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Water quality assessment: A case study of Odiok Itam and Ibiaku Uruan Rivers in Itu and Uruan local government area of Akwa Ibom, Nigeria

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ABSTRACT

A study on the effects of anthropogenic activities on water quality of OdiokItam and IbiakuUruan rivers in Itu and Uruan Local Government Areas of AkwaIbom state were assessed on the basis of their physicochemical parameters between January and December 2013. The following ranges were obtained for the parameter assessed. pH(5.4-5.9), electrical conductivity(11-38µs/cm), total dissolved solids (1.7-6.5mg/l), dissolved oxygen (0.31-0.7mg/L), biological oxygen demand (1.4-1.8mg/L), chemical oxygen demand (21-66mg/L), sulphate (0.6-6.8mg/L), phosphate (0.03-0.2.3mg/L), and calcium (2.2-3.7mg/L). The pH was slightly acidic across the stations. Values obtained forother physicochemical parameters falls within the WHO permissible limit. The results show the absence of pollution threat arising from anthropogenic activities in the various stations. The water of the above rivers could be considered safe for domestic purpose.

Key words: Water quality assessment, Anthropogenic and physicochemical properties

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INTRODUCTION

Globally, water is one of the most abundant and essential commodities of man and occupies about 97% of the earth surface. About 70% of this volume of earth's water is contained in oceans, 21% in polar ice and glaciers.[Ukponget *al*., 2012].

It is one of the most abundant natural resources and has a variety of uses ranging from domestics, agricultural, industrial, navigational, and energy uses. Water has been highly degraded both in quantity and quality due to industrialization and anthropogenic activities. River harboursfreshwater species. Unfortunately, it has long been used and abused for the disposal of wastes. Although the rivers have the capacity of self-purification, this capacity is altered because of anthropogenic activities in the river, leading to the destruction of this important ecosystem. Human strongly influences almost every major aquatic ecosystem and their activities have dramatically increase the fluxes of growth limiting nutrient from surrounding land to receiving water bodies. The flux of these nutrients has profound negative effect upon the quality of surface water worldwide [Smith, 2003].

Surface water is most exposing to pollution due to their accessibility for disposal of waste waters [Samarghandi*et al*., 2007]. The quality of any water body, the functioning of an aquatic ecosystem and its stability to support life forms, depend to a great extent; on the physicochemical characteristics of its water [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 its quality. Expanding human population, industrialization, intensive agricultural practices and discharges of massive amount of waste water into the river and stream, have resulted in deterioration of water quality [Herschy, 1999].In Nigeria, studies on the physicochemical quality of water bodies have been reported extensively [Akpan*et al*., 2005; Mustapha *et al*., 2005; Omoigberale*et al*., 2007; Asonye*et al*., 2007; and Davies *et al*., 2009]. The objectives of this study is to assess water quality using the physicochemical parameters and to evaluate the effects of anthropogenic activities on the physicochemical properties of the river and to access its implication on water quality.

Fig. 1: Map showing the sampling areas

DESCRIPTION OF SAMPLING AREAS

STATION 1

This station is located at OdiokAfahaItam in Itu Local Government Area. The water samples were collected from OdiokItam River. Itu Local Government Area occupies a landmass of approximately 606.10sq/km. It lies between latitude 5.10°N and longitude 8.00°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 IbionoIbom and Ikono Local Government Area respectively.

STATION 2

This station is located at IbiakuUruan in Uruan Local Government Area. Surface water was collected from IbiakuUruan River. Uruan Local Government occupies a large landmass situated between latitude 6°40°N and longitude 7°.2°E. Uruan Local Government Area is bounded in the East by Odukpani Local Government Area in Cross River State, in the west by NsitAtai and IbesikpoAsutan Local Government Area and in the North by Itu Local Government Area.

