Journal Homepage: www.ijarpr.com ISSN: 3049-0103 (Online)

International Journal of Advance Research Publication and Reviews

Vol 1, Issue 2, pp 50-58, October 2024

Comparative Study of the Heavy Metal Contents, Physicochemical Parameters and Microbiological Content of the Choba Section of the New Calabar River, Rivers State Nigeria

Wiri, Thankgod Bariyaa[1]; Gbode Lekia Yenor[2]

[1]Department of Biology, Ignatius Ajuru University of Education Port Harcourt, Nigeria.

[2]Department of Chemistry, Ignatius Ajuru University of Education Port Harcourt, Nigeria.

Correspondence mail: Thankgod.wiri@ust.edu.ng

ABSTRACT

This study focuses on the heavy metal, physicochemical parameter and microbiological contents of the Choba section of the new calabar River in Rivers State Nigeria. It is a comparative study. The study utilized an analytic method which includes physical observation, collecting samples and laboratory analysis; three samples were collected and coded A,B,C and were analyzed. The findings show that the contamination of the River is as a result of anthropogenic activities around and within the River. oil, grease and high fecal content were present, it also shows that aquifers at different sampling points were contaminated. Microorganisms; Bacillus species, coliforms, and Pseudomonas species which are associated with hydrocarbon degradation were found, this is a confirmation of hydrocarbon pollution in the River. The presence of crude oil in the water body lead to a high concentrations of heavy metals which includes Mercury, lead, zinc, iron, copper and cadmium. comparatively, values of physiochemical parameters of water samples at different locations were higher than national and international regulatory agencies like The National Environmental Standards and Regulations Enforcement Agency (NESREA) and the WHO standards.

Keywords : COMPARATIVE, CALABAR RIVER, PHYSICOCHEMICAL, HEAVY METAL, MICROBIOLOGICAL

Introduction

According to Baseto (2002) reports that water pollution occurs when contaminants gets into water, dissolving, suspending or disposing on the bed, this degrades the water quality. He further states that not only does this spell disaster for aquatic ecosystems but that the pollutants seep through layers of rock to reach the underground water which ends up in households for use. Another way water is being polluted is the discharge of city and industrial effluents into water bodies, other indirect contaminants include pollutants that enter water from the soil from ground water systems and from atmospheres like rain. Soil and ground water contain the residue of human agricultural practices and also improperly disposed industrial waste (Hamson, 2010).

Evans (2013) states that water pollution can come from a number of different sources, if the pollution comes from a single source, it is called part source pollution, if it comes from many sources, it is called non part source pollution. Most types of water pollution affect the immediate surroundings of the source. Contaminates can end up in the water by either direct or indirect application. Isiomah (2003) water pollution refers to the presence of deleterious matters in water, it

implies that the quality of water and water system has been degraded. According to Bryant (2003) there are many sources of water pollution but two general categories exist; Direct and Indirect contaminant sources.

MATERIALS AND METHODS

Area of Study

Choba axis of The New Calabar River, is a low lying river which rises at approximately latitude 5°10'N and longitudes 6°50'E close to Elele-Alimini and flows toword the South for approximately 150km before discharging into the Atlantic Ocean at about latitudes 4°20'N and longitudes 7°00'E. It occupies a low relief region, ranging from 0-50m above sea level at the low zone, to 50-100 above sea level at its source. The Choba section of the New Calabar River is within Obio-Akpor Local Government ,Eastern Niger Delta, Nigeria.

Sample Collection

Water samples were collected from three (3) different points in the River. Samples were collected with the aid of sterile sampling bottle. After collection, sample were tightly covered and transported to immediately for laboratory analysis.

