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DETERMINATION OF VARIOUS PHYSICOCHEMICAL PARAMETERS OF AYEYARWADDY RIVER WATER IN MANDALAY REGION, MYANMAR

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ABSTRACT

Climate change may faster greater extremes in weather and can change the quality of water in Ayeyarwaddy river. The Ayeyarwaddy river is the life blood and historical princess of the Union of Myanmar. This research focused on the determination of physicochemical parameters of Ayeyarwaddy river water before and after flood. Three water samples from site 1 (Mayanchan), site 2 (Gaw Wein) and site 3 (Chawseith) in Mandalay District, Mandalay Region were collected in two times duration of February 21st, 2018 (before flood) and June 20th, 2018 (after flood). The Physicochemical parameters of all water samples such as color, turbidity, pH values, total dissolved solids, total hardness, total alkalinity, calcium, magnesium, chloride, sulfate and iron were determined by EDTA titration method, AOAC method, Atomic Absorption Spectroscopy (AAS) and Lovibond Spectro Direct method. Moreover, the bacteriological examinations of water samples were also carried out to know how much of public wastes present in river water as well as the contents of biochemical oxygen demand (BOD) and chemical oxygen demand (COD) were also studied in Eco-Lab, Myanmar.

Key Words: water quality, physiochemical parameters, AAS, EDTA, total alkalinity, public wastes

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INTRODUCTION

Water quality depends on the local geology and ecosystem, as well as human uses such as sewage dispersion, industrial pollution, use of water bodies as a heat sink, and overuse [file/// f:/Water quality-Wikipedia]. Water quality is determined by assessing three class attributes: biological, chemical, and physical parameters. There are standards of water quality set for each of these three classes of attributes. The national standards for drinking water are developed by World Health Organization (WHO) standard. Water is one of the most important natural resources on earth. All animal and plant lives require water for their survival. Water intended for human consumption must be free from chemical substances and micro-organisms that may be a hazard to health. Supervision of water supply, its sources, reservoirs, treatment and distribution must be such as to exclude all possible sources of pollution and contamination. [U.S (EPA) Washington, D.C] . Hence this research has been conducted to determine the various physicochemical parameters of water from Ayeyarwaddy River. A primary reason for is that all three major sources of pollution (industry, agriculture, and domestic) are concentrated along the rivers. Industries and cities have historically been located along rivers because the rivers provide transportation and have traditionally been a convenient place to discharge waste. Agricultural activities have tended to be concentrated near rivers, because river flood plains are exceptionally fertile due to the many nutrients that are deposited in the soil when the river overflow .Water is one of the most important natural resources on earth. Firstly, the water samples have been collected from Ayeyarwaddy River. The physicochemical parameters of water samples were measured and compared with the WHO standard. Secondly, the bacteriological examination of all samples was investigated.

Finally, the values of the biochemical oxygen demand (BOD) and chemical oxygen demand (COD) of all water samples were also determined.

Aim

The aim of this research is to determine the various physicochemical parameters of Ayeyarwaddy river water quality that are suitable for drinking and domestic uses of local people in Mandalay District, Myanmar .

Methods and Materials

Material

EBT, hydroxylamine hydrochloride, disodium Ethylene Diamine Tetra Acetate dihydrate (EDTA) were purchased from ABLE chemical company, Mandalay in Myanmar. Ethanol and deionized water were distilled for purification.

Methods

APHA platinum cobalt standard method; EDTA Titrimetric method; Titrimetric Method; AOAC method; Gravimetric Method; Argentometric Method; Phenonthroline Method.

Sample Collection

Three water samples were collected from three different sites such as site 1 (Pike Kyone), site 2 (Gaw Wein) and site 3 (Chawseith), Mandalay Region in two time duration of on February 21st, 2018 and on June 20th, 2018. The collected water sample (6 L) was filled into plastic containers that were first rinsed several times with distilled water.