MATERIALS AND METHODS

SAMPLING: Sampling was done in the months of January, June and December. Water sample were collected with two litres of plastic containers in replicate. 2mlsof nitric acid were added to the water samples to prevent deterioration and degeneration of samples. Hydrogen ion concentration (pH)was recorded by using HACH digital pH meter. Electrical conductivity was measured with the help of HACH conductivity meter. Other parameters, such as TDS, DO, BOD, COD, sulphate, phosphate, and calcium were estimated by using the standard method for waste water estimation as described in APHA [1998].

STATISTICAL ANALYSIS: The student t-test was used to determine the significant difference in each measured parameters between the stations.

RESULTS

The result of the water quality assessment of OdiokItam and IbiakuUruan River in Itu L.G.A. and Uruan L.G.A. of AkwaIbom State is represented in figures 1 to9.

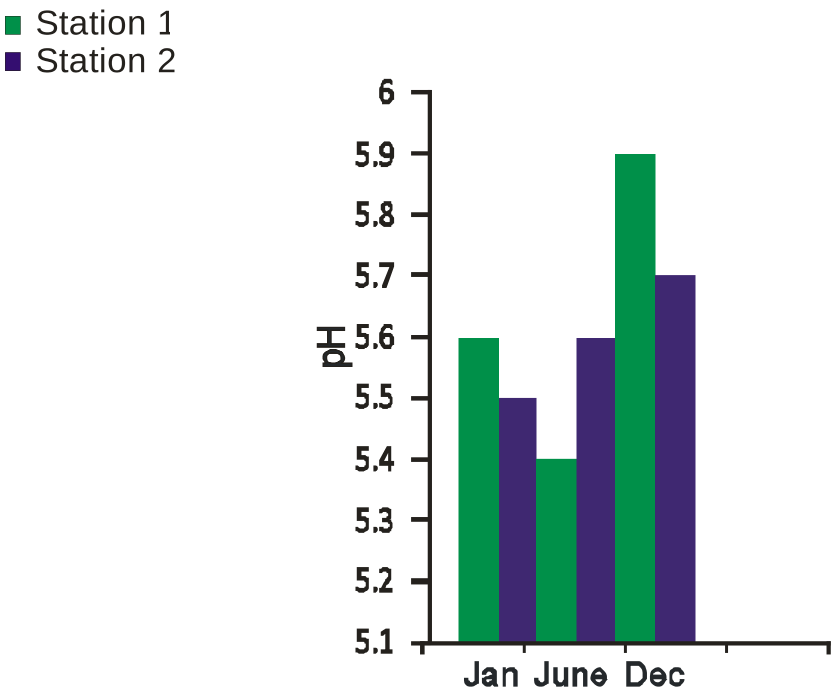

Fig.1: Variation of pH in station 1 & 2

The electrical conductivity (EC) of the water fluctuates from 11.00µs/cm to 38.00µs/cm in both stations. The maximum value (38µs/cm) was recorded in the month of June at Station 2 and minimum value (11µs/cm) was recorded in the same month at station 1. There was a significant difference between the stations at p>0.05. Electrical conductivity is the measure of the ability of a water sample to convey an electric current and it is related to the concentration of ionized substances in water[Anyanwu, 2012]. The conductivity showed that the water is fresh in all the stations but an indication of negligible impact of human activities in the area thus indicating the presence of small amount of total dissolved solids. The electrical conductivity was comparable with the findings of Safari *et al* [2012] and Anyanwu[2012].