Results

Table 1: Comparison of Physicochemical Parameters of Sample with NESREA and WHO Standards at Different Level

S/No	Sample identity	Sampling A	Sampling B	Sampling C	NASREA STDS (2010)	WHO STDs. (1997
1.	Ph	6.04	6.93	7.13	6.5-8.5	6.5-9.2
2.	Conductivity (µs/cm)	105.4	38.4	437.2	Na	300
3.	TDS (mg/L)	48.5	17.7	214.6		500
4.	Turbidity NTU	23	13	27	10	
5.	DO (mg/L)	7.5	8.1	2.8		
6.	BODs (ml/L)	7.5	8.1	2.8		
7.	COD3 (mg/L)	0.9	1.7	1.2	5	
8.	TSS (mg/L)	8	12	6		500
9.	Oil and Grease (Mg/L)	680	560	3870	0.003	

Table 2: Comparing Heavy Metals in Sample with NESREA Standards

S/No	Parameters	Sampling A	Sampling B	Sampling C	NESREA STDS (2010)
1.	Iron (Fe) (mg/L)	0.87	0.67	1.05	0.3
2.	Lead (Pb) (mg/L)	0.57	0.04	0.01	0.2
3.	copper (Cu) (mg/L)	0.07	0.05	0.07	1.0
4.	Cadmium (Cd) (mg/L)	0.07	0.05	0.07	0.003
5.	Zinc (Zn) (mg/L)	0.36	0.25	0.51	3.0

