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Original Article

WATER QUALITY PARAMETERS OF PERTURBED RUMUOLUMINI RIVERS IN RIVERS STATE, NIGERIA

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ABSTRACT

From the public health point of view, it is obvious that the level of activities in an area, determines the level or the types of contaminants, effluents or pollutants, which the Rivers or other water supplying sources will have as a pollutants load. The study employed both laboratory and empirical observation approach to analyse the health implications of some substances in Iwofe, Nkpor and Azumini waters of Rumuolumini, which do not meet Federal Environmental Protection Agency (FEPA), National Environmental and Standard Regulation Agency (NESIRA) and World Health Organization (WHO) guidelines for potable water. Analysis showed that turbidity is (11.4FTU), PH (6.1), total hardness (19.2mgl), Iron content (0.1mg L-1), magnesium (5.1mg-L-1) BOD (36.6mg-L) TDs (255mg L-1) total coliform (12.2mgl) and bacterial count (45.2CFU). These results were compared with WHO, FEPA and NESRA guidelines for drinking water and it indicated that less than 50% of the parameters conformed to the standard. It also shared that the consumption of the water could lead to some adverse health and environmental epidemic diseases.

Keywords: Health, Water Quality Parameters, Rumuolumini, School Environment

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INTRODUCTION

Current trends about sewage, sludges in tidal and stagnant water within the stream found in a school environment, indicate that “water crisis” is approaching an increasingly large number of countries in all parts of the

World. The demand for water resources is rapidly outstripping supply, and many experts see the use of non-renewable sources of water as part of an un-sustainable boom and bust cycle (Khan, 1998).

According to Reddeppa (2001), man is facing a global water crisis with many areas where human demand is outstripping local water supplies. He further gave a distinction between 'Water scarcity' 'water shortage' and 'water stress' and assumed that they are related according to the author. According to him water scarcity is a relative concept intended to convey the imbalance between supply and demand under the prevailing legal, Institutional, regulatory and where applicable, price arrangements. He said that water shortage is an absolute concept Indicating low levels of water supply relative to minimum levels necessary for basic needs, while water stress signifies acute water shortage for prolonged periods.

It is clear that the Increasing water demands and the inability to meet up with the demand has led to crisis in many parts of the world. The crisis is that, good quality water is in short supply, hence human excreta, sewage, sludge are discharged into the aphotic water layers untreated daily. Consumption of this surface water by the students exposes them to the risk of *E coli*, cholera, dysentery and other deadly water borne diseases.

William (2002) pointed out that as abundant as water may appear to be, there is also the need of the appreciation of how little fresh water is on the earth. According to him less than three percent of the world's water is fresh water and most of this is in the ground. Lakes and rivers accounts for only 14% of all water. He concluded by saying, indeed, water is critically scarce in many places. Issues of scarcity have put water at the top of the international political agenda.

The perceived water problems stem not from a shortage of water, but rather from inefficient and unsustainable use of ground water reserves. This is the case of Rumuolumini communities within the Iwofe River flowing all through the year but yet not having potable water at the reach of the Inhabitants, as many companies industrial effluents are discharged their daily, this is confirmed by the growth of many undesirable plants and Eutrophication life-sustaining process within the study area.

Khan (1998) suggested that in order to overcome the above failures reduce poverty and conserve the environment, all within sustainable development framework, it is necessary to adopt a new approach to water resources management

Some of the approaches which he advances include:

i. Address quantity and quality concerns through an integrated approach.
ii. Integrally link land use management with sustainable water management.
iii. Recognize fresh water, coastal and marine environments as a management continuum.
iv. Focus on actions that improve the lives of people and the quality of their environment.

v. Protect all w ater resources and designate special protection zones for drinking water.
vi. Improve water treatment technologies.

The Federal Environmental Protection Agency; FEPA (1991) defined pollution as "Generally, the presence of matter or energy whose nature, location or quantity produces undesired environmental effects. Under the clean water Act; for example, the term is defined as the man-made or man-induced alteration of the physical, biological and radiological integrity of water". Pollution can also be defined as an unfavourable alteration of the environment as a result of man's activities. This therefore means that raising the level of substance(s) in the water environment to a level the water becomes unsuitable for its desired purpose is water pollution. For instance, if petroleum crude or palm oil is added to potable water, it defeats the aim as the water becomes unsuitable for drinking.

Water pollution sources can be categorized as point or non-point sources. The former being those discharges that enter water environment through defined route such as pipes, channels, and storm discharge, while non-point sources do not have designate entry point.

