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The Impact of Human Activities on the Physico-Chemistry of Ogbum-nu-abali Creek, Port Harcourt Metropolis

Woke, G.N. and Wonodi Owunwene Emeka

Department of Animal and Environmental Biology, University of Port Harcourt, Port Harcourt.

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ABSTRACT

Ogbum-nu-Abali Creek of Port Harcourt metropolis was undertaken to assess the impact of human activities in relation to physico-chemistry between March – May, 2006. Results of physico-chemical parameters showed that most of the parameters were higher than the maximum permissible limits for surface waters and discharge of wastewaters into surface waters. Results further showed that pH ranges from 6.20 – 6.70 with a mean value of 6.54 mean values of parameters included: conductivity (1602.03 µs/cm), TSS (174.78mg/L), TDS (5187.577mg/L), Turbidity (8.12NTU), BOD_5 (27.95mg/L), DO (4.51mg/L), Oil and Grease (5.77mg/L), Phosphate (0.443mg/L), Lead (0.3mg/L), Fe (2.74mg/L), Manganese (11.54mg/L), Chromium (0.33mg/L) and Temperature (28.17^0C) respectively. The creek was transparent, foamy, slimy, slightly smelly and no animal life was sighted in it due to deterioration of water quality as evident by high BOD and low oxygen content. It is pertinent to state that anthropogenic activities in and around the creek have given rise to alteration of the physico-chemical characteristics of the water quality rendering it unfit for recreational exercise, therefore, the abattoir at Ahiamakara leading to Nkpogu community should be discontinued to avoid water pollution.

Introduction

Water is one of most abundant compounds found in nature, covering approximately three to fourth the surface of the earth. In spite of this apparent abundance, several factors serve to limit the amount of water available for human use. The impact of human activities on the physico-chemistry of a creek, simply tells us how human activities affect the chemistry and ecology of the creek in question. This include the water quality and quantity, depletion of living resources, biodiversity loss, increased levels of nutrients, introduction of pollutants, and the deterioration of the aesthetic nature of the creek.

Water pollution is the phenomenon where the quality of the water in the water environment including rivers, lakes and wetlands and the ocean, deteriorates (Vesiland and Peirce, 1982). The factors leading to water pollution are diverse and include discharge from industries and households, pollution by minerals and agricultural chemicals and secondary effects such as eutrophication. All of these can endanger life on earth, and can be factors leading to the deterioration of human well being (Bertness, 2002).

Human pollution of rivers is common and very few rivers in the world today are clean of man-made substances. The most common point source of pollutant is probably sewage piped into rivers, or dumped into river but chemical pollution is also common, and industrial accidents (and/or negligence) account for significant destruction of riparian biomass. Heated water dumped into rivers by power plants and factories also affect river life. Non-point source pollutants such as diffuse pollution from agriculture, urbanization and forestry are now being recognized as one of the more damaging sources of pollutants in the developed world.

Pollution of the Nigerian environment in human activities has become a national concern because of the resulting socio-economic effects. Recently, government mandates and legislation have prompted measures to control pollution in our environment. To this end, concerted effort is being made by industries and individuals to adopt relevant responses and contingency measures yet very many individuals and corporate organizations still find joy in deteriorating our environment through their activities.

Ogbum-nu-Abali Creek, being the only creek around the study area has being subjected to an indiscriminate dump site for domestic solid waste. Companies close to the creek have channelled their chemical waste and byproducts, runoff containing spilled petroleum products and discharge of poorly-treated or untreated sewage into the creek and a host of other human activities rendering the creek unfit for agricultural, industrials, household and recreational and environmental activities. Hence the need to carry out a study becomes imperative on the creek. The aim of the study is to determine the extent these activities are impacting on the creek and to get scientific proof of the pollutants present in the creek and their effects on the physico-chemistry of the creek.

Study Area

Ogbum-nu-Abali Creek is located within longitude 40 15" to 4050"E and latitude 60.570N 4050N (Rivers State Map, Political, 1992). The creek complex is characterised by fairly strong current largely controlled by the tidal regime. The tidal amplitude is generally above 2 meters at the estuary head (Imevbore, 1983, Ogamba, 1998).