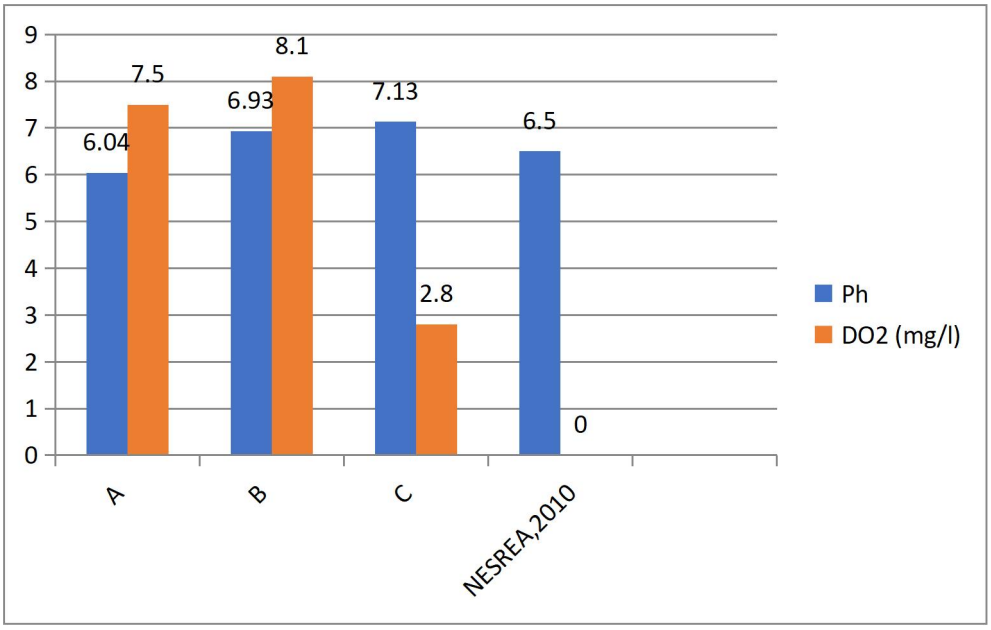

Fig 1: Dissolved oxygen (DO) and pH

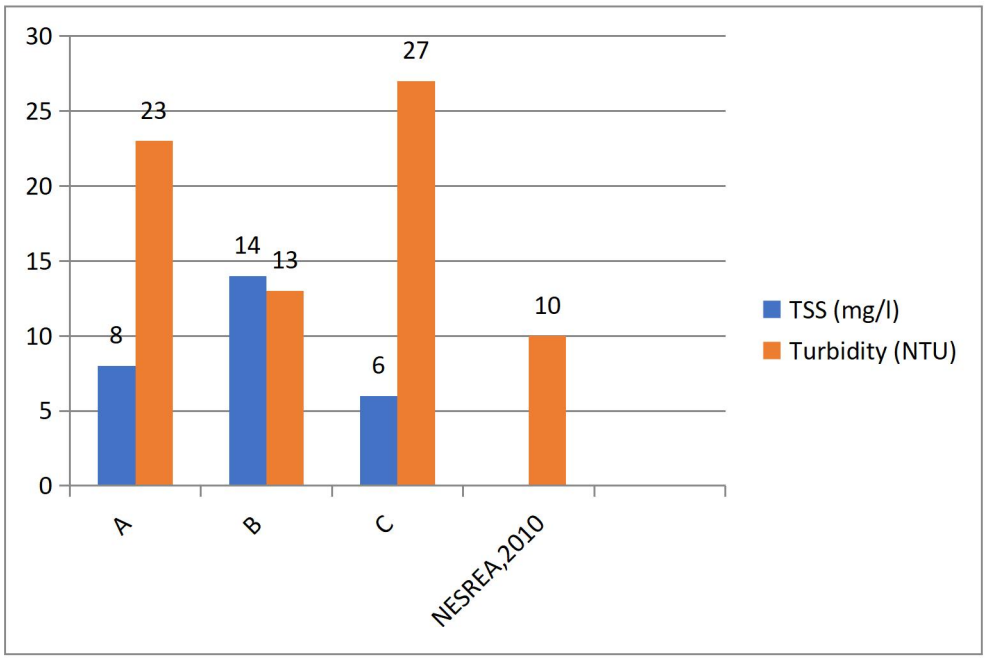

Fig 2: Total suspended solids (TSS) and turbidity

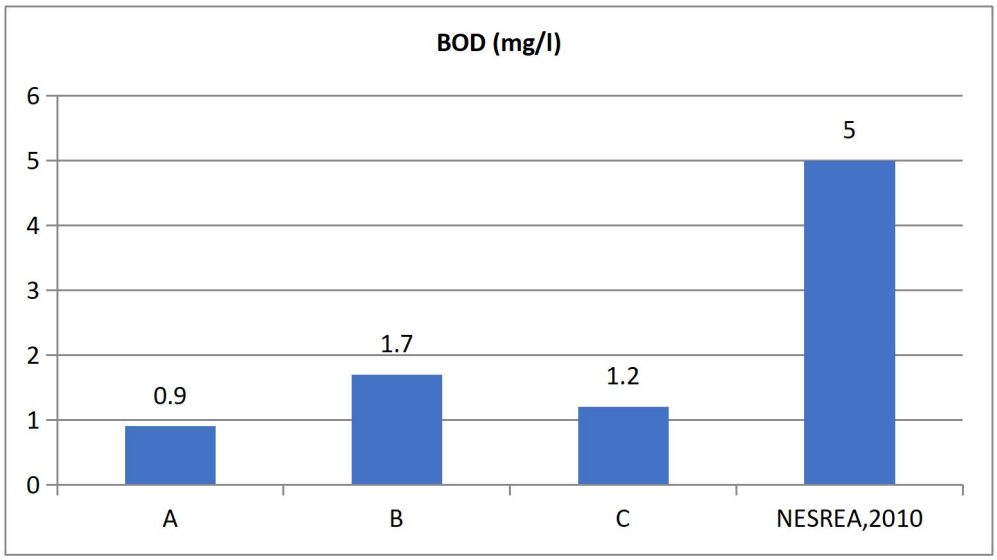

Fig 3: Biological oxygen demand (BOD)

