EFFECT OF HUMAN ACTIVITIES ON WATER QUALITY

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ABSTRACT

The impact of human activities on the physicochemical properties of Afaha Obio-Eno and Odiok Itam rivers were investigated in the month of January, June and December 2013. The physiochemical parameter measured were pH (4.8-5.9), Electrical conductivity (10-17µs/cm), Dissolved oxygen (0.3-0.6mg/l), Biological oxygen demand (1.1-1.8mg/l), Phosphate (0.03-0.41mg/l), Iron (0.11-0.48mg/l), Zinc (0.014-0.28mg/l) and Lead (0.003-0.06mg/l). The pH revealed acidity across the stations and thus can adversely affect aquatic organisms that live in the water since their metabolic processes are pH dependent. Dissolved oxygen was extremely low and can lead to the death of aquatic organisms. The results of this study shows correlation between human activities and physicochemical properties. This information could be useful in setting water quality indexes and general management of aquatic ecosystem.

INTRODUCTION

Water is one of the most important components of an ecosystem. Good quality of water is described by its physical, chemical and biological characteristics (Manjare *et al*., 2010). Its constitutes are integral part of man's life as well as the earth surface, hence the need for continuous research about impact on its quality due to one form of human activity or the other (Aluyi *et al*., 2006). In Nigeria, one of the greatest challenges of environmental managers, hydrologists and water resource analysts has been the problem of surface water pollution and urbanization. Domestics and industrial activities have greatly contributed to increasing pollution of water bodies (Ibeh and Mbah, 2007).

Rivers are important natural resources. They are useful in commercial and domestic purposes. Over the years, the aesthetic values of these water bodies have been reduced due largely to heavy impact by man activities. Anthropogenic activities such as bathing, disposal of effluent, washing and defecation are common occurrence in our water bodies, thereby rendering the water unfit for human consumption and recreational purpose without treatment. Increased human activities both accidentally and intentional along the rivers can basically affect the physicochemistry of the water, thereby affecting the quality of the water. The quality of any water body is a direct functioning of the aquatic ecosystem and its stability to support life depends to a great extent on its physicochemical characteristics (Manjare *et al*., 2010). The monitoring of physico-chemical properties of a water body is necessary for both long term and short term evaluation of it quality. This paper evaluates the effects of human activities on the physicochemical properties of water quality of Afaha Obio-Eno and Odiok Itam rivers in Akwa Ibom State, Nigeria.

STUDY AREA

STATION 1

This station is at Afaha Obio-Eno in Ibiono Ibom Local Government Area of Akwa Ibom State, Nigeria. The water sample was collected from Afaha Obio-Eno River. Ibiono Ibom Local

Government Area lies between 5.187^{0}N and 7.901^{0}E with a total land mass of about 2761.76sq/km. The area is endowed with deposit of crude oil, various qualities of stones, clay and sand. The Afaha Obio-Eno and Ibiaku Uruan rivers are the major rivers in Ibiono and Itu L.G.A's respectively where sand excavation and fishing serves as a source of occupation for most of the inhabitants of these communities. Other activities like bathing, swimming, and discharge of waste from abattoir and washing of clothes by the river are all common features of anthropogenic activities on this river.

