Global Academic Journal of Humanities and Social Sciences

Available online at https://www.gajrc.com
DOI: 10.36348/gajhss.2022.v04i02.005

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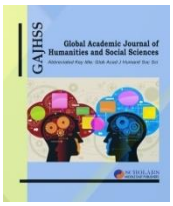

ISSN:2706-901X (P)
ISSN:2707-2576 (O)

Original Research Article

Analysis of Ochani River in Ebubu, Eleme Local Government Area, Rivers State

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Article History
Received: 22.02.2022
Accepted: 26.03.2022
Published: 04.04.2022

Abstract: Surface water undergoes immense strain, and it has been estimated that, owing to its simple disposability, human waste and toxic industrial discharges is released untreated into the surface water. The most affected to this transformation is the surface water caused by anthropogenic contaminants. It is in the light of this that the study assessed the physicochemical and heavy metal parameters in the surface water at Ochani River in Ebubu, Eleme Local Government Area. The water samples were collected 500meters apart from different points, and the adjourning river which serve as the 'control point'. Analysis of heavy metals and physicochemical parameters were done using appropriate measures and standard procedures. The finding indicate that the lead values obtained from the analysis of the sampled water is 0.001mg/l; copper value <0.001mg/l; Zinc values range from 0.002mg/l to 0.004mg/l, while Iron values obtained from the sampled water analysis ranged from 0.336mg/l to 0.724mg/l; and the value of chromium is ranging from 0.001mg/l to 0.004. The laboratory analysis of pH and turbidty values ranged from 5.34 to 5.54 and, 60 - 70 NTU, respectively. These obtained values are below the maximum limit for DPR and WHO surface water standards. Therefore, the study recommend that Ochani River is not safe for human intake.

Keywords: Surface water, Heavy metals, Physicochemical, Ochani river.

1.0 INTRODUCTION

Water is one of the essential natural resources that support human life (Abasaheb, 2013). Clean water is vital to nature and humanity. In recent time, transformation by anthropogenic contaminants no longer supports human use of water, such as drinking water (Akinyemi, Odunaike, Daniel, & Alausa, 2014). The most affected to this transformation is the surface water. Surface water undergoes immense strain, and it has been estimated that, owing to its simple disposability, over 80 per cent of global human waste to highly toxic industrial discharges is released untreated into the surface water (Hasan, & Khan, 2015).

In Nigeria, record has it that oil spillage caused primarily by the leakage of crude petroleum pipe is remote causes of the surface water pollution (Igwe, Chukwudi, & Ifenatuorah, 2017). Also, the low level of technological know-how and the weakness of our laws and their feeble enforcement, the callousness of multinational enterprises participating in the oil business in the country, sabotage by aggrieved individual and communities are the causes of surface water pollution (Ayodele, Fafioye, & Oladunjoye, 2019). On a daily basis, enormous amounts of wastes are discharge into the surface water without following adequate and stipulated standard procedures for such discharge (Murhekar, 2011). Most of these releases are largely due to anthropogenic activities.

Although, there is the belief these releases contain very low concentrations of toxicants, yet

continuous or unabated discharges might lead to accumulations above the threshold levels which might affect the livelihood of the people (Qureshimatva & Solanki, 2015). When water is polluted, the removal of contaminants is exceedingly hard, expensive and frequently impossible. This poses serious implication in terms of food security, water availability for different uses, livelihood and survival on aquaculture.

1.1: Aim and Objectives

The aim of this study is to analyze Ochani River in Ebubu, Eleme Local Government Area, Rivers State.

The following objectives were considered to;

i. Determine the heavy metal parameters of the surface water: zinc (Zn), lead (Pb), iron (Fe), cadmium (Cd), Nickel (Ni), copper (Cu), and chromium (Cr).
ii. Determine the physicochemical properties of the surface water: temperature, electrical conductivity, pH, turbidity, total dissolved solid and total hardness.
iii. Compare the level of heavy metal and physicochemical parameters obtained from the observed sample locations with the World Health Organisation and Directorate of Petroleum Resources standards.

