ANALYSIS OF CONSTITUENTS INAYEYARWADYRIVERWATER SAMPLES FROM MANDALAYAREA BY USING ENERGY DISPERSIVE X-Rays FLUORESCENCE (EDXRF)

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Abstract

In this paper, Ayeyarwady River water samples: River water sample 1, River water sample 2 and River water sample 3 were collected from Mandalay environ. The water samples were analyzed to determine the elemental concentration by using Energy Dispersive X-ray Fluorescence (EDXRF) spectrometer. Silicon (0.14% - 0.19%), sulfur (0.31% - 0.33%), potassium (0% - 0.01%), calcium (0% - 0.013%), iron (0 %- 0.001%) and samarium (0% - 0.001%) were detected by using XRF. The physico-chemical properties such as colour, pH, conductivity, alkalinity and total hardness of River water samples were also measured. These results were compared and discussed with WHO standards.

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

Introduction

Rivers are vital component of the biosphere that contains less than one percent of the world's fresh water with their higher ecological and social significance which are being polluted by indiscriminate disposal of sewerage, industrial waste, and by excess of human activities affecting their physicochemical characteristics and leads to various deleterious effects on aquatic organisms.The rivers provide water for industries, agriculture, aquaculture, commercial and domestic purpose. Unfortunately the same rivers are being polluted by indiscriminate disposal of sewage and industrial wastes and plethora of human activities. River pollution has already acquired serious dimensions in India. Pollution of rivers first affects its physicochemical quality then systematically destroys the community disrupting the delicate food web.

Quality of river water can be regarded as a network of variables such as PH, oxygen concentration, temperature, etc. and any changes in these physical and chemical variables can affect aquatic biota in a variety of ways. Since the quality river water is directly related to health and is important for determination of water utility, it is very essential and important to test the quality of the water before it is used for drinking, domestic, agricultural or industrial purposes. The utility of river water for various purposes is governed by physicochemical and biological quality of the water.

Materials and Method

Ayeyarwady River water samples: River water sample 1 (RM-1), River water sample 2 (RM-2) and River water sample 3 (RM-3) were collected from Mandalayenviron. River water samples, (RM-1) and (RM-2) were collected at near Yadanarbon bridge and Shanlay Kyune village, River water samples(RM-3) were collected at near the GawweinJetty.

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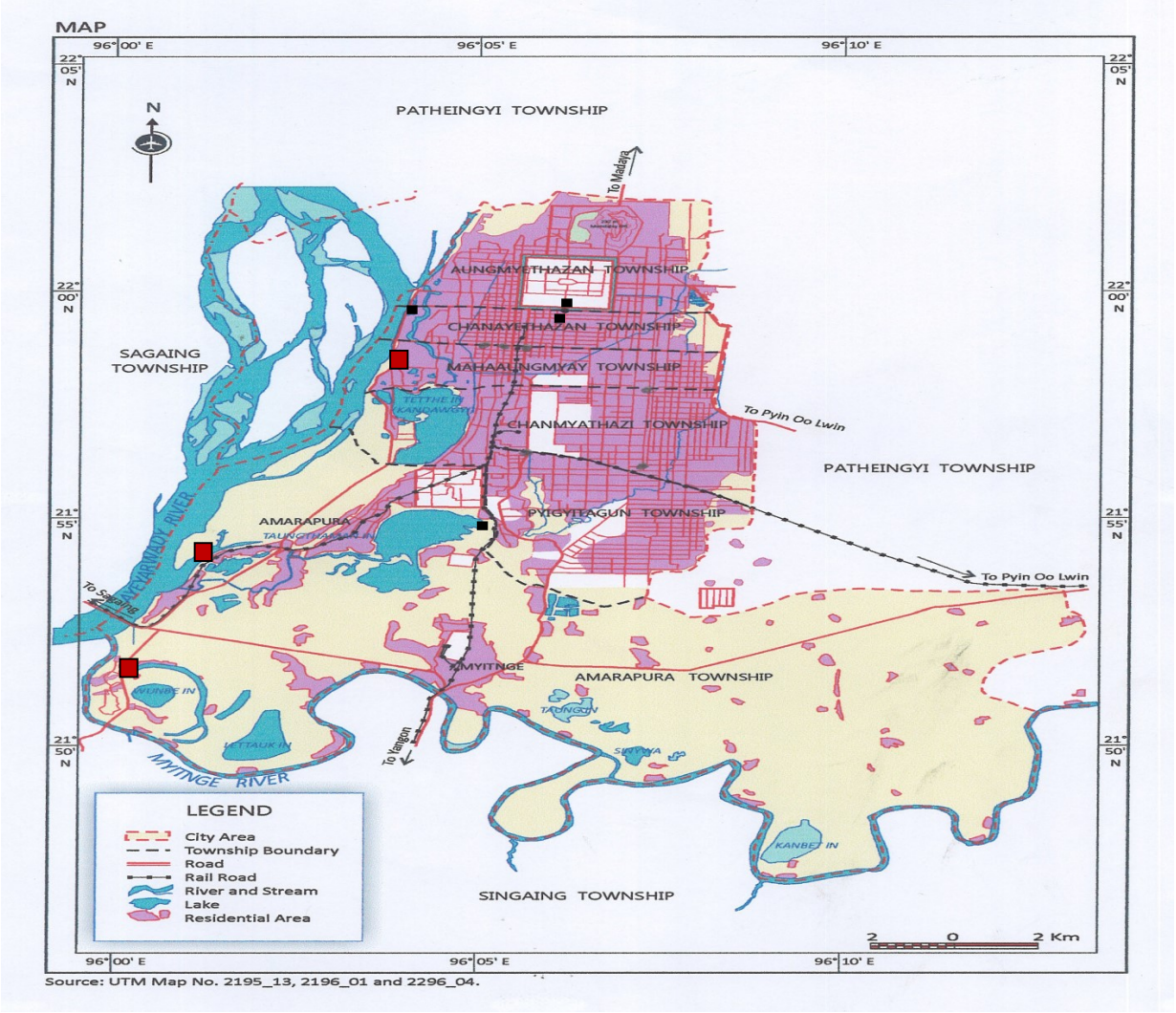