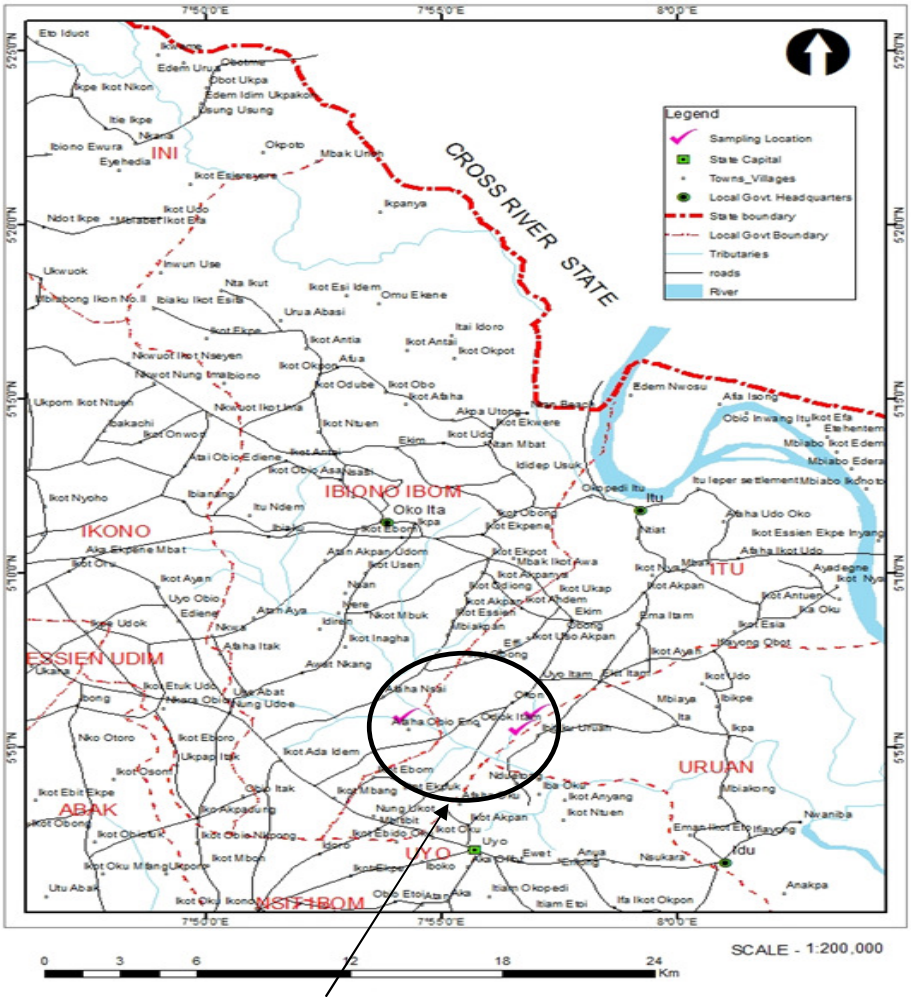

Fig 1: Map Showing Study Areas

STATION 2

This station is located at Odiok Afaha Itam in Itu Local Government Area. The water sample was collected from Odiok Itam River. Itu Local Government Area occupies a landmass of approximately 606.10sq/km. It lies between latitude 5.10^{o}N and longitude 8.00^{o}E. It is bounded in the North and North-East by Odukpani in Cross River State and Arochukwu in Abia State, in South and South-East by Uyo and Uruan Local Government Areas and in the West by Ibiono Ibom and Ikono Local Government Areas respectively.

MATERIALS AND METHOD

The sampling exercise was done in the month of January, June and December 2013. Water sample were collected with 2 liters of plastics containers in replicate. 2ml of nitric acid were added to water sample to prevent deterioration and degeneration of samples. The pH of the water sample was measured using digital pH meter calibrated using buffer solutions 4 and 7.

Electrical conductivity of water samples was measured with a battery operated conductivity meter (model nic-1 mark C). DO and BOD were analyzed using Winkler technique, Phosphate was analyzed using spectrophotometric method while iron, zinc and lead were analyzed using the method described in APHA (1998). Student t-test were used to determine the difference in parameter between stations.

RESULTS AND DISCUSSION

The results of physicochemical parameters measured are represented in Figures 1 to 9.

Hydrogen ion concentration (pH)

The pH ranged from 4.8-5.9. There was no significant difference between the months. However, maximum value was recorded in the month of December at station 2. This result reveals acidity across the months. This may be attributed to the presence of bicarbonate, free carbon dioxide, weak organic acid or chloride of iron which hydrolyze in excess water to produce solution which may have affected the pH of the river. The observed pH range were within values reported by Ewa *et al*., 2011.Values obtained in the month of December across the stations showed some level of significance (p>0.05).