2.0 MATERIALS AND METHODS

The Ochani River is located in Ebubu town in Eleme Local government Area. The coordinates are between 4.8040° N and 7.1683° E, and having an area of 140 square kilometers with a population of 190,884 based on the census conducted in 2006, and projected growth rate of 2.6 percent by 2021 giving an estimated population of 496,298.

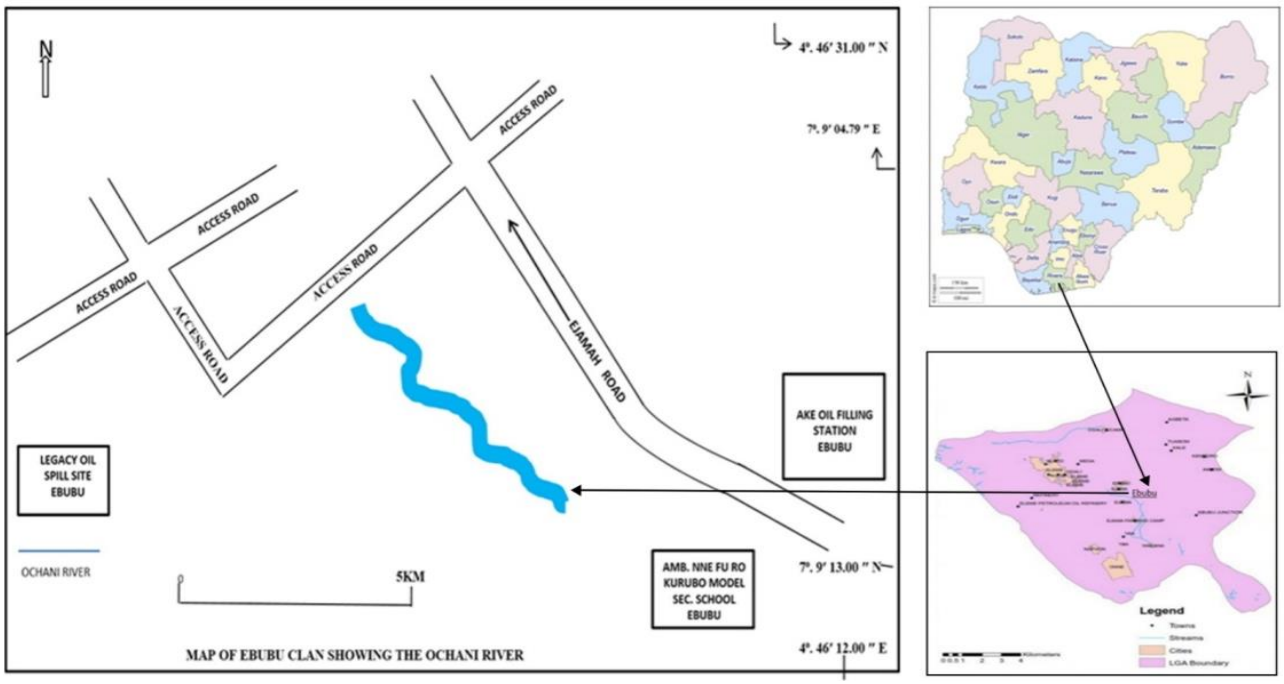

Figure 1.1: Eleme local government area showing the study area

The water samples were collected 500meters apart from three (3) different points and adjourning river which serve as the 'control point'. Samples were collected in clean laboratory bottles by holding a prewashed sampler at the bottom and plunging it about 25 cm below the water surface. The bottle was filled, leaving about 5cm of empty space to allow proper mixing during laboratory analysis using appropriate measures and procedures. Water samples for temperature, pH and turbidity were analyzed in situ (on site) with a HEMED Digital Thermometer or Mercury Thermometer, a portable JENWAY 3015 pH meter and a turbidity meter, while other physicochemical parameters were analyzed following standard procedure. The extract in the water was analyzed for the various heavy metals, namely: nickel, lead, cadmium, chromium, copper, iron, and zinc using atomic absorption Spectro-photometric methods (A.A.S).

Table 1.1: Sampling points showing the coordinates

Sample Site	Latitude	Longitude
Sampling Point A	4.762905	7.161903
Sampling Point B	4.761932	7.162193
Sampling Point C	4.760980	7.164565

Source; field work 2021

3.0 RESULT AND DISCUSSION

The results obtained in Table 1.2 indicate that all parameters show corresponding values that are almost similar across different locations, with the exception of iron (Fe+) which shows slight changes.