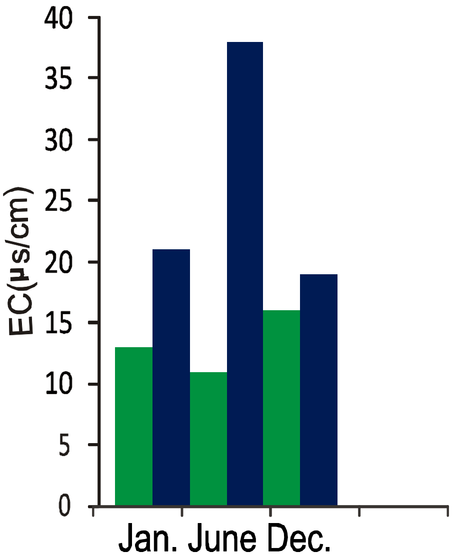

Fig 2: Variation of electrical conductivity in station 1 & 2

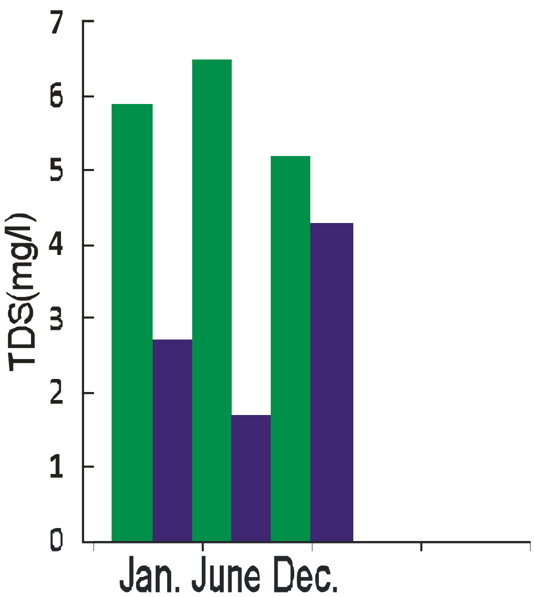

Fig. 3: Variation in Total Dissolved Solids (TDS) in station 1 & 2

The hydrogen ion concentration (pH) shows that the water was acidic. Values ranges from 5.4 to 5.9 across the stations. The maximum pH value (5.9) was recorded in the month of December (Station 1) and the minimum (5.4) was recorded in the month of June also at the same station. There was no significant difference (p>0.05) in pH levels across the stations. The acidity of the watercould be attributed to the presence of bicarbonate, free carbondioxide and weak organic acids in the water. The pH was consistent with the findings of Safari *et al.*, [200] and Ibe*et al.*, [2007].

Fakayode, [2005] noted that aquatic organisms are heavily affected by pH as most of their metabolic activities are pH dependent.

Total Dissolved Solid (TDS) increased from 1.7mg/L to 6.5mg/L across the stations. The minimum value (1.7mg/L) was recorded in the month of June (Station 2),while the maximum value (6.5mg/L) was recorded in the month of June (Station 1).There was a significant difference in TDS between the stations. Total dissolved solid is directly proportional to electrical conductivity of a water body. In this study, it was relatively low compared to the WHO standard. This view is in line with the report of Safari *et al*, [2012].

Dissolve Oxygen (DO)ranges from 0.31mg/L to 0.7mg/L, with the maximum value (0.7mg/L) recorded in the month of December (Station 2) and the minimum value (0.31mg/L) recorded in the month of June (Station 1).Dissolved oxygen of the various stations was lower than the recommended value by WHO. The reduced amount of dissolved oxygen is an indication of high bacterial activities which depletes the amount of dissolved oxygen arising from decomposition by organic compounds by microorganism. The result obtained in this study relates favorably to that of Essien-Ibok*et al*, [2010]