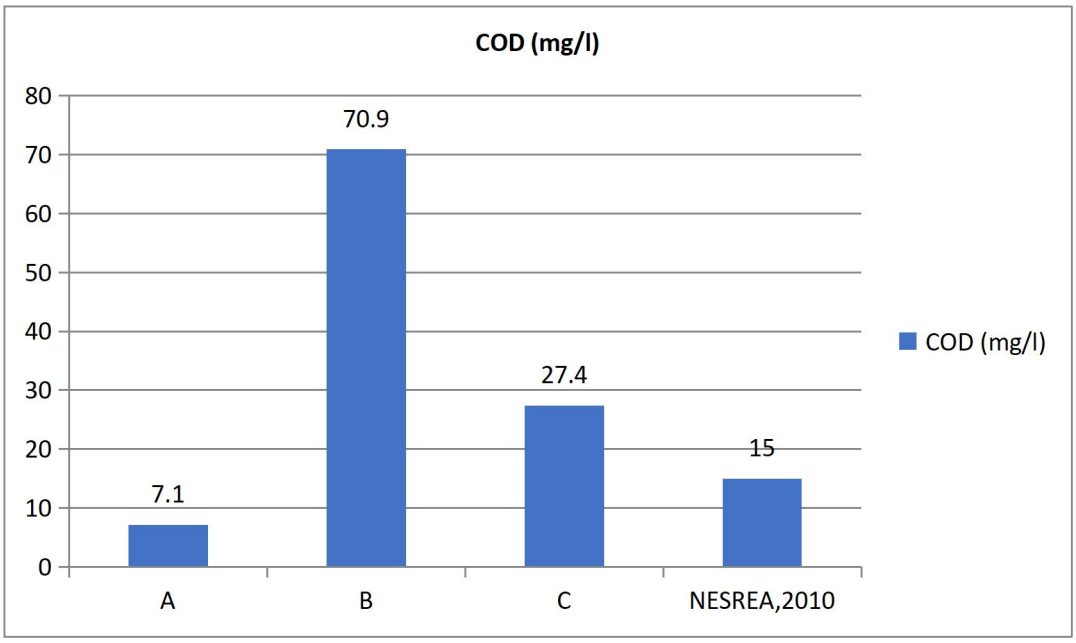

Fig 4: Chemical Oxygen Demand (COD)