Table 1.2: Heavy metal parameters with WHO and DPR standards

S/N	Parameters in mg/l	Sampling point A	Sampling point B	Sampling point C	Control Sample point (Okpako-Ejamah River)	WHO 2004 Limits	DPR 2018 limits	Standard Deviation SD	Standard Error SE	Mean ± SD
1	Lead	0.001	0.001	0.001	0.001	0.01	0.05	0	0	0.001 ±0
2	Zinc	0.004	0.004	0.002	0.009	0.01	1.0	0.001154701	0.000666667	0.0033 ±0.0011
3	Copper, Cu	0.001	0.001	0.001	0.001	0.5	1.5	0	0	0.001±0
4	Cadmium	0.001	0.001	0.001	0.001	0.003	NS	0	0	0.001±0
5	Nickel	0.001	0.001	0.001	0.001	0.02	0.07	0	0	0.001±0
6	Iron, Fe	0.336	0.724	0.456	0.286	1.0	1.0	0.198648769	0.11468992	0.51±0.2
7	Chromiu, Cr	0.001	0.004	0.001	0.001	0.05	0.05	0.001732051	0.001	0.002±0.002
	TOTAL	**0.345**	**0.736**	**0.463**	**0.3**					

Source: Field work 2021

The lead values obtained from the analysis of the sampled water in Table 1.2 is 0.001mg/l across the three (3) sample locations. The standard deviation and the standard error for lead across all stations is zero, showing no variability in the mean value. The obtained values are below the maximum limit for DPR and WHO surface water standards, which are 0.05mg/l and 0.01mg/l, respectively.

Zinc values obtained from the analysis of the sampled water ranged from 0.002mg/l to 0.004mg/l, with a mean value of 0.003333mg/l across all sample locations in appendix 1. The standard deviation and standard error were within the range of 0.001154701mg/l and 0.000666667mg/l respectively, showing a low degree of variability and high accuracy in analysis. The obtained value is also below the maximum permissible limits of DPR and WHO, which are 1.0mg/l and 0.01mg/l respectively. The value from the control sample obtained in table 1.2 is 0.009mg/l, which is not more than the maximum permissible limit.

The copper value obtained from the analysis of the sampled water is <0.001mg/l for all three sample locations, including that of the control station obtained from the adjoining surface water at Okpako. The mean value was 0.001 mg/l with no variability around the mean, giving a Zero figure for standard deviation and standard error. The obtained value is also below the maximum limit for surface water as given by DPR, WHO, which are 1.5mg/l, and 0.5mg/l respectively.

Cadmium values obtained from all three sample locations, sampling point A, sampling point B, and sampling point C, are all 0.001mg/l. The standard deviation and standard error value of zero show no degree of variability around the mean value of 0.001mg/l. The obtained sample values are within the range and less than the maximum value of 0.003mg/l required by WHO (2004).

Nickel values obtained from all the three sample points are all <0.001mg/l. The standard deviation and standard error value of Zero shows no degree of variability around the mean value of 0.001mg/l, hence an accurate correlation between the independent and dependent variables. The obtained sample values are within the range and less than the maximum value of 0.02mg/l required by WHO and 0.07mg/l for DPR.

Iron values obtained from the sampled water analysis ranged from 0.336mg/l to 0.724mg/l, with a mean value of 0.505333mg/l, the standard deviation and standard error of 0.198648769mg/l and 0.11468992mg/l mean a low degree of variation in the analyzed sample. The obtained value is also below the maximum permissible limits of DPR and WHO, which is 1.0mg/l. The value from the control sample obtained is also 0.286mh/l, which is relatively lower than the maximum permissible limit.

The mean value of chromium is 0.002mg/l with sampled analysis ranging from 0.001mg/l to 0.004 and, the standard deviation and standard error of 0.001732051mg/l and 0.001mg/l respectively. The value obtained is less than the maximum DPR and WHO standard for surface water, which is 0.05mg/l.