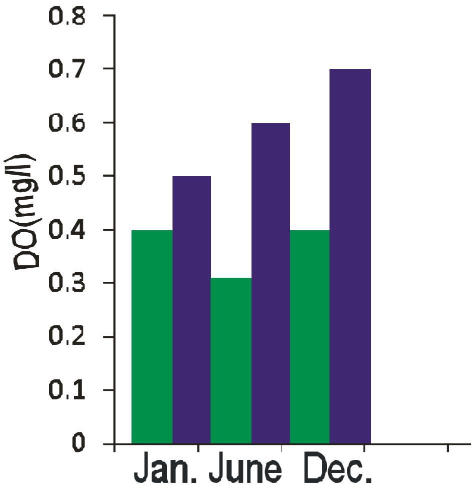

Fig. 4: Variation of dissolved oxygen (DO) in station 1 & 2

Biological Oxygen Demand (BOD) is a standard water treatment test for the presence of organic pollutants and directly shows the amount of degradable organic matter by microbial metabolism [Amadi*et al*, 1997]. In this study, biological Oxygen demand (BOD)fluctuates between 1.4mg/L and 1.8mg/L across the stations. Station 1 in the month of January recorded a value of 1.8mg/L as the maximum; a minimum value of 1.4mg/L was recorded in December also at station I.The BOD values recorded in the study are lower than the recommended WHO standard. Low BOD value isan indication of low amount of degradable organic waste. The amount present at any point in time could be affected by the degree of water current.The observed BOD value (1.4-1.8mg/L) in this study is comparable to those reported by Ekhaise and Anyasi[2005].

Chemical Oxygen Demand (COD) increases from 21mg/L in station 2to 66mg/Lin station 1during the periods under investigation.A maximum value of 66mg/Lwas recorded in the month of December at Station 1while a minimum of 21mg/L was recorded in the month of June at station 2.These values were lower than the WHO standard. The lower values obtained could be due to increase in water current. The COD values in this study are comparable to those of Akaninwor and Egwim [2006]; and Ekhaise and Anyasi [2005].

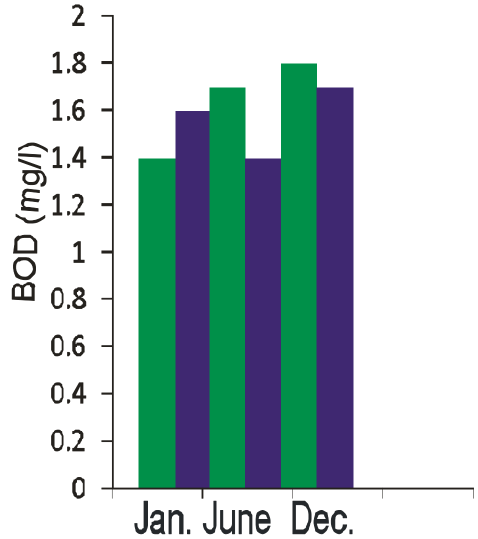

Fig. 5: Variation of biological oxygen demand (BOD) in station 1 & 2

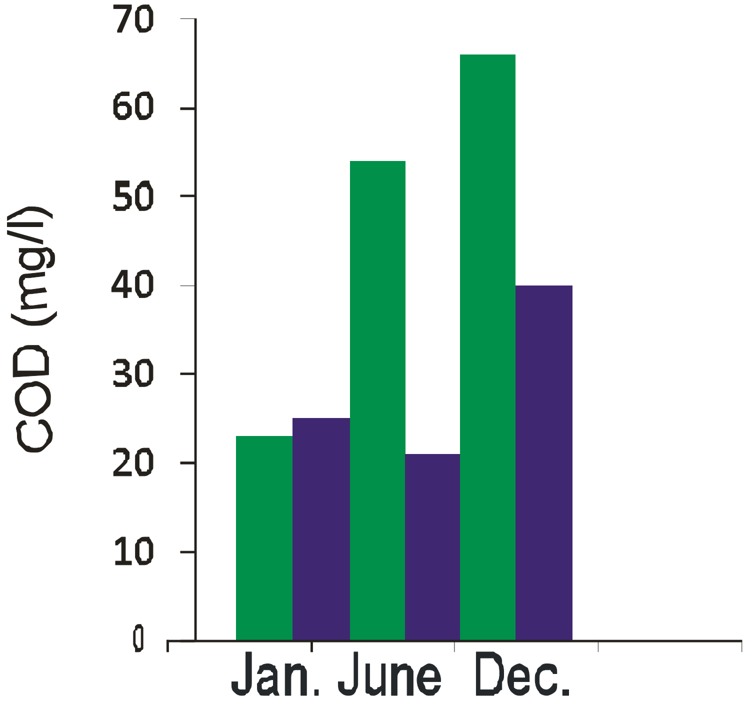

Fig. 6: Variation of chemical oxygen demand (COD) in station 1 & 2

Sulphateranged between 0.6 mg/L to 6.8mg/L. A maximum value of 6.8mg/L was recorded in the month of June at station 1while a minimum value of 0.6mg/L was recorded in the month of June also at station 1.Values were lower than the recommended WHO standard values. The sulphate level observed in this study may have beeninduced by anthropogenic activities. Higher loading may have occurred in the river from agricultural activities such as fertilizer application. The low value recorded may be due to sediment absorption and removal by water current. This result is consistent with the findings of Akubugwo and Duru[2011].