Tele:

E-mail addresses: imsubiznessjournals@yahoo.com

Table 1. Table showing the analytical results of surface water in the three stations for three months

Parameters	Station									
	March			April			May			WHO/ FEPA STD
	1	2	3	1	2	3	1	2	3	
pH	6.50	6.70	6.70	6.50	6.40	6.20	6.40	6.50	6.99	6.5-8.5
Conductivity (μs/cm)	154.00	4350.00	27450.00	160.00	4000.00	27980	170.00	4750	28000.00	40
Total suspended solid (mg/L)	21.60	130.00	380.00	19.40	131.00	365.00	21.00	140.00	365.00	30
Total dissolved solid (mg/L)	71.00	2010.00	1800.00	74.00	2000.00	19000	76.20	2050.00	19600	500
Turbidity (NTU)	2.00	12.00	12.50	2.00	9.00	12.80	1.80	9.00	12.00	5
Biochemical oxygen demand (mg/L)	17.84	32.00	32.20	19.20	31.80	34.00	19.04	31.50	34.00	4
Dissolved oxygen (mg/L)	5.50	4.60	2.60	5.70	4.20	3.60	6.20	4.40	3.80	6-8
Oil and Grease (mg/L)	2.34	7.60	7.40	2.40	6.24	8.60	2.48	6.50	8.40	10
Phosphate (mg/L)	0.38	0.46	0.48	0.36	0.71	0.42	0.38	0.38	0.42	5
Lead (mg/L)	0.10	0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.1
Iron (mg/L)	0.08	3.42	3.48	0.08	3.68	3.40	3.68	3.36	3.45	20
Manganese (mg/L)	0.04	0.80	0.80	0.04	0.10	0.80	0.06	0.12	0.10	5
Chromium (mg/L)	0.06	0.48	0.52	0.08	0.46	0.38	0.06	0.50	0.40	0.1
Temperature (^oC)	27.30	30.70	32.40	28.00	28.70	32.00	28.00	28.70	32.70	20-33

Much of its water is retained even at low tide with little fresh water input characteristics of rivers within the southeast of Nigeria (Rashed, 2001; Chindah and Braide, 2003). The climate is tropical with average temperature of $25^oC - 31^oC$ (Egborge and Sagay, 1979; Telsola, 1988 and Onwundinjo, 1990).

The vegetations predominantly are mangrove and Nypa palm and coastal vegetation (Kinako, 1977; Imevbore, 1983, Wilcox, 1983; Ogamba, 1998). There are several human activities that take place around the creek ranging from waste dump site, dense riverine settlements and winning, to sewage and industrial effluent discharge points into the creek.

Materials and Methods

Water samples for physico-chemical studies were collected from the three sample stations, for three months starting from March to May, 2006. For the purpose of this study, the stations were divided into three: Station 1: (Nwaja Creek) there is a fast foodstuff (Tantalizers) discharging their sewage/waste water into the water body, drainage discharging untreated sewage into the creek. Station 2: (Ogbum-nu-Abali Creek) the activities that take place around this station are numerous but to mention a few densely populated riverine settlement, waste dump site, sand winning, abattoir and sewage discharge effluent drainage channelled into the creek. While Station 3 (Amadi Greek) the activities that take place there ranges from fishing, sand-winning waste dump site and mean of transportation for companies close to the creek.

Sample Collections

Water samples were collected in accordance with the shoreline sampling method as described by Milne (1996). Samples were collected by wading to slightly above knee depth and samples were taken approximately 20-30cm below the water surface. Sterilized sample bottles of 250ml volume size were used by holding the bottle at its base and dipping it downwards below the water surface, opened and allowed to fill up, then corked still under water and then brought to surface (APHA, 1998). The samples were taken to the laboratory for analysis.

Physico-chemical parameters such as pH, total dissolved solids (TDS), conductivity, temperature (OC), dissolved oxygen, total suspended solid (TSS), biochemical oxygen demand (BOD_5) and turbidity were collected for each sample station. The Azide modification method was used to determine the initial dissolved oxygen (DO) (APHA, 1998). Temperature measurement of surface water was carried out with a mercury in glass thermometer (centigrade OC) whereas a measuring cylinder was used to measure TSS (APHA, 1998). Other parameters such as oil and grease, phosphate, lead (pb), iron, manganese and chromium, were measured using Spectrophotometrically Atomic Absorpotion model (AAS): Perkin Elmer 3110.