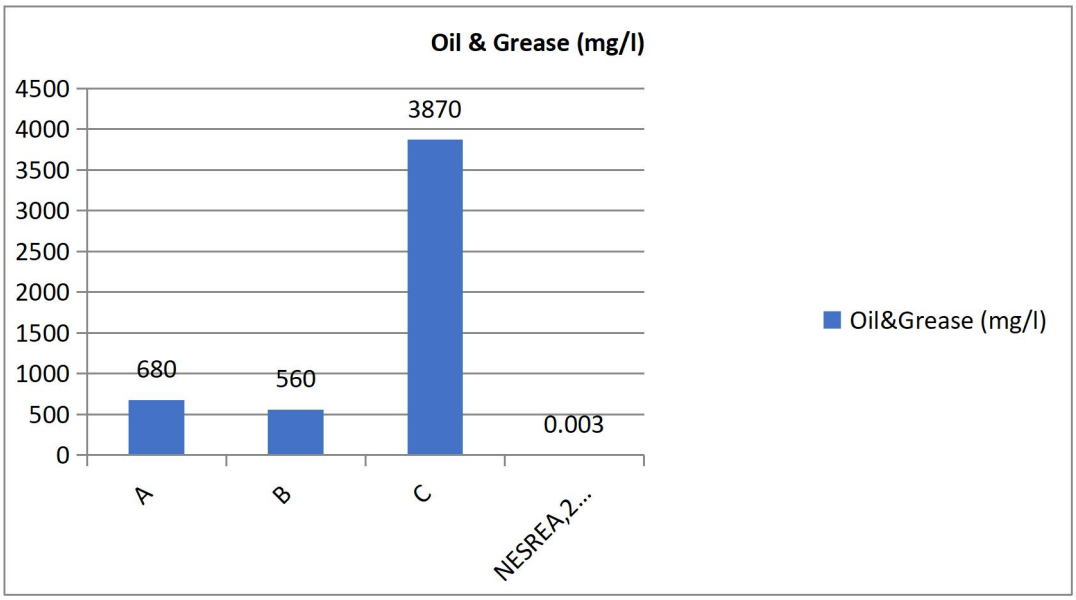

Fig 5: oil & grease

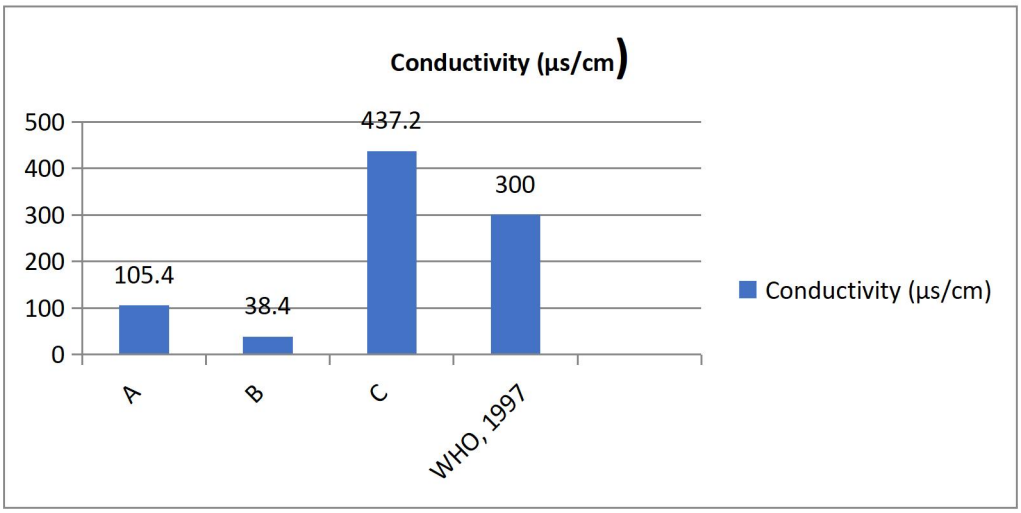

Fig 6: Conductivity

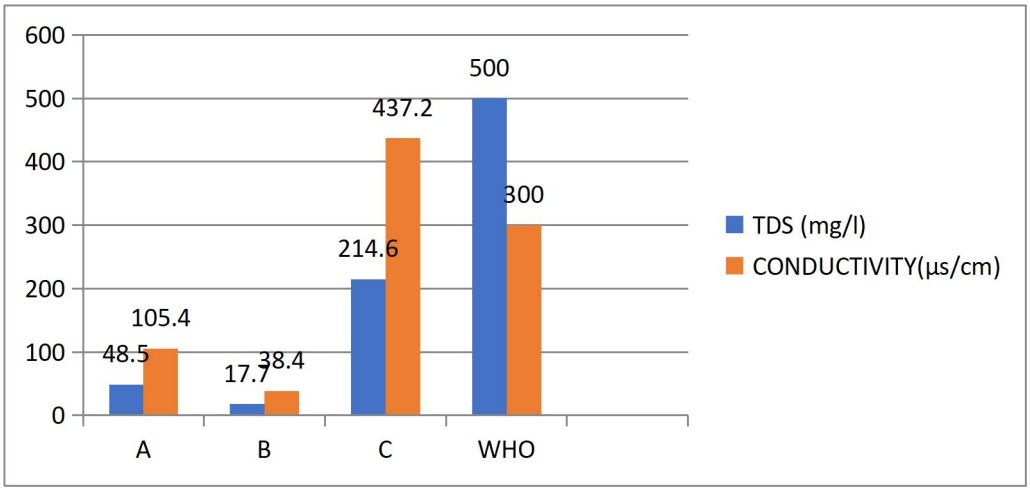

Fig 7: Total dissolved solid (TDS) and Conductivity(µs/cm)