Figure (1) Water Sample 1, 2and 3

Characterization

Analysis of Physical Properties of Water Collected from Ayeyarwaddy River

Estimation of Color

Method: APHA platinum cobalt standard method

The color of the collected water sample was estimated by APHA platinum cobalt standard method (APHA 18th Edt, 1992).

Procedure

25 mL sample was placed in the sample cell and the color was determined at 455 nm against 25 mL demineralized water blank.

Estimation of pH Value

Method: Direct Measurement by pH meter

The pH of water was determined by using a pH meter (AOAC, 2000).

Procedure

Electrodes were rinsed with distilled water and dried by gently cleaning with a soft tissue. The instrument was standardized with electrodes immersed in a buffer solution of pH 7. Then the pH of sample was measured by dipping electrodes after cleaning into well stirred sample for 1 minute.

Estimation of Total Dissolved Solid

Method: Evaporation

The TDS was estimated by AOAC method (AOAC, 2000; Arnold, 1990).

Procedure

The evaporating porcelain basin was cleaned thoroughly with concentrated nitric acid and washed with distilled water. The basin was dried in an oven at 200°C for 1 hour. The basin was cooled, desiccated, weighed and stored in a desiccator.

100 mL of water sample was quantitatively transferred to the pre weight basin and evaporated to dryness on a steam bath. Then the sample in the basin was dried in an oven at 103°C to 105°C

for 1 hour. The basin holding residue was cooled in a desiccator and weighed. The cycle of drying at 103°C to 105°C, cooling desiccating and weighing was repeated until the constant weight was obtained.

Calculation

$$\text{Total Dissolved Solid, mg / L} = \frac{(A - B) \times 1000}{\text{mL sample}}$$

Where,

A = weight of sample and basin in mg

B = weight of basin in mg

Analysis of Chemical Properties of Water Collected from Ayeyarwady River

Estimation of Total Hardness

Method: EDTA Titrimetric method

The total hardness was determined by EDTA titrimetric method)

Procedure

50 mL of sample was pipetted to the conical flask. 2 mL of buffer solution was added 2 drops of EBT indicator was added and the sample was slowly titrated by standard EDTA titrant until the last reddish tinge disappears from the solution. The end point color was blue.

Calculation

$$\text{Hardness (EDTA) as mg } CaCO_3 \text{ / L} = \frac{A \times B \times 1000}{\text{mL sample}}$$

Where,

A = mL titrant for sample

B = mg $CaCO_3$ equivalent to 1.00 mL EDTA titrant

Estimation of Calcium

Method: EDTA Titrimetric Method

The amount of calcium was determined by EDTA titrimetric method

Procedure

25 mL sample was mixed with 25 mL distilled water. 50 mL of distilled water was taken as colour comparison. 2 mL of NaOH solution and 0.2 g of murexide indicator were added to the sample and blank. 2 or 3 drops of EDTA titrant were added to the blank to procedure an unchanging colour.

The sample was titrated immediately with EDTA solution until the colour changed as blank.

Calculation

$$\text{mg Ca / L} = \frac{\text{A} \times \text{B} \times 400.8}{\text{mL sample}}$$

$$\text{Ca hardness as mg } CaCO_3\text{/L} = \frac{\text{A} \times \text{B} \times 1000}{\text{mL sample}}$$

Where,

A = mL titrant for sample and

B = mg $CaCO_3$ equivalent to 1.00 mL EDTA titrant at the calcium indicators end point.

Estimation of Magnesium

Method: Calculation Method

The amount of magnesium was determined by EDTA titrimetric method

Magnesium can be calculated by the following formula.

mg Mg/L = [Total hardness as $CaCO_3$/L – Ca hardness as $CaCO_3$/L] × 0.244 × 1000

Estimation of Total Alkalinity

Method: Titrimetric Method

The amount of total alkalinity was determined by EDTA titrimetric method (www.uobabylon.edu.iq/eprints/publicaton22630.pdf).

Procedure

20 mL sample was titrated with standard H_2SO_4 using phenolphthalein indicator until the color changed from pink to colorless. Then 2 drops of methyl orange indicator were added and the titration was continued until the color turned to faint red orange.