Table 2. Mean value of surface water at various stations

S/N	Parameters	Station			Mean Value	WHO/ FEPA STD
		1	2	3		
1	pH	6.47	6.53	6.63	6.5-8.5	6.54
2	Conductivity (μs/cm)	161.33	4366.67	27810	40.00	1602.03
3	Total suspended solid (mg/L)	20.67	133.67	370	30.00	174.28
4	Total dissolved solid (mg/L)	75.73	2020.00	13467	500.00	5187.57
5	Turbidity (NTU)	1.93	10.00	12.43	5.00	8.12
6	BOD_5 (mg/L)	18.69	31.77	33.4	4.00	27.95
7	Dissolved oxygen (mg/L)	5.80	4.40	3.33	6.8	4.51
8	Oil and Grease (mg/L)	2.41	6.78	8.13	0.05	5.77
9	Phosphate (mg/L)	0.37	0.52	0.44	5.00	0.443
10	Lead (mg/L)	0.10	0.11	0.1	0.05	0.3
11	Iron (mg/L)	1.28	3.49	3.44	1.00	2.74
12	Manganese (mg/L)	0.05	0.34	0.57	5.00	11.54
13	Chromium (mg/L)	0.07	0.48	0.43	0.05	0.33
14	Temperature (^OC)	27.77	29.37	32.37	20.33	28.17

Results

The result of analysis on the physico-chemical parameters of three sampling stations are presented in Table 1. Mean value of surface water of the three stations are presented in

Table 2. While mean variation of temperature, pH and oil and grease in the various stations sampled are presented in Fig. 1, 2 and 3 respectively. The results obtained show that pH ranged from 6.20 – 6.70 with a mean density of 6.54 (Table 1).

Conductivity (µs/cm) range from 15400 – 4350.00 with a mean value of 1602.03, TSS (mg/L) (19.40 – 380.00), with mean value of 174.78, TDS (mg/L) (74.00 – 19600.00) with a mean value of 5187.5767mg/L, Turbidity (NTU) (1.80 – 12.80), with a mean value of 8.12, BOD_5 (mg/L) (17.84 – 34.00) with the mean value of 27.95, DO (mg/L) 92.60 – 6.20) with a mean value of 4.51mg/L, Oil and Grease (mg/L) (2.34 – 8.60) with a mean value of 5.77mg/L, Phosphate (mg/L) (0.36 – 0.71), with a mean value of 0.443mg/L, Lead (mg/L) (0.10 – 0.12), with a mean value of 0.31mg/L, iron (mg/L) (0.08 – 3.68) with a mean value of 2.74mg/L (Table 2), Manganese (mg/L) (0.04 – 0.12) with a mean value of 11.54 mg/L, Chromium (mg/L) (0.06 – 0.52) with a mean value of 0.33mg/L and Temperature (^oC) ranged from (27.30 – 32.70) with a mean value of 28.17^oC, Fig. 1, Fig. 2 and Fig. 3 respectively.

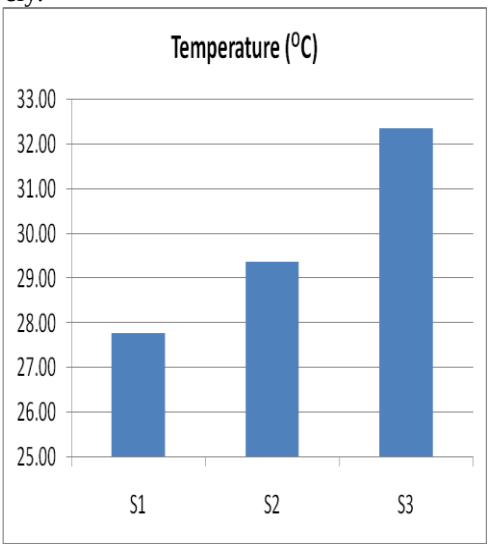

Fig 1. Variation of mean temperature values in the various stations sampled.