Water exists in nature in three forms: rain water, surface water and underground water. The surface water exists in abundance in some areas as river, stream, pond or lake. This water source is usually polluted by animal and human faecal waste, domestic-landfill, sewage, pesticides, fertilizers, waste-refuse to industrial-hydrocarbon/oil, leachate from refuse dump sites, Industrial wastes and toxic materials etc (Ojelabi, 2001; and Idka, 2001).
This is the case with Iwofe River (the river under consideration)

Writing on water policy reform, Cookey (2001, submitted that Industrial Pollution has gradually changed the quality of water bodies in Nigeria. He observed that many towns and villages in the country have suffered adversely from water pollution resulting from toxic wastes which affect the environment in number of ways. He outlined some of the pollutants to include battery manufacturing, paints, plastics, chemical fertilizers, textile industries and oil industries. He noted that the oil refineries/producing companies are among the biggest water pollutants in the country. Over 2,000 barrels of crude oil is spilled annually into Nigeria waters especially in the Niger Delta of which Iwofe River is one of the tributaries, and a home for many companies e.g. Saipen, Grenaka, Eagle cement.

Other causes of pollution in water bodies include:
Municipals discharges, Dredging activity, Gas flaring, Transportation, Agriculture, Flood and Erosion. Dredging activity has helped to destroy the stability and also reduce the water quality especially in the fresh water where communities depend on surface water as their portable water source. During dredging, so many materials both organic and inorganic components floats on the water column. This brings about reduction of the amount of light entering the water body with the attendant decline in photosynthetic activities. Effluent from industrial sources, machinery and

storage facilit ies during handling may leak into the water environment and spread quickly to different water bodies depending on the quantity spilled and the current pattern. The Iwofe River has in a number of occasions experienced oil spill, which polluted the water.

MATERIALS AND METHOD

The sites for water sample collection were as follows: Iwofe water side I, II & III, Iwofe C.O.E stream side, and Nkpor village, and one well water from these five stations were all analysed.

The sources of data were from primary and secondary sources. The primary data were obtained from field experiment (i.e. water analysis result) while secondary data were from literature and the Internet.

The sampling was carried out to cover the two different seasons - dry season (spanning from October/November - April) and flood/rainy season (spanning from April - October).

Five sampling stations were selected covering the area of study and also points of major activities which Include: oil bunkering, fishing, washing of clothes, bathing, utensils and sand mining/drilling.

The water samples were collected between 1200 – 1600 hours local times on each sampling day. The depth of collection was 0.35m as to get average value, corked and transported in cool ragolis bottles. Samples for determination of organic carbon were wrapped in alum foil while those for p^H were collected in dark polythene bags, this was carried in this form to reduce the problem of alteration and errors..

The samples for the analysts of water bacteriology were aseptically collected in one 2 sterilized bottles and well corked to avoid oxidation while the water chemistry samples was collected in one litre polythene Jerry cans and also well corked. The samples for dissolved oxygen (DO) and biological oxygen demand (BOD) were collected in 20ml bottles.

Study Area

The study Area is connected with a underground drainage culvet network where waste water, sewage, sludges, human refuse from the neighbouring towns and Iwofe campus of Ignatius Ajuru University are carried down to the tidal stream. Fishermen also apply most unscientific and illegal method to kill fishes, which add in term of effluents loads in Iwofe river. The study area covers Nkpor village, Bigtree, St. John, Mgbuodohia village and Akar junction, where students inhabit in their large numbers. Also the study area have the following geographical coordinates of $4^0 47'21''$ North, $6^0 59.55''$ East respectively.