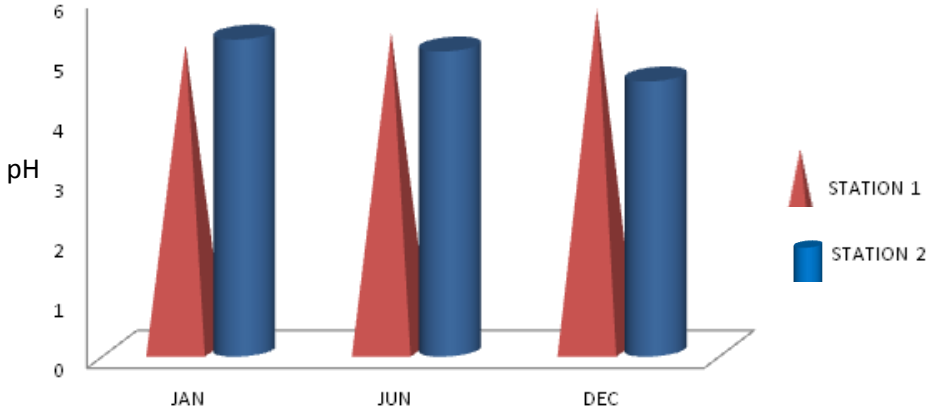

Fig. 2: Variation of pH in stations 1 & 2

Electrical Conductivity (EC)

The electrical conductivity varies from 10-17µs/cm**.** The maximum value of 17µs/cm was recorded in the month of December at station 1 while the minimum value of 10µs/cm was recorded in the month of June also at station 1. The values obtained are typical of unpolluted fresh water but the fluctuation in values obtained across stations and months could be due largely to the presence of small quantity of dissolved solids. The result was comparable with the findings of Essien-Ibok *et al*., 2010.

Dissolved Oxygen (DO)

Dissolved oxygen indicates the presence of organic content whose decomposition depletes oxygen level. The dissolved oxygen value recorded fluctuates from 0.3-0.6mg/l. The lower DO recorded could indicate increased organic load due to surface run-off and increase input from surrounding lands. This is consistent with the report of Essien-Ibok *et al.,* 2010.

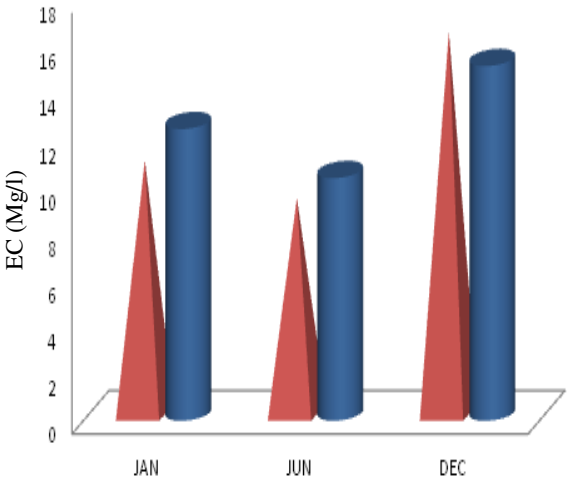

Fig 3: Variation of EC in stations 1 & 2

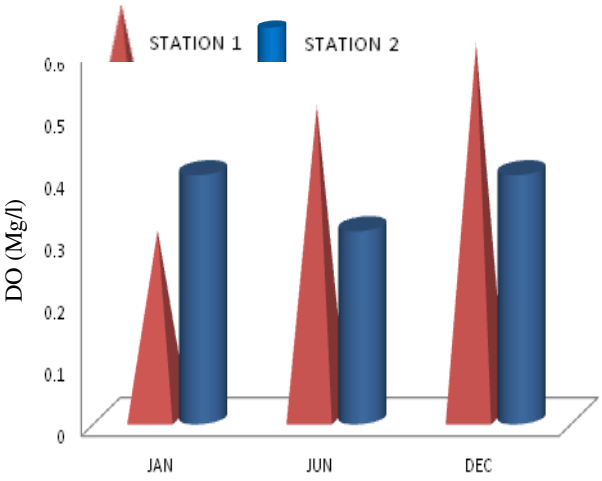

Fig. 4: Variation of DO in stations 1 & 2

Biological Oxygen demand (BOD)