Figure 1 The collection sites of Ayeyawady River from Mandalay Environ

River water samples were collected in good quality polythene bottles of five liter bottles were tightly sealed after collection and labeled. River water samples were taken from each of the collected sites. The elemental content of the water samples were determined by EDXRF technique. Each water samples was prepared for EDXRF analysis. The water sample was put into the sample cup (30 mL) for EDXRF measurements. Each sample was run for about 100 seconds in EDX 7000. The value of pH and Conductivity were determined using pH meter and conductivity meter (Ecoscan Con 5) at Department of Chemistry, University of Mandalay. The colour, alkalinity and total hardness values of the water samples were determined at Public Health Laboratory, Mandalay.

Experimental Results and Discussion

The concentrations of the elements of the three River water samples were determined by EDXRF technique. The results were shown in Table (1-2) and Figure(1-11).The physical properties such as colour, pH and conductivity of three River water samples were determined and the results were presented in Table (3) and Figure(7-9). The chemical properties such as

alkalinity and total hardness of three River water samples were determined and the results were presented in Table (4) and Figure (10-11).

Table 1 Concentrations of Elements of River Water Samples Analyzed by EDXRF

No.	Code Name	Concentrations of Elements (%)					
		Silicon (Si)	Sulphur (S)	Potassium (K)	Calcium (Ca)	Iron (Fe)	Samarium (Sm)
1	RM-1	0.16	0.033	0.010	0.013	0.001	ND
2	RM-2	0.197	0.031	0.010	0.013	0.001	0.001
3	RM-3	0.149	0.032	0.010	0.013	0.001	ND

RM-1= River water samples 1
RM-2= River water samples 2
RM-3= Riverwater samples 3

Table 2 WHO Standards of Some Elements for Drinking Water

No	Elements	WHO Standards	
		Highest desirable level	Maximum permissible level
1	Calcium(Ca) (mg/L)	75	200
2	Iron (Fe)(mg/L)	0.3	1.0

Table 3 Analysis of Physical Properties of Water Samples

Parameters	Sample code name			WHO Standards	
	RM-1	RM-2	RM-3	Highest Desirable Level	Maximum Permissible Level
Colour (Platinum, Cobalt Scale)	12	25	18	5	50
pH	7.7	7.6	7.5	6.5	8.5
Conductivity (µS/ cm)	94.1	103.3	89.1	200	800