Calculation

$$\text{Phenolphthalein Alkalinity (P) as mg } CaCO_3 / L = \frac{A \times N \times 50.000}{\text{mL sample}}$$

$$\text{Total Alkalinity (T) as mg } CaCO_3 / L = \frac{B \times N \times 50.000}{\text{mL sample}}$$

Where,

A = mL standard acid used in phenolphthalein

B = Total mL titrant used in both titration

N = Normality of standard acid

Estimation of Sulfate

Method: Gravimetric Method

The amount of sulfate content in the collected water sample was estimated by Gravimetric method (Gary D. Christicn, 2004).

Procedure

The pH of 150 mL sample was adjusted with HCl to 4.5 to 5.1 to 2 mL HCl was added and heated to boiling. Warm $BaCl_2$ solution was added with stirring until precipitation appears to be complete then about 2 mL in excess $BaCl_2$ was added. A total of 5 mL $BaCl_2$ solution was added wherever the amount of precipitate was small. The precipitate was digested to 80° to 90°C weight. The precipitate was filtered and washed with warm distilled water until washing were free of chloride as indicated by testing with $AgNO_3.HNO_3$ reagent. The precipitate was dried ignited 800°C for 1 hour cooled in desiccator and weighed.

Calculation

$$\frac{(mg)SO_4}{L} = \frac{(mg)BaSO_4 \times 411.5}{\text{mL sample}}$$

Estimation of Chloride

Method: Argentometric Method

The amount of chloride content was estimated by argentometric method (Madhulekha shukla and Sunita Arya, 2018).

Procedure

10 mL of sample was mixed with 90 mL of distilled water. 1 mL of K_2CrO_4 indicator solution was added and titrated with standard $AgNO_3$ solution to a pinkish yellow end point. The sample procedure was done with 100 mL of distilled water as blank.

Calculation

$$\text{mg Cl / L} = \frac{(\text{A} - \text{B}) \times \text{N} \times 35450}{\text{mL sample}}$$

Where,

A = mL titrant for sample

B = mL titrant for blank and

N = normality of $AgNO_3$

Estimation of Iron

Method: Phenonthroline Method

The amount of iron content in the collected water sample was investigated by phenonthroline method (L.G.Saywell and B.B.Cunningham, 1937).

RESULTS AND DISCUSSION

Determination of Physicochemical Parameters of Collected Water Sample from Ayeyarwaddy River on February 21st, 2018

Table (1) Result of Site 1, 2 and 3 from Ayeyarwaddy River on February 21st, 2018

No	Parameters	Result			Maximum permissible	Unit
		Site 1	Site 2	Site 3		
1	Appearance	Clear	Slightly Turbid	Slightly Turbid		
2	Color	5	6	6	50	Units
3	pH value	7.2	7.4	7.3	6.5 to 9.2	
4	Total Solids	255	307	277	1500	mg/L
5	Total Hardness	60	50	80	500	mg/L
6	Total Alkalinity	130	195	130	950	mg/L
7	Calcium	16	12	20	200	mg/L
8	Magnesium	5	5	7	150	mg/L
9	Chloride	20	20	20	600	mg/L
10	Sulphate	29	20	49	400	mg/L
11	Total Iron	Nil	Nil	Nil	1	mg/L

site 1 = Mayanchan, site 2 = Gaw Wein, site 3 = Chawseith

According to above table the parameters of collected water sample site 1, site 2 and site 3 in the Ayeyarwaddy river are in the range of permissible level of WHO standard. So, the Ayeyarwaddy river water should be used for domestic. For local people, river water should not drink directly, and people should be boiled for drinking.