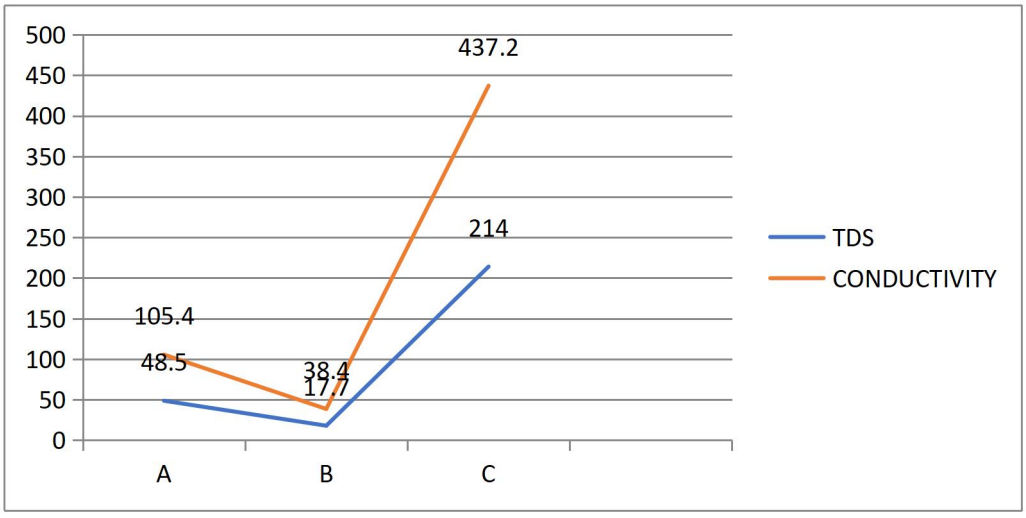

Fig 8: Relationship between Conductivity (µS/cm) and TDS (mg/L) of sample

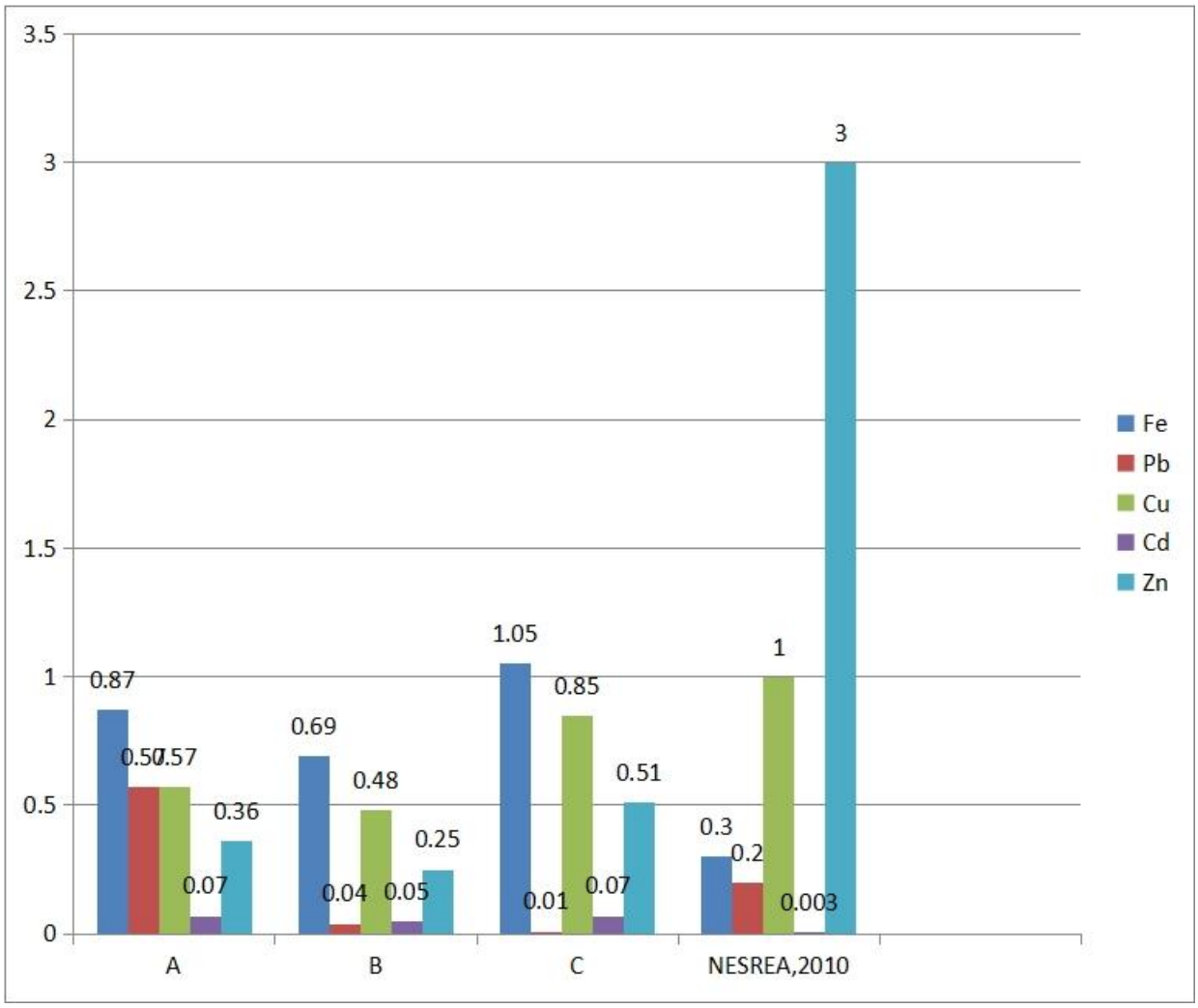

Fig 9: Heavy Metals (Fe, Pb, Cu, Cd, and Zn)

Table 3: Bacterial Counts of Groundwater Samples at Three Different level

Samples	THBC(cfu/ml)	TCBC(cfu/ml)
A	**$7.8X10^6$**	**$9.5X10^6$**
B	**$7.7X10^6$**	**$8.0X10_6$**
C	**$7.0X10^6$**	**$7.0X10^6$**

Discussion

The results of physiochemical parameters across sampling locations, and comparison of the values with established standards are as shown in Table 1. Values of pH at point A (6.04) and point B (6.93) were slightly acidic while the value of pH at point C (7.13) was slightly alkaline. The results also showed that the pH values of the samples were within NESREA standards excepting at point A pH (6.04). In table 1, values of Biochemical Oxygen Demand (BOD_5) at points; A (0.9 mg/L), B (1.7 mg/L), and C (1.2 mg/L) were below NESREA standard of 5 mg/L, An indication that ground water has passed through some natural filters. Chemical Oxygen Demand (COD) of groundwater samples were below NESREA (2010) standards of 15mg/l excepting COD at point B (70.9 mg/L) and at point C (27.4 mg/L). COD at point A