Table 4 Analysis of Chemical Properties of Water Samples

Parameters	Sample code name			WHO Standards	
	RM-1	RM-2	RM-3	Highest Desirable Level	Maximum Permissible Level
Alkalinity (mg/L)	130	130	260	200	500
Total Hardness(mg/L)	40	40	160	100	500
Calcium(Ca) (mg/l)	8	12	12	75	200
Magnesium(Mg) (mg/l)	5	24	29	50	150
Chlorine(Cl) (mg/l)	20	20	100	250	600

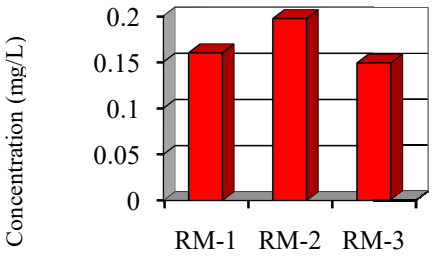

Figure 2 Comparison of silicon Concentration in different water samples

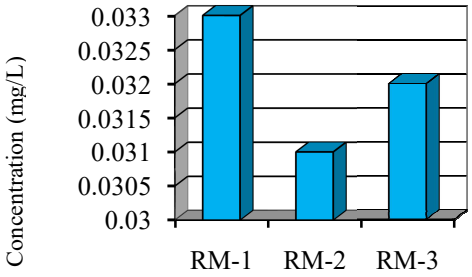

Figure 3 Comparison of sulphur Concentration in different water samples

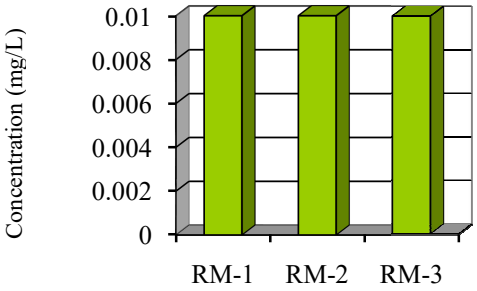

Figure 4 Comparison of potassium Concentration in different water samples

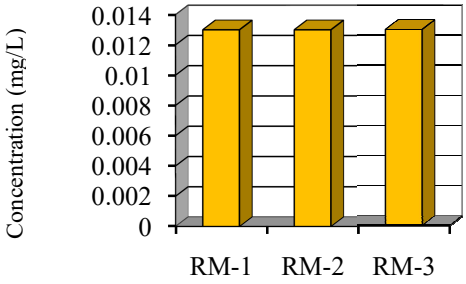

Figure 5 Comparison of calcium Concentration in different water samples

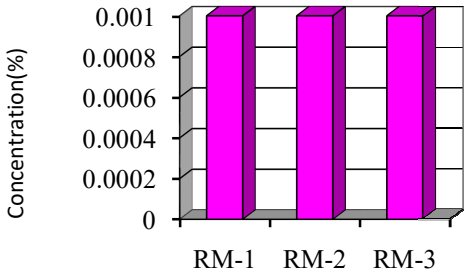

Figure 6 Comparison of Iron Concentration in Different Water Samples

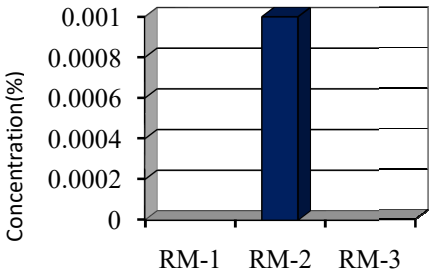

Figure 7 Comparison of Samarium Concentration in Different Water Samples

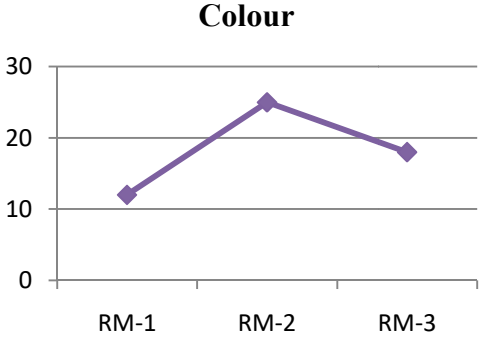

Figure 8 Comparison of Colour in different Water Samples

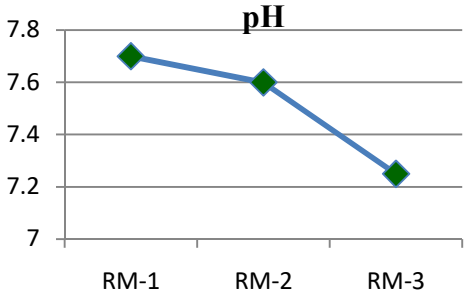

Figure 9 Comparison of pH in different Water Samples

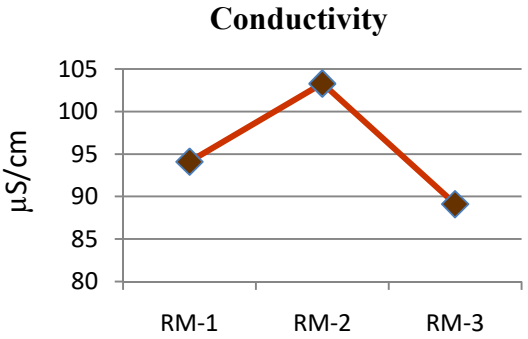

Figure 10 Comparison of Conductivity in different River water samples

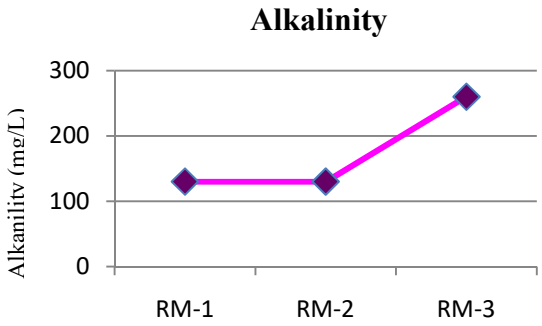

Figure 11 Comparison of Alkalinity in different River waters

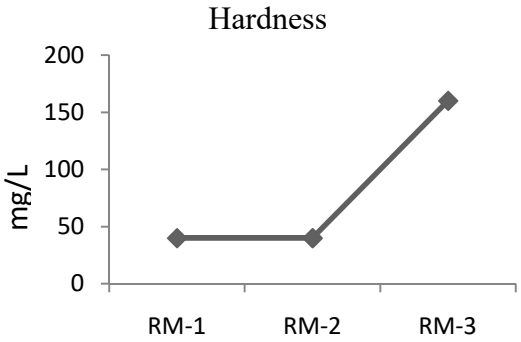

Figure 12 Comparison of total hardness in different River water samples