Comparison of the pH, Color, Total Solid, Total Hardness and Total Alkalinity Content of Site 1, 2 and 3 on February 21st, 2018 (Before Flood)

Table (2) Comparison of the pH, Color, Total Solid , Total Hardness and Total Alkalinity Content of Site 1, 2 and 3 on February 21st, 2018 (Before Flood)

Sample	site 1	site 2	site 3	WHO standard
pH	7.2	7.4	7.5	6.5 to 8.5
Color	5	6	6	15
Total solid	255	307	277	1000
Total hardness	60	50	80	500
Total alkalinity	130	195	130	950

site 1 = Mayanchan, site 2 = Gaw Wein, site 3 = Chawseith

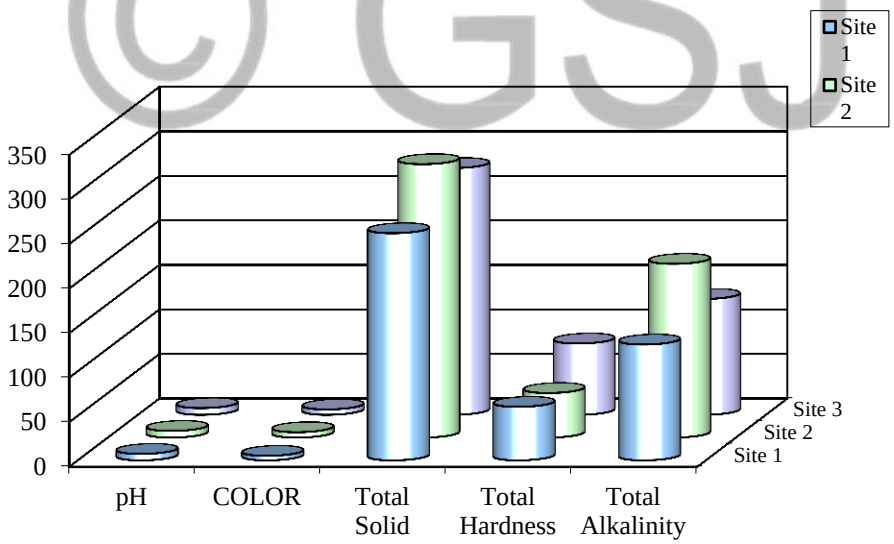

Figure (2) Comparison of pH, Color, Total Solids, Total Hardness and Total Alkalinity of Site 1, Site 2 and Site 3 on February 21st, 2018 (Before Flood)

From the observation of above table, the amount of total solid content and total alkalinity of site 2 have the highest contents that are unfit for direct drinking.

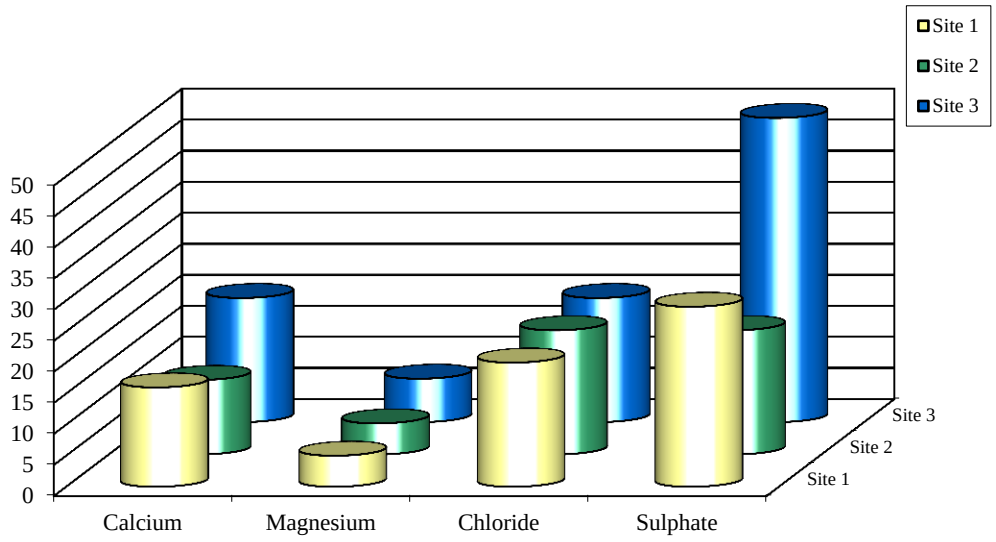

Figure (3) Comparison of Contents of Calcium, Magnesium, Chloride and Sulphate of Site 1, 2 and 3 on February 21st, 2018 (Before Flood)

According to above comparison, the sulphate content of site 3 is higher than that of site 1 and site 2.

