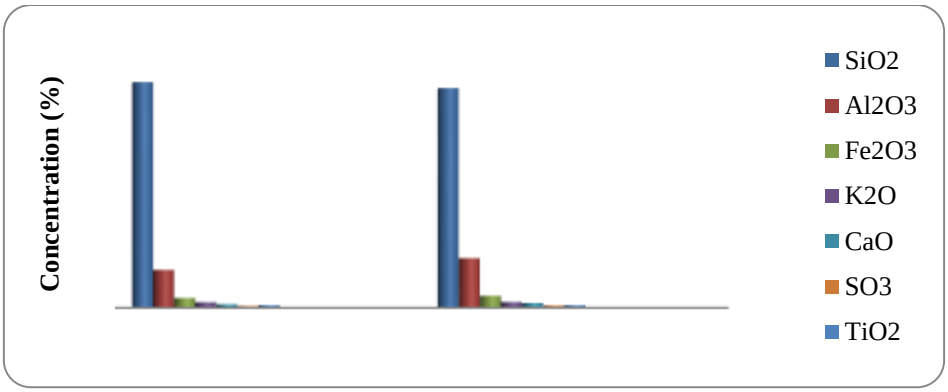

Figure 4 Concentration of element oxides in samples (Pyin Oo Lwin)

Table 2 The element oxides present in two kinds of samples(Myitnge))

No	Element Oxide	Concentration (%)	
		RS-3 (Sample 3)	RS-4 (Sample 4)
1	SiO_2	58.247	47.533
2	Al_2O_3	27.11	22.38
3	Fe_2O_3	6.198	6.125
4	K_2O	1.786	1.991
5	CaO	0.818	1.422
6	TiO_2	0.703	0.567
7	SO_3	0.592	0.651
8	MnO	0.190	0.136
9	Cr_2O_3	0.059	0.047
10	NiO	0.039	ND
11	SrO	0.011	ND
12	CuO	0.005	0.002

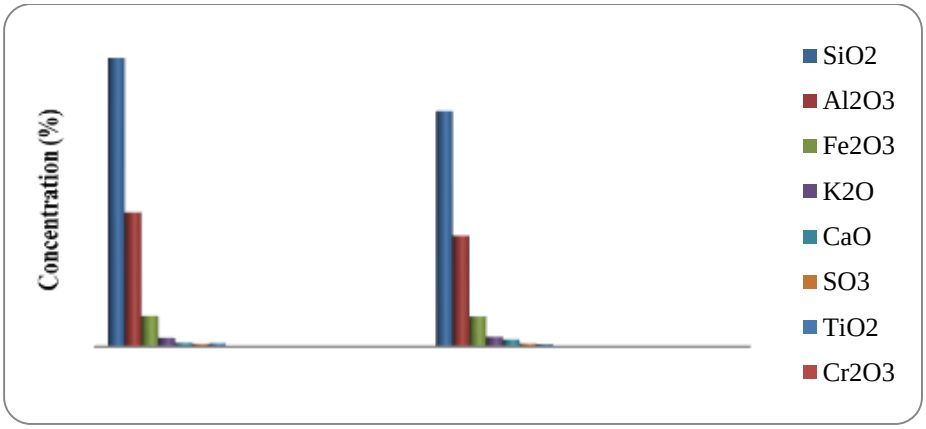

Figure 5 Concentration of element oxides in samples (Myint nge)

Table 3 Amount of trace element oxides in samples (Pyin Oo Lwin)

No	Elements Oxide	Concentration (%)	
		RS-1 (Sample 1)	RS-2 (Sample 2)
1	Cr_2O_3	0.054	0.063
2	MnO	0.041	0.064
3	NiO	ND	0.028
4	SrO	0.019	0.027
5	CuO	0.019	0.009
6	ZnO	0.006	0.004