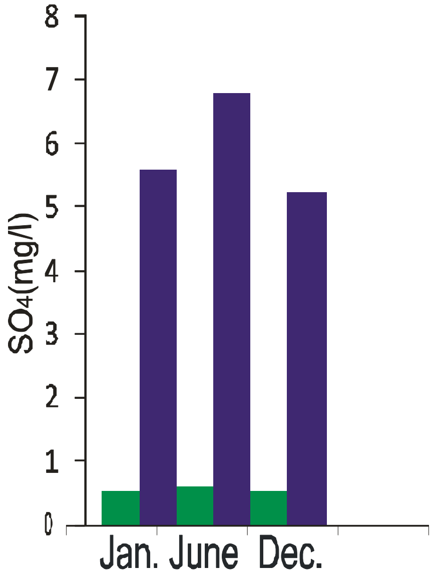

Fig. 7: Variation of sulphate (SO_4) in station 1 & 2

Phosphate value ranges from 0.03mg/L to 0.23mg/L in the stations. The maximum value of 0.23mg/L was recorded in the month of January at Station 2 and the minimum value of 0.03mg/L was recorded in the month of June at station 1.The reason for the decreased in phosphate value across the stations may be due to heterotrophic uptake by micro-organisms, sediment absorption and removal by the currents. The peak value for phosphate was recorded in the month of January (Station 2) when phosphorus containing materials were introduced into the water by human activities, such as washing of vehicles, bathing and laundry activities.

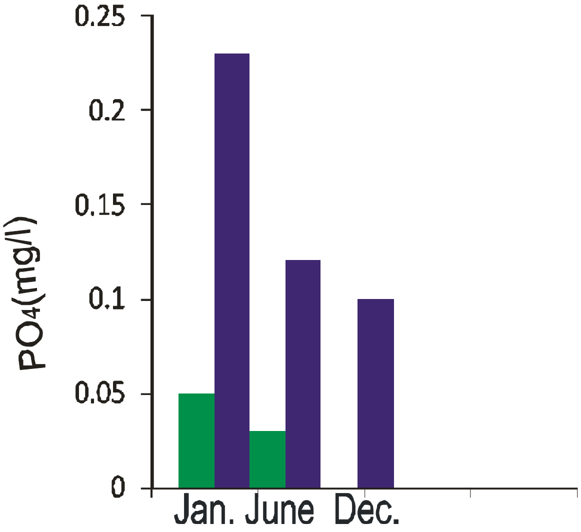

Fig. 8: Variation of phosphate (PO_4) in station 1 & 2

Calcium valuevaried between 2.2mg/L to 3.71mg/L across the stations. The maximum value (3.71mg/L) was recorded in the month of June at Station 2 and the minimum value (2.2mg/L) was recorded in the month of January at station 1. Calcium in the river was lower than the recommended WHO standard. This may be due to low calcium in surface run-off, removal by water current or absorption by sediments. The value is in line with those reported by Omoigberia and Ogbeibu[2007], and Ukpong and Peter [2012].