Bacteriological Examination of collected Water Sample

Table (3) Bacteriological Examination of collected water sample before flood

Sample	site 1	site 2	site 3
Probable Coliform Count	5/5	5/5	5/5
Escherichia coil Count	Isolated	Isolated	Isolated

Water Bacteriological Examination

Table (4) Bacteriological Examination collected water sample after flood

Sample	site 1	site 2	site 3
Probable Coliform Count	5/5	5/5	5/5
Escherichia coil Count	Isolated	Isolated	Isolated

Determination of Physicochemical Parameters of Collected Water Sample from Ayeyarwaddy River on June 20th, 2018 (After Flood)

Table (5) Result of Site 1, 2 and 3 from Ayeyarwaddy River on June 20th, 2018

No	Parameters	Result			Maximum permissible	Unit
		Site 1	Site 2	Site 3		
1	Appearance	Turbid	Turbid	Turbid		
2	Colour	15	12	10	50	units
3	pH value	6.9	7.1	7.6	6.5 to 9.2	
4	Total Solids	202	257	267	1500	mg/L
5	Total Hardness	40	40	40	500	mg/L
6	Total Alkalinity	65	130	130	950	mg/L
7	Calcium	8	8	8	200	mg/L
8	Magnesium	5	5	5	150	mg/L
9	Chloride	20	20	20	600	mg/L
10	Sulphate	39	39	39	400	mg/L
11	Total Iron	Nil	Nil	Nil	1	mg/L

According to above table, the physicochemical parameters of the collected water samples site 1, site 2 and site 3 in the Ayeyarwaddy River are in the permissible values.

Comparison of the pH, Color, Total Solid, Total Hardness and Total Alkalinity Content of Site 1, 2 and 3 (on June 20th, 2018) (After Flood)

Table (6) Comparison of the pH, Color, Total Solid, Total Hardness and

Total Alkalinity Content of Site 1, 2 and 3 (on June 20th, 2018) (After Flood)

Sample	site 1	site 2	site 3	WHO standard
pH	6.9	7.1	7.6	6.5 to 8.5
Color	15	12	10	15
Total solid	202	257	267	1000
Total hardness	40	40	40	500
Total alkalinity	65	130	130	950