The biological oxygen demand ranges from 1.1 to 1.8mg/l. The values observed were lower than the WHO standards of 6.0mg/l. The lower value recorded across the stations may be due to increase input of decomposable organic matter into the river. Organic matter requires oxygen for their biodegradation. This result is in line with the report of Akubugwo and Duor (2011).

Chemical Oxygen Demand (COD)

The Chemical oxygen demand obtained falls between 23-66mg/l with a maximum value (66mg/l) recorded in the month of December at station 2. These values were lower than the WHO standard of 40mg/l in the raining season and higher during the dry season. There was no significant difference between the stations ($p<0.05$). The COD values recorded in the study could be due to increase in water current and are comparable to those of Akaninwor and Egwim (2006).

Phosphate (PO)

The phosphate level fluctuates from 0.03 to 0.41mg/l across the stations. The maximum values of phosphate were recorded in the month of June (station 1). This could be attributed to high rain fall with increase surface run-off from agro area arising from agricultural activities. It can also be attributed to other human activities such as bathing, washing of clothing and motor cycles with detergents and other soaps with high tendency on increasing phosphate. This result is consistence with the findings of Anyanwu, 2012. There was no significant difference between the stations at $p<0.05$.

Heavy Metals

Heavy metals or trace metals are required by both plant and animals in small quantity. The heavy metals measured were Iron, zinc and Lead. Iron and zinc were more abundant across the stations and are fairly above the permissible limit of WHO. However, lead (0.005-0.06mg/l)falls within the WHO permissible limit. This can affect the metabolic process of organism and can lead to subsequent death of organism. There was great significant difference in heavy metal concentration between the stations at ($p>0.05$).