Comparison of the silicon concentration of River water samples were shown in Table (1) and Figure (2). Silicon concentration of River water samples were found to be varied. River water sample 3(RM-3) contains the lowest silicon concentration. River water sample 2consists of the highest silicon concentration. The amount of siliconin River water sample 2 (RM-2) was larger than other water samples.

Comparison of the Sulphur concentration of Ayeyarwady River water samples are shown in Table (1) and Figure (3). Sulfur concentration of water samples are found to be varied, River water samples 2 (RM-2) has the lowest Sulphur concentration. River water samples 1(RM-1) has the highest Sulfur concentration.

Comparison of the Potassium concentration of Ayeyarwady River water samples are shown in Table (1) Figure (4). Potassium concentration of River water samples are found to be varied. River water samples 1 (RM-1), River water samples 2 (RM-2) and River water samples 3 (RM-3) have the same Potassium concentration.

Comparison of the Calcium concentration of Ayeyarwady River water samples are shown in Table (1)and Figure (5). Calcium concentration of River water samples are found to be varied. River water samples 1 (RM-1), River water samples 2 (RM-2) and River water samples 3 (RM-3) have the same Calcium concentration.

Comparison of the iron concentration of Ayeyarwady River water samples are shown in Table (1)and Figure (6). Iron concentration of water samples, River water samples 1 (RM-1),

River water samples 2 (RM-2) and River water samples 3 (RM-3) are found to contain the same value of Iron concentration.