site 1 = Mayanchan, site 2 = Gaw Wein, site 3 = Chawseith

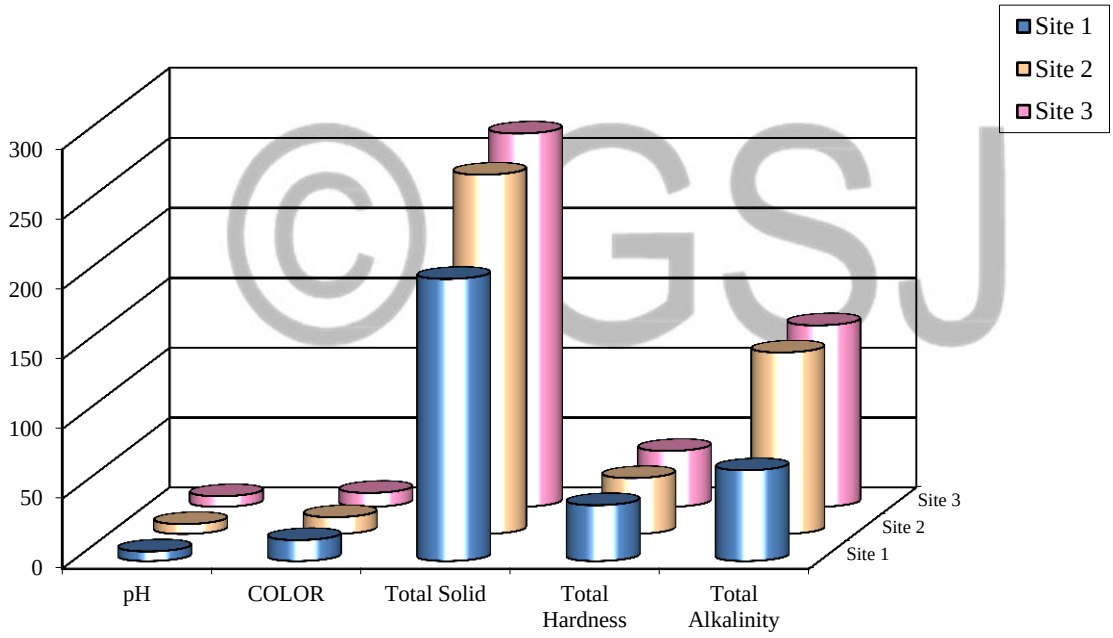

Figure (4) Comparison of pH, Color, Total Solids, Total Hardness and Total Alkalinity of Site 1, Site 2 and Site 3 (on June 20th, 2018) (After Flood)

From the observation of above table, the amount of total solid content and total alkalinity of site 3 have the highest content that are unfit for direct drinking.

Comparison of the Calcium, Magnesium, Chloride and Sulfate Content of Site 1, 2 and 3 (on June 20th, 2018) (After Flood)

Table (7) Comparison of the Calcium, Magnesium, Chloride and Sulfate Content of Site 1, 2 and 3 (on June 20th, 2018) (After Flood)

Sample	site 1	site 2	site 3	WHO standard
Ca	8	8	8	200
Mg	5	5	5	150
Cl	20	20	20	250
SO_4^{2-}	39	39	39	250

site 1 = Mayanchan, site 2 = Gaw Wein, site 3 = Chawseith

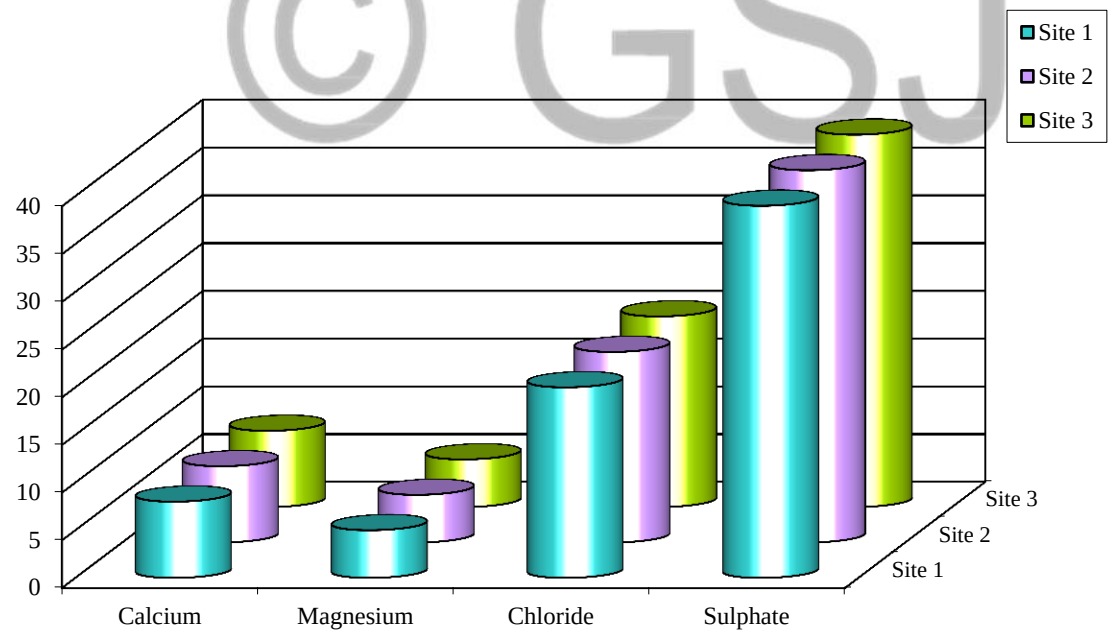

Figure (5) Comparison of Contents of Calcium, Magnesium, Chloride and Sulphate of Site 1, 2 and 3 (on June 20th, 2018) (After Flood)

According to above comparison the parameters of the three sites are equal in amount and then all of the parameters of the water samples are in the WHO standard.