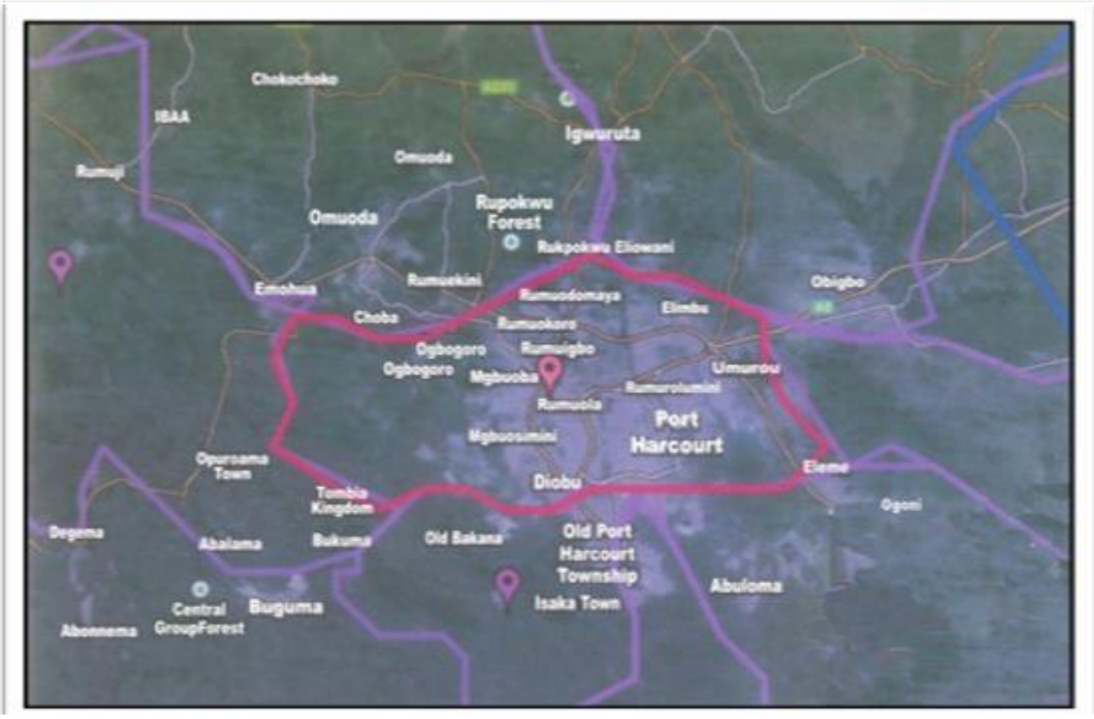

Figure 1. Map of the study area. *Source:* Obio/Akpor Google Satellite Light Map (2013)

Results and Discussion

The results of the analysis based on APHA (2000) for the physical parameters of the water samples from Rumuolumini water was presented in Table 1.

Rumuolumini in Iwofe area comprises the following communities: (a) Nkpor village Mgbuodohia (c) mgbuosimini (d) Iwofe water side /Bigtree (e) Rumuolu respectively, but they are collectively called Rumuorlumini. The communities mentioned is accommodating the following companies: Saipen Limited, Grenaka Ltd, Eagle cement, master energy, etc. they are alsothe land lord community to Ignatius Ajuru University of Education. Is also a loading and offloading point of oil, in Obio/Akpor Local Government Area of Rivers State.

It has a jetty that load passengers from Iwofe in Port Harcourt to Tombia in Degema Local Government Area of Rivers State and Rumuoro in Agbakiri in Emohua Local Government Area of Rivers State.

Temperature: The months of January, May and July had the same temperature value of 24.6°C. The highest temperature of 26.6°C (Table 1) was obtained in the month of March. These values are within allowable limits of surface water comparing it to Federal Environmental Protection Agency, FEPA (1991) Standard (35–40°C) and World Health Organization WHO (1985) Standard (24–28°C). The water temperature will not have any effect on the environment and on human health, though if allowed to exceed the FEPA limit, it would greatly reduce level of dissolved oxygen and pH. The pH ranges between 5.9 and 6.3 from January to October with a mean p^H of 6.1 (Table 1). The p^H range for the existence of most biological life is quite narrow and critical, the acceptable p^H range for drinking water is between 6.0 and 9.0 (FEPA 1991), (WHO 2006). This implies that Rumuolumini water was potable for most of the year except in May and October when the p^H was slightly below the acceptable limit, because of serious industrial waste dumping and human excreta disposal.

Dissolved Oxygen (DO): The mean dissolved oxygen in Rumuolumini water was 0.96 mg/I. Do was highest in January (2.9) and ranged from 0.16 to 0.9 between February and October. These values fell short of WHO (2006) allowable limit of 3 – 7mg/I and FEPA (1991) limit of > 7mg/l. most game fish require at least 4–5 mg/I level of DO to thrive (Corson, 1990). It therefore, implies that Rumuolumini water is not suitable for the breeding of fish in fish ponds, since it is marine habitat and accompanied with high level of effluents load in the tidal stream.

Complete absence of Do results in anaerobic condition, putrefaction and the development of foul odour. Moderately high dissolved oxygen content is necessary for the maintenance of healthy aquatic ecosystems and particularly for the most prized game fish such as salmon and trout (Chukwu et al, 2007). It therefore, implies that water with very low DO may have adverse health and environmental implications.

Turbidity: Turbidity is associated with suspended solids concentration. It was observed that size and concentration of particles influenced the measurement of turbidity. World Health Organisation (2004) allows for a minimum of 5FTU. The water samples in March had the least turbidity at 6.6FTU. This is expected as it represents the peak of the rainy season where a lot of water run-off from the soil around the river may account for higher turbidity. The nature of the solid causing the turbidity may have some health implications.