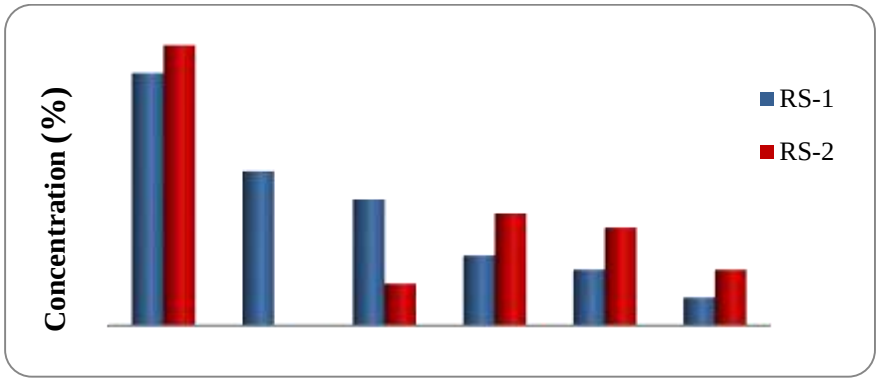

Figure 6 Concentration of trace element oxides in samples (Pyin Oo Lwin)

Table 4 Amount of trace element oxides in samples (Myit nge)

No	Elements Oxide	Concentration (%)	
		RS-3(Sample 3)	RS-4(Sample 4)
1	Cr_2O_3	0.059	0.047
2	MnO	0.190	0.135
3	NiO	0.039	ND
4	SrO	0.011	0.019
5	CuO	0.005	0.017

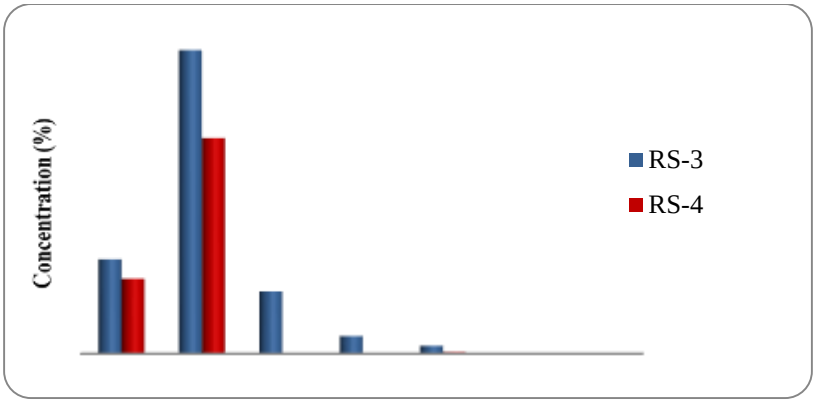

Figure 7 Concentration of trace element oxides in samples (Myint nge)

Table 5 Amount of trace toxic element oxides in samples (Pyin Oo Lwin)

No	Element Oxide	The amount determined (%) (RS-1)	The amount determined (%) (RS-2)
1	CuO	0.019	0.009
2	NiO	ND	0.028
3	ZnO	0.006	0.004

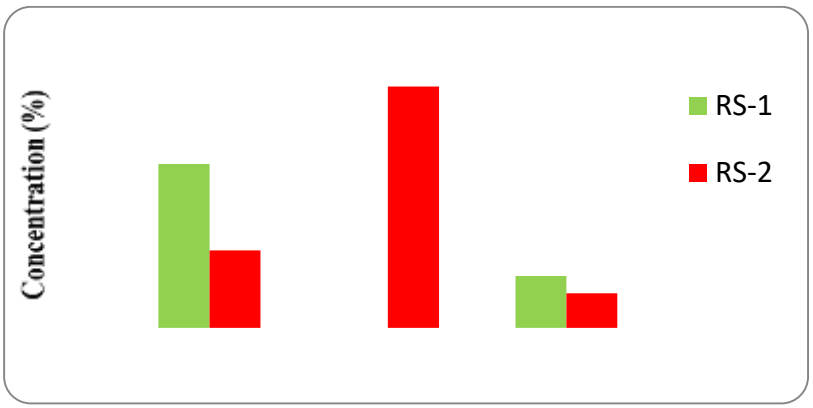

Figure 8 Concentration of toxic element oxides in samples (Pyin Oo Lwin)

Table 6 Amount of trace toxic element oxides in samples (Myit nge)

No	Element Oxide	The amount determined (%) (RS-3)	The amount determined (%) (RS-4)
1	CuO	0.005	0.002
2	NiO	0.039	ND

