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Spatial variation of heavy metals in Odiokitam and Ibiaku Uruan River, Akwa Ibom State Nigeria

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ABSTRACT

Spatial variation of heavy metals in OdiokItam and IbiakuUruan rivers were investigated in the months of January, June, and December 2013. The heavy metals concentrations were analyzed using atomic absorption spectrometry. The following range of values was obtained for the various heavy metals. Iron (Fe) (0.37-1.23mg/L), copper (Cu)(0.001-0.003mg/L), zinc (Zn) (0.014-0.55mg/L) and lead (Pb) (0.004-0.06mg/L) respectively. The result shows that zinc and copper were within the World Health Organization (WHO) permissible level while iron and lead were slightly above the permissible level.Extreme high values could pose potential health threat to domestic use of the water and also make the water unfit for organism that live in it.

Key words: Spatial variation, impacted load, human activities and Heavy metals

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INTRODUCTION

Worldwide, water bodies are the primary dump sites disposal of waste especially from industries and settlements that are near them. These wastes have a great toxic influence on the water body, as they can alter the physical, chemical and biological nature of the receiving water body [Sangodoyin 1991, Adekunle and Eniola, 2008]. The initial effect of waste is to degrade the physical qualityof the water. Later biological degradation becomes evident in terms of number, variety and organization of the living organisms in water. Often, the water bodies readily assimilate waste materials they receive without significant deterioration of some quality criteria; the extent of this is referred to as its assimilative capacity[Adekunle and Eniola. 2008].

The importance of water to human has resulted in the setting of most rural communities and industries as well as individual homes along the river course [Egborge, 1987]. Large amount of water consume by humans form surface water, which includes rivers, streams, lakes, wetlands, and groundwater [Thurman *et al*., 1998]. Water pollution is basically rendering the water unfit for human consumption and recreational purposes.

The quality of any water body is governed by its physiochemical and heavy metal factors. Rivers have important multi-usage components such as source of drinking water, irrigation, fishery and energy production [Iscen*et al*., 2008].Water is a scare and fading resources and itsmanagements can be an impact on the flow and the biological quality of rivers and streams [Prat and Mune 2006].

Expanding human population, industrialization,intensive agricultural practices and discharge of massive amount of waste water quality can greatly influence both the physicochemical and heavy metal parameters of the

water[Herschy 1999]. Discharge of toxic chemicals, over pumping of aquifer and contamination of water bodies with substance that promote algae growth are some of today major cause of water quality degradation. Direct contamination of surface water with metals discharging from mining, smelting and industrial manufacturing is a long standing phenomenon [Moore *et al.*, 1998]. The impact of these anthropogenic activities has been so extensive that the water bodies have lost their self-purification capacity to a large extent[Sood*et al.*, 2008].In Nigeria, extensive study has been carried out on the physiological and heavy metal of various water bodies [Anyanwu, 2012, Ukpong and Peter, 2012, Aluyi et al., 2006]. The objective of this research is to establish the spatial variation of heavy metals in 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^{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 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^{o}40^{o}N and longitude 7^{o}.2^{o}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 samples were collected with 2 liters plastic containers in replicate. Two millilitres of nitric acid were added to water sample to prevent deterioration and degeneration of samples.

HEAVY METAL ANALYSIS: Quantitative estimation of the various heavy metals viz: Iron, copper, zinc and lead were carried out using atomic absorption spectrometryas describe in APHA [1998].

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

RESULTS AND DISCUSSION

The results of the heavy metal concentration of this study area show significant difference between Station 1 and Station 2 at p>0.05 for most of the parameters(figure 2 to 5).

Iron (Fe):Iron ranged from 0.37mg/L to 1.23mg/L in both stations and was significantly different between Station 1 and Station 2 at p>0.05.The minimum value of 0.37mg/L was recorded in the month of December (Station 1) and the maximum value of 1.23mg/L in the month of June (station 2).

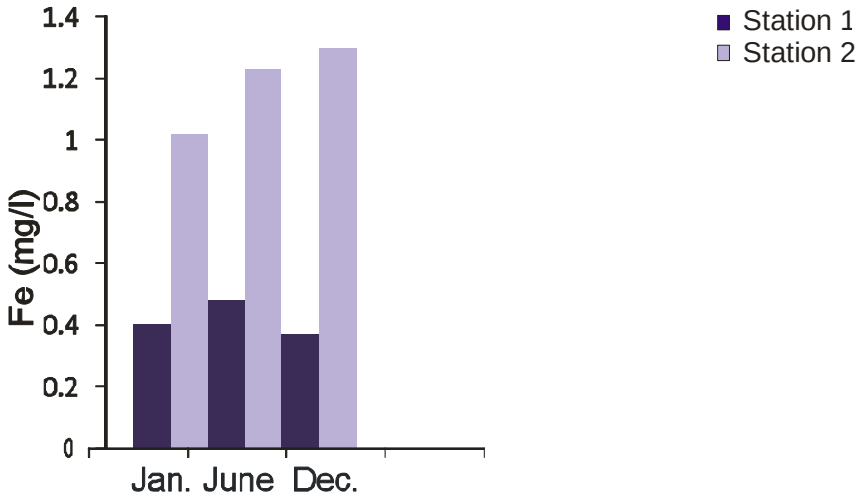

Fig. 2: Variation of Iron in station 1 & 2

Zinc (Zn): Values for Zinc fluctuated from 0.014mg/L to 0.55mg/L across the stations. The maximum value of 0.55mg/L was recorded in the month of June at Station 2 and the minimum value of 0.014mg/L was recorded in the month of January at station 2 also revealed significant difference in values between both stations.