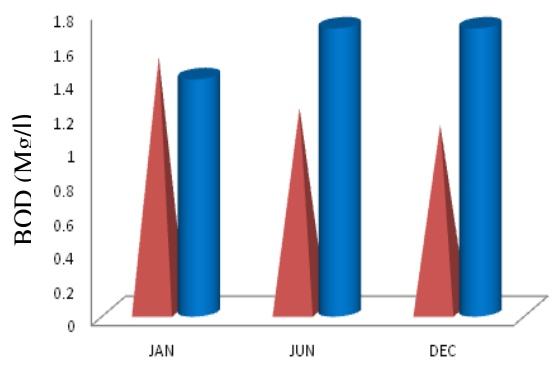

Fig. 5: Variation of BOD in stations 1 & 2

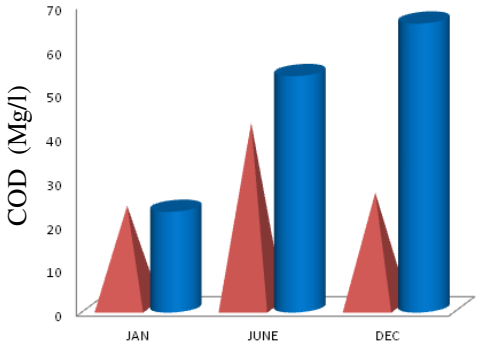

Fig. 6: Variation of COD in stations 1 & 2

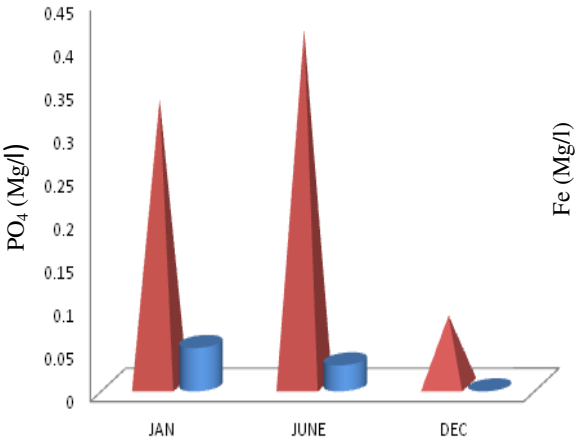

Fig. 7: Variation PO_4 in stations 1 & 2

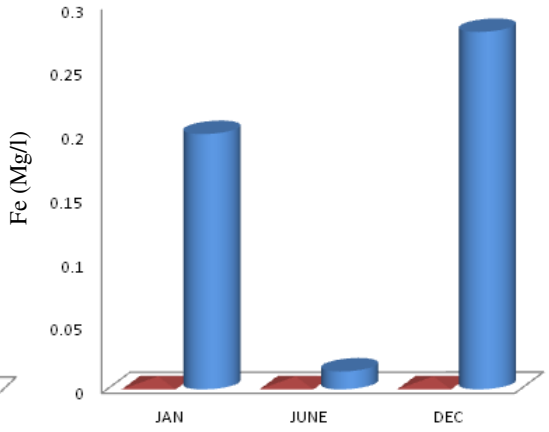

Fig. 8: Variation of Iron in stations 1 & 2

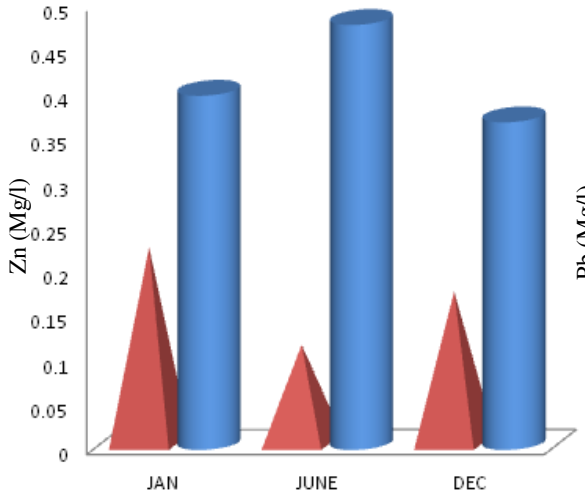

Fig. 9: Variation of Zn in stations 1 & 2

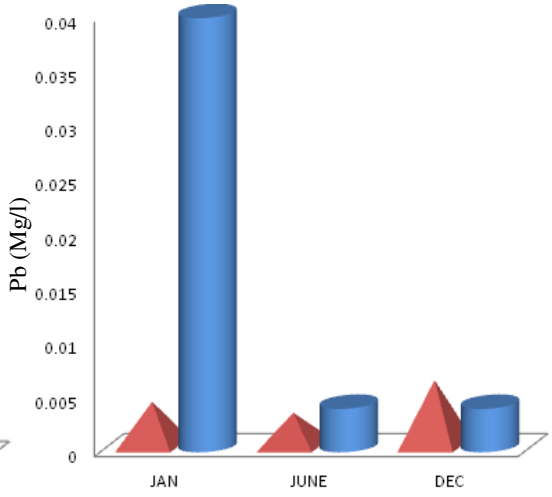

Fig. 10: Variation of Pb in stations 1 & 2

CONCLUSION

In conclusion, the rivers may not be polluted when compared with WHO standard for clean water. However, values obtained showed that the physicochemical properties of the water are constantly fluctuating. This trend could suggest high level of impact by external factors such as effluents, industrial waste water, domestic wastes and other organic pollutants. The water is

therefore rendered unfit for drinking and for most domestic purposes. The pH was acidic across the stations and dissolved oxygen was very low. This alone can affect biochemical process of freshwater organisms. We therefore recommend proper treatment of effluent and industrial waste water before release into the environment.

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