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Physico-Chemical Index of River Benue and Its Implications

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***Abstract**: Water samples from five different locations on River Benue were collected and analysed for physic-chemical analysis including Fe using atomic absorption spectrophotometer (AAS) during the dry and wet seasons. The result of analyses revealed that the values for pH 6.45for dry and 6.43 for wet season and Electricalconductivity 60.1µ/cm for dry and 86.1µ/cm for wet season are not within the WHO standard limit. TSS (114.3mg/L and 79.2mg/L),Total hardness (21.6mg/L and 40.9mg/L) Cl,(19.7mg/Land 32.1mg/L) Mg(34.2mg/L and 29.4mg/L) and NO3(2.0 mg/L and 2.7mg/L) for dry and wet seasons respectively are within standard limit. TDS with values of 35.5mg/L for dry and 77.5mg/L for wet season is far below the standard limit thus making the water unsafe for life.*

***Keywords**: water, quality, implications*

I. Introduction

Water, which is one of the common substances knownis undoubtedly the most precious natural resources that nature provided to sustain life on our planet. The total quantity of fresh water on earth could satisfy all the needs of the human population if it were evenly distributed and accessible. Without water, life on earth would be non-existent, it is essential for everything to grow and fluorish.

Waterhas alwaysbeen a subject of great interest to man since it is essential to human survival. Man needs water for industrial development, navigation,irrigation to grow food,generation of hydro-electric power,recreation and enhancement of fish,wildlifeand hostof other purposes.Water has found its wildest use in the industry asmediumof heat transfer,heat exchanger;it also functions as raw materials in beverage and chemical industry. The energy required to rupture the hydrogen bond and liberate a molecule of water to a vapour is much greater than of the other chemical compounds.

Water may be characterized as meteoric, connate or mixed depending on where it originated. Meteoric water fall as rain and percolate through porous and permeable rocks to the water table. It is a good solvent for many substances and rarely occurs in its pure form in nature. Natural water includes rainwater, well water, river water, lake water, lagoon water, spring water and sea water. Rainwater is the purest form of natural water because it is formed as a result of the condensation of water vapour in the atmosphere, that is, it is a natural form of distilled water.

The presence of some substances in water constitutes the impurities (Aremu*etal.*,2011). The range of water requirement has increased completely with greater demands for higher quality water in the advent of industrialization and increasing human population. Besides, it is revealed that 65% of human body contains water. Fortunately, the largest demand for water quantity such as agriculture irrigation and industrial cooling require the least in terms of quality. The most sophisticated demand for water quality are exerted by drinking water supplies and specialized industrial manufacture, but their quantitative needs are moderate. In addition to the above stated uses, water has been considered since ancient times, as the most suitable medium to disperse waste and the cheapest. Besides the usefulness of water, there are several human activities that have indirect and undesirable effects on aquatic environment such as the accidental and uncontrolled use and release of chemicals, discharge of untreated waste, etc(Akudo, 2010, Apeh*etal.,* 2012).The high rate of untreated effluent discharged into River Benue at Makurdi is alarming. Some rural dwellers use the river as their toiletwhile some people use the same river as their mainsource of drinking water. This therefore poses a serious treat to the quality of water from the river. RiverBenue is one of the two major rivers in Nigeria. It starts from the Cameroon mountains and flows westwards through Makurdi to meet the River Niger at Lokoja in Kogi State. Along the Makurdi new bridge, the river is 1.194km wide with an average depth and cross-sectional area of 7.82m and 4608.42m2 respectively (Akpen and Eze, 2006). Makurdi town, located in the Benue valley experiences a typical tropical climate with distinct dry and wet seasons. The wet season, this lasts forseven months starts from April and ends in October. The dry season begins in November and ends in March. Within the same period, the area experiences two distinct weather situations; while harmattan, with cool and chilly weather is experienced from December to early February; hot weather and high temperatures are experienced between the later part ofFebruary the study was carried out in February for the dry season and July for the rainy season. Industrial wastes from the Benue BreweryLimited (BBL) and Nigeria, Bottling Company (NBC) all located along Gboko road are channelled into the River Benue. Also wastes from the New Garage market and the abattoir near the new bridge are washed into the river, other sources of pollution of the river are faeces from humans directly in

the river, washed animals and human wastes from land to the river as well as fertilizer and other chemicals applied to the crops that are usuallygrown at the river banks. The contamination of this river has led to incidents of water related diseases in the area. Notable among water related diseases in Makurdi are typhoid fever, amoebic dysentery and cholera (Akpen and Eze, 2006). River Benue is the main source of water supply for the inhabitants of Makurdi, both for industrial, agricultural anddomestic purposes. These informed the decisions to assess the surface water quality of the River Benueespecially as it affects human health.