BOD and COD Parameters of Ayeyarwaddy River

Table (8) BOD and COD Parameters of Ayeyarwaddy River

Sr.	Quality parameter	Results	Method	Drinking standard	Effluent standard	Remarks
1	BOD	9 mg/L	Estimated by Ecolab with Jenway Dissolved OxygenMeter (Model-970)	≤ 3 mg/L	≤ 50 mg/L	Above DW limit
2	COD	< 30 mg/L	Lovibond SpectroDirect Method No. 130, 131, 132	NG	≤ 250 mg/L	Normal

CONCLUSION

In this research work, three kinds of water sample site 1 (Mayanchan), site 2 (Gaw Wein) and site 3 (Chawseith) were collected from Ayeyarwaddy river before and after flood. The physicochemical parameters of selected samples were investigated by the help of Public Health Center, Mandalay Region.

Moreover, three selected samples from Ayeyarwaddy river in which some parameters such as pH, color, Total Solids, Total Hardness and Total Alkalinity were measured and compared by graph that indicates Total Solids and Total Alkalinity of site 2 are higher than that of other two sites. In addition, Cl^-, SO_4^{2-}, Ca, Mg and Fe contents of above three samples were also contracted and SO_4^{2-} content of site 3 is distinctly higher than other two sites.

Similarly, the measurements of physicochemical parameters of other three samples collected in June 20, 2018 (after flood) that were done and compared by the graph. From these comparisons, total Solids and total alkalinity of site 2 are higher than that of other two sites as well as SO_4^{2-} content of site 3 is distinctly higher than other two sites. The bacteria, Coliform and *E. coli* present in the water sample in all sites in the Ayeyarwady river that is the presence of human discharges in water and pointing out the river water should not drink directly. So, the Ayeyarwady river should be boiled for drinking as well as for household use. But it can be directly used for agriculture.

REFERENCES

Dey, K., Mohapatra, S. C., & MISRA, M. B. (1970). Assessment of water quality parameters of the river Brahmani at Rourkela. *I Control Pollution*, *21*(2).

Delfino, R. J. (2002). Epidemiologic evidence for asthma and exposure to air toxics: linkages between occupational, indoor, and community air pollution research. *Environmental health perspectives*, *110*(Suppl 4), 573.

Ra, K. (2011, September). Water quality management at river basin in Myanmar. In *Presentation at the 3rd WEPA International Workshop, Manila, the Philippines* (Vol. 21).

Saywell, L. G., & Cunningham, B. B. (1937). Determination of iron: colorimetric o-phenanthroline method. *Industrial & Engineering Chemistry Analytical Edition*, *9*(2), 67-69.

Iqbal, I. (2015). The space between nation and empire: the making and unmaking of eastern Bengal and Assam Province, 1905–1911. *The Journal of Asian Studies*, *74*(1), 69-84.

Keck, S. L. (2003). Representations of River Travel in Burma: 1890–1914. *Asian Journal of Social Science*, *31*(1), 36-54.

Hlaing, U. C. (2008). Anthropological communities of interpretation for Burma: An overview. *Journal of Southeast Asian Studies*, *39*(2), 239-254.

World Health Organization. (2003). *Diet, nutrition, and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation* (Vol. 916). World Health Organization.

Buhlmann, K. A., Akre, T. S., Iverson, J. B., Karapatakis, D., Mittermeier, R. A., Georges, A., ... & Gibbons, J. W. (2009). A global analysis of tortoise and freshwater turtle distributions with identification of priority conservation areas. *Chelonian Conservation and Biology*, *8*(2), 116-149.

Xu, C. Y., & Singh, V. P. (2004). Review on regional water resources assessment models under stationary and changing climate. *Water resources management*, *18*(6), 591-612.