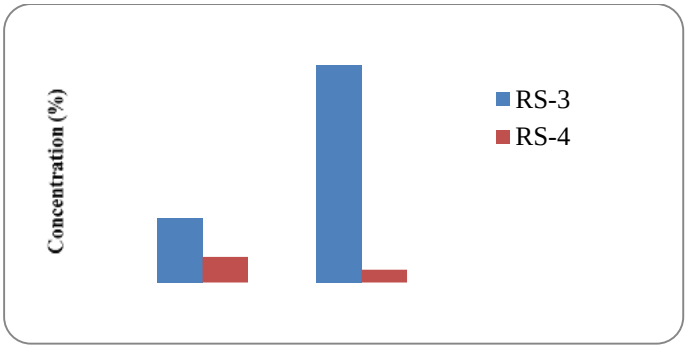

Figure 9 Concentration of toxic element oxides in samples (Myint nge)

Table 7 The conductivity and pH values of four different samples

No	Samples code name	Conductivity (µS/cm)	pH value
1	RS-1	72.9	8.9
2	RS-2	78.7	8.8
3	RS-3	82.5	8.4
4	RS-4	72.9	8.0

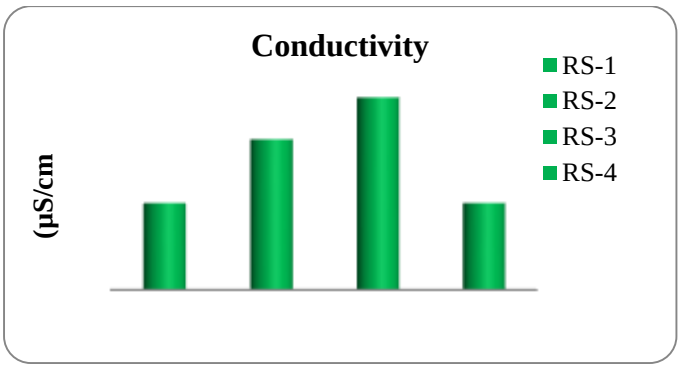

Figure 10 The Conductivity of different river sediment samples

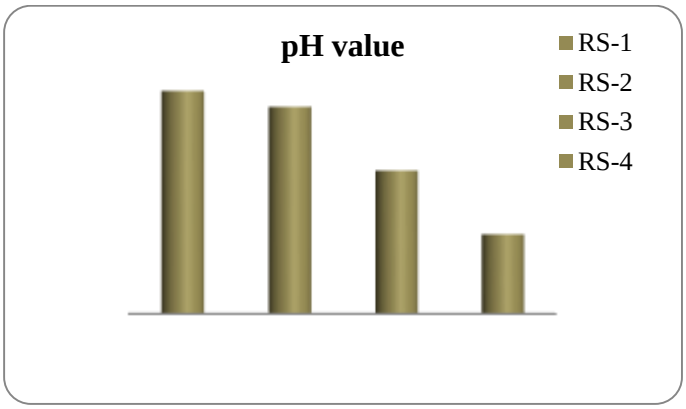

Figure 11 The pH values of different river sediment samples

Dothatawady River Sediment samples: River Sediment sample 1 (RS-1), River Sediment sample 2 (RS-2), River Sediment sample 3 (RS-3) and River Sediment sample 4 (RS-4), were collected from Pyin Oo Lwin township and Myit nge township Mandalay region area.

The elements that contain in four kinds of samples of (Pyin Oo Lwin and Myit nge) were analyzed by using Energy Dispersive X-Ray Fluorescence (EDXRF) method. Most elements can exist as element oxides in sediment. Among the elements having atomic number 11 to 92, it was found that there are 13 element oxides such as Al_2O_3, SiO_2, SO_3, K_2O, CaO, TiO_2, Cr_2O_3, MnO, Fe_2O_3, NiO, CuO, ZnO, SrO, in the River Sediment sample 2 (RS-1). However, River Sediment sample 1 (RS-1) contains 12 element oxides that are found in RS-1. NiO is not found in RS-1. The element oxides present in the samples were described in Table (1) as the order of high to low concentration.

Twelve element oxides such as Al_2O_3, SiO_2, SO_3, K_2O, CaO, TiO_2, Cr_2O_3, MnO, Fe_2O_3, NiO, CuO and SrO, are found in the River Sediment sample 3 (RS-3). However, River Sediment sample 3 (RS-3) contains 12 element oxides that are found in RS-3, NiO and SrO are not found in RS 4. The element oxides present in the samples were described in Table (2) as the order of high to low concentration.