The laboratory analysis of pH value in table 1.3 ranged from 5.34 to 5.54 with a mean deviation of 5.46 ±0.02. Also, the control sample collected from Okpako river shows a dip in the pH value but is closer to the WHO and DPR standards as compared with the study location samples. The pH values, which give an indication of acidity and alkalinity of the water, show the surface water in the area is less than the 6.5-8.5 for DPR and 7.0-8.9 required for surface water by the WHO standard.

Table 1.3: Physicochemical Parameters with DPR (2018), WHO (2004)

S/N	Parameters	Sampling point A	Sampling point B	Sampling point C	Control Sample point (Okpako-Ejamah River)	Mean	Standard Deviation SD	Standard Error SE	Mean ± SD	DPR 2018 Limits	WHO 2004 Limits
1	pH	5.35	5.54	5.49	5.76	5.46	0.098488578	0.056862407	5.46 ±0.02	6.5-8.5	7.0-8.9
2	Conductivity µS/cm	24	31	25	82	26.66667	3.785938897	2.185812841	26.67 ±3.79	NS	900
3	Temp^{0}C	28.1	28.1	28.1	28.0	28.1	4.35117E-15	2.51215E-15	28.1 ± 4.35E-15	Ambient ±2	NS
4	Turbidity (NTU)	70	70	60	8	66.66667	5.773502692	3.333333333	66.67±5.77	10	5
5	TDS (mg/l)	17	20	17	55	18	1.732050808	1	1.73±1.00	2000	1000
6	Total Hardness (mg/l)	6	10	8	16	8	2	1.154700538	8±2	NS	100

Source: Field work 2021

The electrical conductivity (EC) of the observed sampled analysis ranged between 24 to 31 µS/cm. The maximum electrical conductivity observed from the analyzed sample is that of the control sample analysis of 82µS/cm. The standard deviation shows relative variation in the mean value for the study locations and an observed value lower than the WHO (2004) standard of 900 µS/cm.

The mean value temperature for the analyzed sample locations across is 28.1^{0}C, while the observed temperature for 'Control location' analyzed is 28.0 ^{0}C. The mean deviation gives a record value of 2.51215E-15 which shows variations did not differ significantly across locations. Ambient temperature is the air temperature of any object or environment where equipment is stored, hence DPR (2018) and WHO (2004) return Ambient2.

The values of turbidity observed ranged from 60 - 70 NTU. This value is higher than the DPR and WHO values of 10 and 5 NTU for potable water. Turbidity is the degree of clearness or opaqueness of water. The value of the turbidity observed in the study area is relatively higher than that of the control, which stands at 8 NTU.

The observed value for the TDS ranges from 17-20mg/l for all three river station, a mean deviation value of 1.73±1.00 indicating variation did not differ significantly across locations. A standard error value of 1.154700538 also indicates accuracy in the mean value. The observed values show a possible relationship with the Electrical Conductivity. Relatively, the observed value from all three locations is lower in comparison to maximum TDS for DPR (2018) and WHO (2004) are 2000mh/l and 1000mh/l respectively.

The total hardness observed from the sampled analysis ranges from6-10mg/l. The mean value and mean deviation are 8±2 which indicates a slight variation around the mean. The total hardness for all observed locations, including that of the control samples is within and below the maximum limit WHO standard.

4.0 CONCLUSION AND RECOMMENDATIONS

The fitness of surface water from Ochani River was examined using some water quality parameters. The result shows that heavy metals Pb, Zn, Cu, Cd, Ni, Fe, and Cr are all within the permissible limits required by WHO (2004) and DPR

(2018) for fresh water. It was observed that Ochani river is free from observed metallic contamination. The physicochemical parameters like turbidity are relatively higher than the permissible limit for both DPR and WHO. The pH shows a dip compared to the standard; hence the water can be said to be slightly acidic. The river cannot be said to be completely safe for human intake, but can be used for industrial and other domestic activities like washing, irrigation, etc. As Ebubu town's industrialization and population grow; periodic river analysis should be routinely carried out. Such an examination will disclose the Ochani River's surface freshwater quality, allowing for better forecasting for domestic purposes. It is necessary to notify consumers and other water users that Ochani River is not safe for human intake.

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