II. Materials And Methods

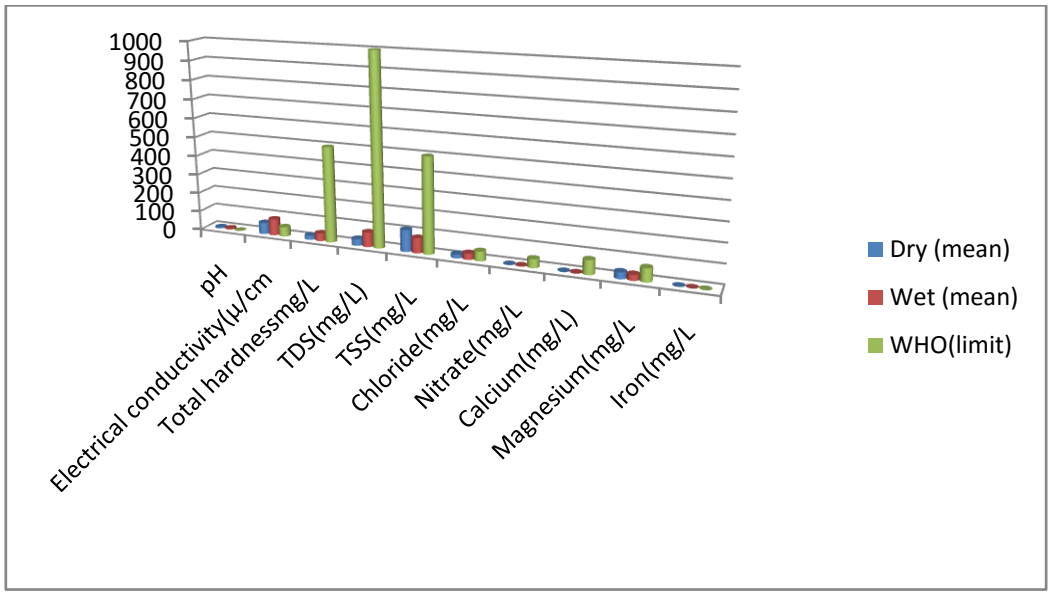
3 liter capacity plastic cans that were properly washed with detergent, HNO_3, rinsed with distilled water and then with the sample (river water) without air bubbles as per standard procedure were used to collect the samples. Standardized mercury-in-glass centigrade thermometer, Digital pH meter (Labtech), Conductivity meter (model –HANNA EC 215), Atomic Absorption spectrophotometer (AAS) (model-UNICAM SOLAR 969) DO_2 meter and UV-Visible spectrophotometer (JENWAY 6305) were used for the analysis.

Mohrs method using silver nitrate as titrant was used for chloride determination.Total Dissolved Solids (TDS) was determined by the evaporation method.Total Suspended Solids(TSS) was determine by filtration.Titrimetric method using EDTA as titrant and erichrome black T asindicator was employed to evaluate the total hardness.For calcium hardness determination EDTA was used as titrant with mirazine as indicator.

Total Iron was estimated by photometric method using palintest iron tablets No.1 and No.2 successively after complete dissolution.

Table 1:Physico-chemical data for dry and wet seasons:

Parameters	Dry(mean)	Rainy(mean)	WHO limit
pH	6.45	6.43	6.5-8.5
Electric Conductivity(µ/cm)	60.1	86.1	50
Total Hardness(mg/L)	21.6	40.9	500
TDS(mg/L)	35.5	77.5	1000
TSS(mg/L)	114.3	79.2	500
Chloride (mg/L)	19.7	32.1	50
Nitate(mg/L)	2.0	2.7	45
Calcium(mg/L)	1.6	2.3	75
Magnesium(mg/L)	34.2	29.4	70
Iron(mg/L)	0.03	0.01	0.3



The pH of the water samples inboth seasons are slightly acidic with mean values of 6.43 for rainy and 6.45 for dry seasons respectively.The acidity of the water could be attributed to automobile emissions, anthropogenic emissions from industrial effluents and bush burning.

The electrical conductivity (E.C.) of the water samples in the seasons were 86.1µ/cm for rainy and 60.1µ/cm for dry season. Chloride concentration was 32.2mg/L for rainy season and 19.7mg/L for dry seasons respectively. Chloride ions in very small concentration or as impurity in a raw material can cause active corrosion. This corresponds to the values obtained for EC which was higher in rainy than in dry season.The total

dissolved solids (TDS) values in the study areas were 77.5mg/L for rainy and 35.5mg/L for dry seasons respectively. Both TDS values are far below the WHO standard of 1000mg/L for portable water therefore making the water not suitable for drinking.

The total suspended solids (TSS) value for rainy season is 79.2mg/L and 114.3mg/L for the dry season. The TSS value is higher in the dry season than in the rainy season, this could be attributed to more anthropogenic activity dust from moving vehicle, debris of leaves shaded by plants in different areas which could find their way into the river by moving air. The TSS depicts solid particles in the atmosphere that were not able to dissolve in the rainy season. These particles may be biodegradable and leads to depletion of dissolved oxygen, thereby contributing to health problems in aquatic lives.

Total hardness was detected in the rainy season with the mean of 40.9mg/L and 21.6mg/L for dry season. A higher value of hardness was obtained for rainy season than for dry season because of the run-off agricultural activities prepondent in rainy season. This means that the water will be harder in rainy season than in dry season. This is in line with the mean values for Calcium whichare 2.3mg/L and 1.6mg/L for rainy and dry seasons respectively. It should be noted that calcium is the major cause of water hardness and this overrides the concentration of magnesium, another cause of water hardness which was higher in dry than in wet with 29.4mg/L and 34.2mg/L respectively. The presence of Mg and Caions showed that the water contains mineral elements required for body building. Hardness of water spoils the fabrics of clothes, causes chocking and clogging trouble in pipe lines. It also causes formation of scales in boiler, leading to wastage of fuel and the danger of overheating of boilers.

III. Conclusion

Ions detected in the sampling locations are within the WHO permissible limit, the pH is slightly below the WHO permissible limit of 6.5-8.5 for potable water; TDS is in a very low content making the water not potable. This study work has revealed that the water might be potable especially when treated irrespective of the anthropogenic activities. However, activities detrimental to the water quality should be checked since residents of the area used water from the river for domestic purposes. Also authorities concerned should set up environmental monitoring team to further assess the area.

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