S1: Nwaja creek
S2: Ogbum-Nu-Abali creek
S3: Amadi creek

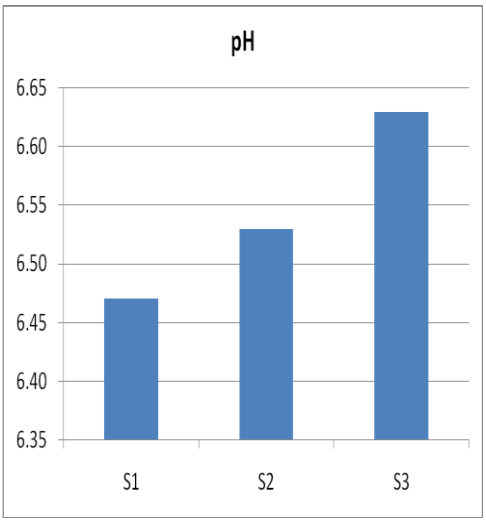

Fig 2. Variation of mean pH values in the various stations sampled.

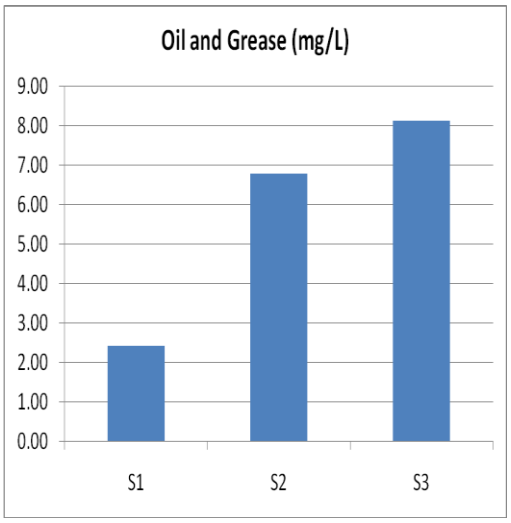

Fig 3. Variation of mean oil and grease values in the various stations sampled

Discussion

The pH of an aquatic system is an important indicator of water quality and the extent of pollution in the watershed areas. Unpolluted water streams normally have a near neutral or slightly alkaline pH between 6.5 – 8.5 as stipulated by WHO, 2006. The concentration of hydrogen ion has great significance for chemical and biological process occurring in natural water as it can influence the growth of water biota, especially fish population. Also, most of the aquatic organisms are adapted to an average pH and do not withstand abrupt changes. The pH value of 6.5 – 8.5 stipulated standard by FEPA (1991), WHO (2006).

High BOD values were above stipulated standards and may account for the low dissolved oxygen recorded in the river which can cause anoxic conditions capable of killing living organisms in the river. The higher values could be attributed to the flood and municipal drains depositing wastes (organic, inorganic and debris) into the estuary thereby leading to increased fouling and degradation as was observed in Amadi creek.

Phosophate value were insignificant when compared with the recommended WHO/FEPA limits of 0.5mg/L. Phosphates can be present in surface water through domestic sewage, either units organic or inorganic form Wilmot, 1997. Phosphates help in the facilitation of the growth of algae, which is a beginning stage in the eutrophication process (Imevbore, 1983).

Other physico-chemical parameters were above the recommended standard by WHO/FEPA for a surface water and may not be suitable for fish production for human consumption. The water quality especially in the Ogbum-nu-Abali Creek did not compare well with stipulated standards for drinking water by FEPA (1991) and WHO (2006) and should not be consumed by humans.

Conclusion

In view of this study, it is pertinent to state that anthropogenic activities in and around the creek have given rise to alteration of the physico-chemical characteristics of the water quality rendering it unfit for recreational exercise and it could be possible that the aquatic organism which are mainly depended upon as a source of money by fishermen in these areas could suffer from food chain poisoning through bioaccumulation and biomagnifications. It is important that the abattoir of Ahiamakara leading to Nkpogu community should be discontinued. This will help to increase the

biochemical oxygen demand content of the water body, hence runoff/drainage from companies around the creeks must be properly monitored by government agencies.

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