Trace element oxides present in samples RS-1, RS-2 of Pyin Oo Lwin were also determined. It was found that Cr_2O_3, SrO, Cuo, MnO, NiO and ZnO were present in the samples and described in Table (3) and Figure (6).

Trace element oxides present in samples RS-3, RS-4 of Myit nge Cr_2O_3, SrO, Cuo, MnO and NiO were also determined and it was found that were present in the samples and described in Table (4) and Figure (7).

Some trace toxic element oxides present in samples RS-1, RS-2 of Pyin Oo Lwin were also determined and it was found that Cuo, NiO and ZnO were present in the samples and described in Table (5) and Figure (8).

Some trace toxic element oxides present in samples RS-3 of Myit nge were also determined and it was found that Cuo and NiO. River Sediment sample 4 (RS-4) contains only toxic element oxide of CuO, However NiO and ZnO are not found in RS 4, described in Table (6) and Figure (9).

The pH values of Dothtawady River Sediment samples are shown in Table (7). The pH values of River Sediment sample 1 (RS-1), River Sediment sample 2 (RS-2), River Sediment sample 3 (RS-3) and River Sediment sample 4 (RS-4) are found to be 8.9, 8.8, 8.4 and 8.0 respectively. RS-4 show the lowest value of pH (8.0). River Sediment sample 1 (RS-1) has the highest value of pH (8.9).

The Conductivity of Dothtawady River Sediment samples are presented in Table (7). Conductivity values range from 72.9-82.5μS/cm. Dotetawady River Sediment sample 1 (RS-1) and (RS-4) have lowest conductivity value (72.9 μS/cm). The Dotetawady River Sediment sample 3(RS-3) has highest conductivity value (84.5 μS/cm).

Conclusion

In this paper, the quantitative data are measured by the EDX-7000 software, which is used in the calibration system with the internal standards. These data obtained in the samples were not considered on the organic compounds.

Four Dothtawady River Sediment samples (RS-1, RS-2, RS-3 and RS-4) were chosen for the study from Mandalay region area.

RS-2 sample contains thirteen element oxides such asAl_2O_3, SiO_2, SO_3, K_2O, CaO, TiO_2, Cr_2O_3, MnO, Fe_2O_3, NiO, CuO, ZnO, SrO. RS-1 sample contains twelve element oxides (except NiO). RS-3 sample contains twelve element oxides (except ZnO). RS-4 sample contains ten element oxides (except NiO, SrO and ZnO). The elements found in four Dothtawady River Sediment samples are very valuable macro and micro elements for plant growth.

One of the plants' nutrient, potassium (K) in four sediment samples are 1.749%, 1.823%, 1.786% and 1.991%. This means that the selected sediment samples can supply potassium nutrient to the plants. Among the four samples, RS-4 can support more potassium than that of others.

For agriculture, maximum permissible value of soil pH is 7.5-8.5. The pH values of four Dothtawady River Sediment samples are found to be 8.0-8.9.

For agriculture, the suitable conductivity is 100 μS/cm. Conductivity values of Dothtawady River Sediment samples are found to be 72.9-82.5 μS/cm. Therefore, conductivity values of four sediments samples fall in suitable conductivity value.

In Pyin Oo Lwin, for toxic elements, the amounts of copper and zinc of River Sediment sample RS-1 are higher than that of River Sediment sample RS-2. Then Nickel was detected River Sediment sample RS-2, but nickel toxic was not found in River Sediment sample RS-1.

In Myit Nge, for toxic elements, nickel and zinc does not found in River Sediment sample RS-4 but nickel toxic was detected in River Sediment sample RS-3. Copper contents of River Sediment sample RS-3 is higher than that of River Sediment sample RS-4. From the above data, Pyin Oo Lwin samples (RS-1, RS-2) contain more toxic elements than Myit nge samples (RS-3, RS-4).

From the point of view of elemental concentration, pH and conductivity, the four selected Dothtawady River Sediment samples are found to be used for the suitable to grow agriculture purpose.

Among these four Dothtawady River Sediment samples, the quality of Dothtawady River Sediments sample 4 (RS-4) is better than others.

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