Comparison of the Samarium concentration of Ayeyarwady River water samples are shown in Table (1) and Figure (7). The amount of Samarium in River water samples 1 (RM-1) and River water samples 3 (RM-3) were not be detected by XRF. Samarium was found in River water samples 2 (RM-2)

The Colour of Ayeyarwady River water samples are presented in Table(3) and Figure(8). Colour values range from12-25. Ayeyarwady River water samples 1 (RM-1) has lowest value .The Ayeyarwaddy River water samples 2 (RM-2) has the highest value .

The pH values of Ayeyarwady River water samples are shown in Table (3) and Figure (9). The pH values of River water samples 1 (RM-1), River water samples 2 (RM-2) and River water samples 3 (RM-3) are found to be 7.7, 7.6, and 7.5 respectively. River water samples 3 (RM-3) has the lowest value of pH (7.5). River water samples 1 (RM-1) has the highest value of pH (7.7).

The Conductivity of Ayeyarwady River water samples are presented in Table(3)and Figure (10).Conductivity values range from 89.1-103.3 microsecment/centimeter. Ayeyarwady River water samples 3 (RM-3) has lowest conductivity value (89.1 μS/cm). The Ayeyarwady River water samples 2 (RM-2) has the highest conductivity value (103.3 μS/cm).

Alkalinity of Ayeyarwady River water samples are presented in Table (4)Figure (11). The alkalinity of River water samples 1 (RM-1), River water samples 2 (RM-2) and River water samples 3 (RM-3) are 130 mg/L, 130 mg/L and 260 mg/L respectively. River water samples 1 (RM-1) and River water samples 2 (RM-2) have the same value of lowest alkalinity. River water samples 3 (RM-3) has the highest value of alkalinity.

The total Hardness of Ayeyarwady River water samples are presented in Table(4)and Figure (12). Total Hardness values range from 40-160. Ayeyarwady River water samples 1 (RM-1) and samples 2 (RM-2) contain the same total Hardness value. The Ayeyarwady River water samples 3 (RM-2) has the high value.

Conclusion

In this paper, for drinking water, highest desirable value of pH is 7-8.5 and maximum permissible value is 6.5-9.2. pH values of three Ayeyarwady River water samples were found to be 7.5-7.7. Therefore, pH values of River water samples fall in maximum permissible value.

For drinking water, highest desirable value of conductivity is 200μS/cm and maximum permissible value is 800μS/cm. Conductivity values of Ayeyarwady River water samples are found to be 89-105 μS/cm. Therefore, conductivity values of three water samples fall in maximum permissible value.

For drinking water, highest desirable value of alkalinity is 200 mg/L and maximum permissible value is 500 mg/L. Alkalinity values of three River water samples were found to be 130-260 mg/L. Alkalinity values of River water samples were found to be within the WHO Standards.

For drinking water, highest desirable amount of calcium is 75 mg/L and maximum permissible value is 200 mg/L. The amount of calcium of three Ayeyarwady River water samples

are found to be 8-12 mg/L. Therefore, the amount of calcium of three Ayeyarwady River water samples exist lower than the highest desirable value and maximum permissible value.

For drinking water, highest desirable amount of Magnesium is 50 mg/L and maximum permissible value is 150 mg/L. The amount of Magnesium of three Ayeyarwady River water samples are found to be 5-29 mg/L. Therefore, the amount of Magnesium of three Ayeyarwaddy River water samples exist lower than the highest desirable value and maximum permissible value of WHO standard.

For drinking water, highest desirable amount of chlorine is 250 mg/L and maximum permissible value is 600 mg/L. The amount of chlorine of three Ayeyarwady River water samples are found to be 20-100 mg/L. Therefore, the amount of chlorine of three Ayeyarwady River water samples exist lower than the highest desirable value and maximum permissible value.

From the XRF analysis, silicon (0.16% - 0.19%), sulfur (0.31% - 0.33%), potassium (0.10% - 0.12%), calcium (0.007% - 0.013%), iron (0.001% of each) and samarium (0.001% of each) are also present in three Ayeyarwaddy River water samples. Moreover, it is obviously seen that toxic elements are not found in all River water samples.

From the point of view of pH, alkalinity, conductivity, colour, total Hardness and elemental concentration, these three Ayeyarwady River water samples are found to be used for drinking purpose and domestic use.

Among these three Ayeyarwady River water samples, the quality of Ayeyarwaddy River water sample 1(RM-1) is better than others.

Acknowledgement

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