Total Dissolved Solid: The mean dissolved solids was 225. The months of January to May had the least values for TDS which was much lower than tolerance limits of 500mg/I (WHO 2004). Thus, the contamination was not high enough to be worrisome. However, July to October had values which was higher than tolerable limits. This may be clue to the high rainfall during that period of the year, increase in water level and tidal currents.

Iron content: Iron has the following beneficial effects, chlorophyll synthesis, oxidation- reduction reactions in respiration and as a constituent of certain enzymes and proteins. The mean Iron concentration in Rumuolumini was 0.08mg/l. This falls within the WHO (2004) limit of 0.30mg/l and FEPA (1991) limit of 20mg/l.

Magnesium: High content of Magnesium and calcium results in hardness of water. Magnesium has also been known to be essential in plant growth and development. From the results of the analysis, the mean magnesium content of Rumuolumini water was 5.08mg/l, while magnesium content ranged from 4.0mg to 6.6mg/L from January to October. The highest magnesium content in Rumuolumini water was observed in July. The magnesium content in Rumuolumini water is very close to the WHO (1985) Standard of 5.0mg/l and far below FEPA (1991) requirement of 200mg/L.

Total colform: Microbial contaminants are usually present in sewage and also animal waste. The major sources of microbial contamination are septic systems and agricultural practices such as manure spreading. A total coliform level of l0cfu/l00ml is the acceptable WHO (2004) standard. The mean coliform level in Rumuolumini water was 12.8 cfu/l00ml January to May had values ranging from 14.8 cfu/l00ml to 25cfu/l00ml; which was higher than WHO (2004) standard. July and October had values less than l0cfu/l00ml which is within the safe limits. Possible chronic health effects of coliforms include; Gastroenturitis, typhoid fever, dysentery, cholera and salmonella infection.

Table 1: The Monthly mean values, standard deviati ons and the coefficient of variation (Cov) of the Iwofe River Quality Parameters.

Parameter	Jan	March	May	July	Oct	Mean	S.D	Cov
Temp.	24.6	26.6	24.6	24.6	25.0	25.0	0.75	0.03
Turbidity	8.6	6.6	14.6	14.6	12.2	11.36	3.74	0.33
p^H	6.3	6.24	5.88	6.0	5.96	6.08	0.22	0.04
Fe	0.11	0.66	0.13	0.03	0.05	0.08	0.06	0.75
Total hardness	18.6	12.8	18.0	23.8	23.0	19.2	5.0	0.26
Calcium hardness	14.2	9.6	12.8	17.2	17.6	14.1	4.1	0.29
Mg	4.4	4.0	5.2	6.6	5.4	5.08	16.4	0.32
TDS	0.12	0.21	0.64	588	536	225	263.8	1.17
DO	2.9	0.9	0.46	0.16	0.36	0.96	0.97	1.01
BOD	36	24	45	40.5	36	36.3	8.38	0.23
Coliform	25	17.6	14.8	3.2	3.2	12.76	8.5	0.67
Bacterial	82.8	34.4	64	24	20.8	45.2	33.2	0.73

CONCLUSION

The results showed that the following water quality parameters of Rumuolumini surrounding water bodies (surface and underground water) met the WHO/FEPA limits: Temperature, pH (for most of the year), TDS, mg, Fe and bacterial count. The following parameters did not meet the WHO/FPA requirement: DO, turbidity, BOD, and total coliform. This result indicates that the consumption of the water is likely to cause gastroenteritis, typhoid fever, cholera and salmonella infection. The low DO of the water makes it also unsuitable for the breeding of fish in fish ponds which also account for the reduction of fish and other aquatic organism population which is being experienced in the river most parts of the year, as water Europhication result.

It will be advised that the water should not be consumed without appropriate treatment Proper environmental management will also be necessary to reduce the pollution level of the water.

The state and federal ministry of environment should set up a monitoring team to checkmate the activities of borehole water with in the school surrounded environment. Such as Rumuolumini, Nkpor, Bigtree, St. John, Mgbuodohia and Townhall area.

The Rivers State Environmental Sanitation Authority workers, should be trained and re-trained with the modern water testing facilities for the purpose of determining the depth of borehole (within (vadose zone and aquifer zone).

Also water storage tanks, should follow a due scientific assessment, as a routine of quality control department of the Ministry of Health in Rivers State.

All Rumuolumini surface and underground water should be subjected to a thorough water sanitation activities within the water catchment area.

Liquid and solid waste dumping should be avoided since the sur face water within the Rumuolumini area is still considered as a source of neighbourhood water.

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