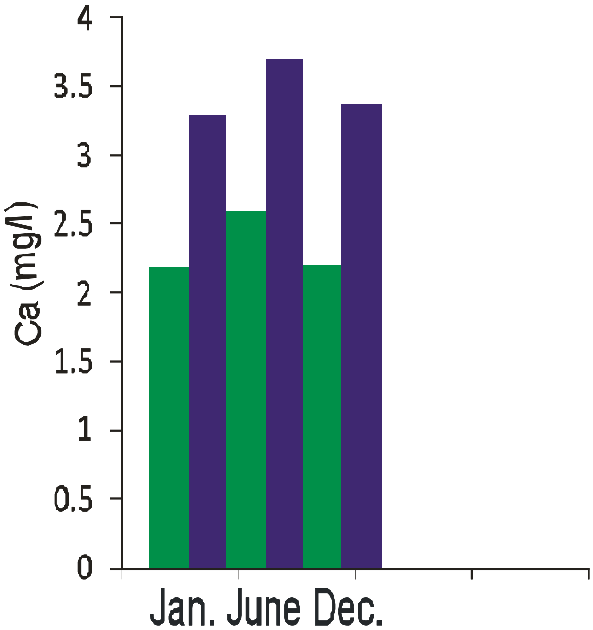

Fig. 9: Variation of calcium in station 1 & 2

CONCLUSION

With the exception of few parameters, it was observed that the investigated parameters fall below recommended WHO standard. It thus shows that all the physicochemical parameters of pollution used in this studywere not affected. The few exceptions could be traced to human activities, such as bathing, washing, discharge of waste water, and the use of fertilizers and pesticides in agro-farm lands. Hence, the investigated stations could not be regarded as being polluted.

REFERENCES

[1] JO Akaninwor;O Egwim, *Journal of Environmental Science*,**2006**, 3, 3, 182.
[2] AW Akpan; EBC Ufodike, *Journal of Aquatic Science*,**2005**, 20, 2, 95.
[3] EI Akubugwo; MKC Duru, *Global Research Journal of Science*, **2011**, 1, 53.
[4] BA Amadi; AC Chikezie; CC Ugoh, *Niger Delta Biologia*, **1997**, 2, 1, 139.
[5] APHA, *Standard Methods for the Examination of Water and Wastewater*,New York, USA, **1998,** Pp. 1268.
[6] EM Anyanwu, *Jordan Journal of Biological Sciences*, **2012**, 5, 1, 54.
[7] CC Asonye; NP Okolie; EE Okenwa; UG Iwuanyanwu, *Africa Journal of Biotechnol*.,**2007**, 6, 5, 624.
[8] OA Davies; BB Otene, *European J. of Scientific Res*., **2009**, 26, 4, 498.
[9] FO Ekhaise; CC Anyasi, *African Journal of Biotechnology*, **2005**, 4, 10, 1065.
[10] MA Essien-Ibok;NW Akpan; MT Udo; LA Chude; IA Umoh; Asuquo, *Nigerian Journal of Agriculture, Food and Environment*,**2010**, 6, 2, 72.
[11] SO Fakayode,*AJEAM-RAGEE*,**2005**, 10, 3.
[12] RW Herschy,*Journal of Biological Sciences*,**1999**, 2, 200.
[13] SA Manjare; SA Vhanalakar, DV Muley, *International Journal of Advance Biotechnology and Research*, **2010**, 1, 119.
[14] MK Mustapha; JS Omotosho, *AJAZEB*, **2005**, 7, 77.
[15] MO Omoigberale; AE Ogbeibu, *Global Journal of Environ. Sciences*,**2007**, 6, 1, 13.
[16] D Safari; G Mulongo; D Byarugaba; W Tumwesigye,*International Research Journal of Environmental Science*,**2012**, 1, 4, 6.
[17] M Samarghandi; J Nouri; AR Mesdaghinia; AH Mahui; S Nasseri; F Vaezi, *Int. J. Environ. Sci. Tech*.,**2007**, 4, 1, 25.
[18] VH Smith, *J. of Environmental Science and Pollution Research*,**2003**, 10, 139.

[19] EC Ukpong;BU Peter,*Nigerian Journal of Technology*,**2012**, 31, 2, 127.
[20] WHO, *Water and Health in Europe,* WHO Regional Publications,European Series, **2002**, Pp. 93.