was 7.1 mg/L in table 1.Values of turbidity at points A, B, and C were 23NTU, 13NTU, and 27 NTU respectively. These values were above NESREA standard of 10 NTU. Conductivity of groundwater samples at points A, B, and C were 105.4µs/cm, 38.4µs/cm, and 437.2µs/cm. Oil and grease at point A was 680mg/L, point B (560 mg/L), and point C (3870mg/L). Value of oil and grease at point C was highest. All the values were above NESREA standards of 0.003mg/L in table 1.Heavy metals; iron, lead, copper, cadmium, and zinc were analyzed, and result in table 2 showed that the values of copper and zinc were below NESREA standards of 1.0mg/L and 3.0 mg/L respectively. Cadmium and Iron exceeded NESREA standards. Values of lead were below NESREA standards of 0.2 mg/L excepting the value at point A (0.57mg/L).In table 2, values of iron at point A (0.87 mg/L), B (0.69 mg/L) and C (1.05 mg/L) were above NESREA standard of 0.3mg/L.In table 2, values of cadmium at point A (0.07 mg/L), B (0.05 mg/L) and C (0.07 mg/L) were above NESREA standard of 0.003mg/L.Values of copper at point A (0.57 mg/L), B (0.48 mg/L) and C (0.85 mg/L) were below NESREA standard of 1.0mg/L in table 2.Values of zinc at point A (0.36 mg/L), B (0.25 mg/L) and C (0.51 mg/L) were below NESREA standard of 3.0 mg/L in table 2.Values of lead at point A (0.57mg/L) was higher than NESREA standard, while values at B (0.04mg/L) and C (0.01 mg/L) were below standard in table 2.Total dissolved solids at points; A, B and C were 48.5mg/L, 17.7 mg/L and 214.6mg/L respectively. These values were below WHO (1997) standards of 500 mg/L in table 1.Electrical conductivity of samples at points A, B, and C were 105.4µs/cm, 38.4µs/cm, and 437.2µs/cm respectively. Conductivity at point A (105.4µs/cm) and B (38.4µs/cm) were below WHO (2003) standards of 300µs/cm. Point A has the highest electrical conductivity of 437.2µs/cm in table 1.Total suspended solids in groundwater samples at point; A, B, and C were 8 mg/L, 14 mg/L, and 6 mg/L respectively. These values were below WHO (1993) regulatory standard of 500 mg/L in table 1.

Conclusion

Water contamination of the Choba Section of The new Calabar River is mainly as a result of the activities of man around the River. The defecation of residents who resides at the River bank led to coliforms been found in the river. Hydrocarbon pollution due to the activities of multinational oil companies. Microorganisms; *Bacillus cereus*, and *Bacillus aurous* which are associated with hydrocarbon degradation were found. This shows the presence of crude oil. Also coliform bacteria were also detected. Comparatively, values of physiochemical parameters of water samples at different locations were higher than the NESREA standards. This shows that none of the water samples can be regarded portable owing to this fact.The presence of crude oil in water is as a result of exploration and exploitation, transportation of crude oil in Rivers State. Also, pipeline vandalism can contribute to this factor.

Recommendations

The following were recommended:
Water from the Choba River should not be use for drinking as it is not potable due to its high coliform contents and heavy metal which is far above recommended standards for potable water by WHO.

REFERENCES

Ahmed, R.C. (2014) Health Risks Associated with Polluted Water, Cambridge University Press.

British Medical Association. (2017) Hazardous Wastes and Human Health 1st Edition.

Bryant, O.W. (2008) A review of Sources of Water Pollution

Encyclopedia Historian (U.S) (2000). Classification of Water Associated Disease.

Evas, F.T (2001) Environmental Science Sustaining the Earth 32nd Edition.

Igwe, T.R (2013) A textbook of Health Implication of Polluted Water. Cambridgew University Press.

Miller, U.E (2012), New York Village .

of Water Pollution, Reviewed Harvard University Press.

Orabogor, A.K. (2012) A Handbook of Types

Peterson, C.X (2012) Importance of Good Water. The American Journal of Environmental Health, 31, 1-15.

Porteus, K.C (2011) Source of Water Pollution, Harvard University Press.

Stadler, P.R. (2014) Ecology of the Effect of water Pollution, University Press.

Umar, O.W. (2010) A review of studies on water pollution. The journal of Environmental Health Authors and Guide.

University Press, Environmental Protection Agency, (2015).

University Press; Water Supply in the Deacade.

W.H.O (2012) Standards for chemical in drinking water 3rd Edition.

W.H.O (2013) A Hand book on Inorganic water 1st Edition.

White, F.V. and Levis (2016). A textbook on Health Hazards of Polluted Water. IRCND NO