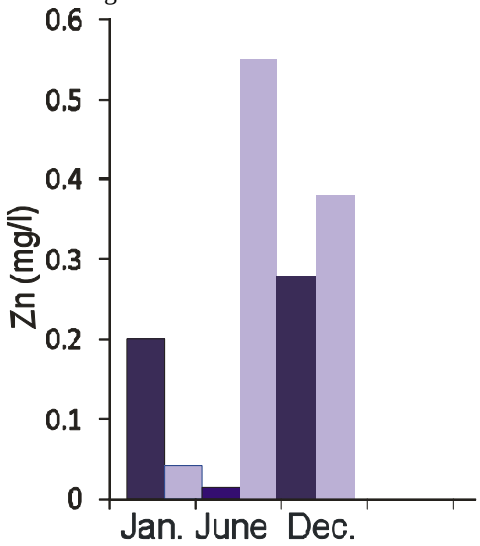

Fig. 3: Variation of Zinc in station 1 & 2

Copper (Cu): The value of Copper falls within 0.001mg/L and 0.003mg/L in both stations for the months. Valueswere higher in the month of June at Station 1(0.003mg/L) and lowerin the month of December and January 0.01mg/L at both stations. There is no significant difference between Station 1 and Station 2 at p>0.05.

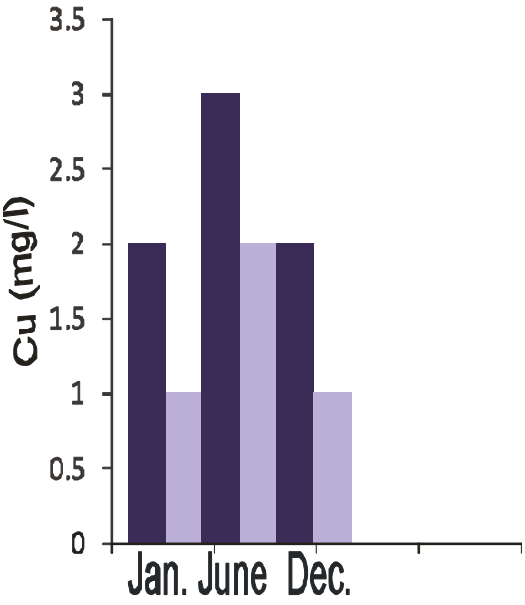

Fig. 4: Variation of Copper in station 1

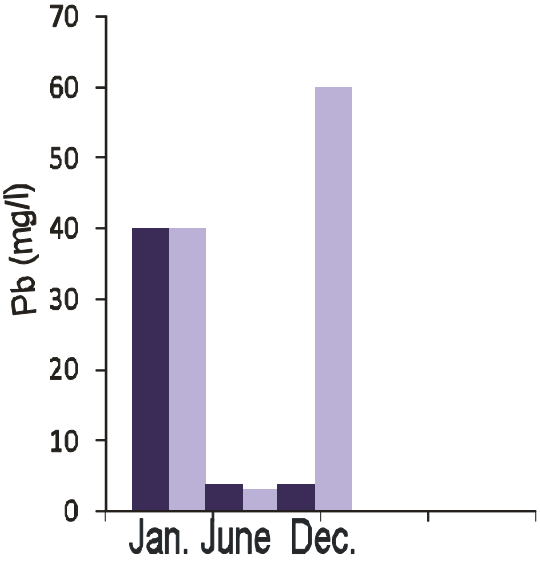

Fig. 5: Variation of lead in station 1 & 2

Lead: The Lead varies from 0.004mg/L to 0.06mg/L across the stations. The maximum value (0.06mg/L) was recorded in the month of December at Station 2 and the minimum value of 0.04mg/L was recorded in the month of June and December. There is no significant difference between Station I and Station II at p>0.05. The pattern of heavy metal concentration in the study area could have been occasioned by the amount of rainfall which has great influences on rate of dilution and also determine the pattern of surface runoff. Runoff could contribute significantly to the heavy metal load of a water body as it picks up various metal deposit along it course to the river. This could possibly explain the low levels of heavy metal concentrations at the various stations in December where rainfall is at its lowest level. June recorded significant high level at the stations due to increase rainfall associated with this time of the year.This finding is in line with the findings of Ukpong and Peter [2012]. This high trend could also be due to effect of human activities around the rivers such as washing of motorcycles and cars, accidental or intentional dumping of metallic materials.All this sources increase the loads content of surface water runoff. Extreme high values could pose potential health threat to domestic use of the water and also make the water unfit for organism that live in it. The finding was in line with the report of Ukpong and Peter [2012].

CONCLUSION

This study revealed that Iron and Lead were fairly above the recommended WHO standard while Zinc and Copper falls within WHO standard.

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