



STATUS OF POLLUTANTS IN NSUDU-RIVER, OKWOYI ISIEKE IBEKU UMUAHIA NORTH, LOCAL GOVERNMENT AREA OF ABIA STATE FOR DRINKING PURPOSE

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ABSTRACT

This study examines the status of pollutants in Nsudu River for drinking water purpose. Water samples were collected from Nsudu River and analyzed at Enugu State Water Corporation (quality control unit) laboratory. Physical, chemical and bacteriological tests were conducted on the collected samples following standards and acceptable methods of water analysis. The results obtained showed that turbidity, total solid, total suspended solid, total dissolved solid, alkalinity, electrical conductivity, pH, total hardness, calcium, magnesium, iron, chloride, etc. conformed with the acceptable limits stipulated by both World Health Organization (WHO) and Nigerian standard for Drinking Water Quality (NSDWQ) with the exception of the biological parameters which were found to be above the standards stipulated by the two bodies. More so, ANOVA results showed ($P < 0.01$) and (F-test of 12094 > F-crit. of 6.9) indicating significant difference between the biological contaminants.

Keywords Drinking, Nsudu-River, Pollutants, Status, Water

INTRODUCTION

Demand for water is increasing daily due to the increase in the population of our country. Having access to quality drinking water is a fundamental human right for everyone, no matter the nationality, color, economic status, religion and creed. WHO (2018) has noted that contaminated drinking water as well as poor hygiene are associated with transmission of diseases like cholera, diarrhea, polio and dysentery. Pollution of the water bodies is a very serious problem in the globe today which have the need of contiguous evaluation of water resource policy at all levels, these pollutants in water have been confirmed to be among the highest cause of deaths and diseases in the globe which accounts for the deaths of not less than 14,000 people on daily basis in the country today (Nuray Balkis, 2012). Water is said to be contaminated, when it is impaired with anthropogenic pollutants which makes it not to be suitable for human use, like drinking, domestic use or even have a marked shift in its ability to support its constituent biotic communities. It was considered as a rule-of-thumb that a polluted stream or river cleanse itself every few kilometers but this is not always true. Today's streams and rivers are open polluted from sources to estuary (World Bank, 1997). According to Garrick et al. (2017), there have been efforts to value water which have advanced over the past 30 years, ranging from willingness to pay for drinking water and ecosystem services, to participatory processes that capture water's different cultural benefits. Nonetheless, valuing water is still difficult and contentious owing to water's physical, political and economic characteristics.

Undoubtedly, inadequate quality and quantity of supply of water have created serious impact on our water resources management and sustainability of the environmental (Chukwu, 2015). Quality water is a major deciding factor for healthy life, which relates directly to the socio-economic success of a nation (Anthoni *et al.*, 2019; Xue *et al.*, 2019 and Yousefi *et al.*, 2018). Chitonge,

et al. (2020) in their study opined that about 663 million people globally do not have access to safe water. It has also been reported that rural communities in sub-Saharan Africa account for more than 50% of those lacking potable water (Osunla and Okoh 2017, Furtatova, and Kamenik, 2018). Similarly, The Vanguard New Paper of 22nd March 2021 in her national news disclosed that UNICEF has expressed serious concern over inadequate supply of potable water in Nigeria, noting that over 86 percent of people in the country (Nigerians) lack access to a well managed drinking water source. UNICEF in a statement to memorialize the World Water Day further noted that "although about 70 percent of Nigerians are reported to have access to a basic water services, more than half of these water sources are contaminated." This is a major reason why the poor rural dwellers use different surface water sources in their areas for drinking and domestic purposes without ascertaining the potential risks associated with the use of such water. The study tends to disclose the level of knowledge of water related issues that could be associated with Nsudu River as a result of point and non point source pollution. The choice of the method adopted for the study was in line with the method of analyzing drinking water quality. Nonetheless, the study aims at investigating the status of Nsudu River in Umuahia North, L.G.A. of Abia State for drinking purpose.

MATERIALS AND METHODS

The Study Area

The study was carried out in Umuahia North L.G.A. of Abia State, Nigeria. It occupies an area of about 253, 979 km² with population of about 220,660 at the 2006 census. Umuahia North Local Government Area is located within the South-East agro-ecological zone of Nigeria. Umuahia North lie between 5° 30" and 5° 40" N of the equator and latitude 7° 25" and 7° 32" E of

Greenwich meridian. The rainfall range of the area is about 2,000 – 2,500 mm, average annual of 27°C and relative humidity range of 80 – 90% in the wet season (National Root Crop Research Institute – NRCRI, 2002). The river receives some domestic waste discharge both solid and effluent from Isieke area and some industrial waste discharge in Okwoyi area especially from animals waste though in small quantity. In general, Abia state is prone to flooding and erosion, which can be attributed to the soil types found in the area, the low-lying topography, increased rainfalls and poor sanitation, credited to behavioral practices of the people (ESMP report, 2014). Fig. 1 shows the map of Abia State with its local government areas.



Fig. 1: Map of Abia State showing all its local governments

Source: Inec Re-Run-Guber State Assembly Polls in 325 Units in Abia State (www.google.com)

MATERIALS AND EQUIPMENTS USED

The following materials and equipments were adopted in execution of the study

- Turbid meter, covets and distilled water were used for carrying out turbidity test of the water samples under studied.
- Conductivity meter, distilled water, beaker, electrode, glass wares, etc. were used for determination of electrical conductivity of the different water samples.
- 0.02N of tetraoxosulphate IV acid (H_2SO_4), Distilled water, beaker, etc. were used for total alkalinity determination of the water samples.

- Pipettes, test-tubes, test tube racks, distilled water, flasks, beakers, beaker stands, etc. were used in determination of total hardness.
- Glass fiber filter, gas burner, weighing balance, distilled water, measuring cylinder, etc. these equipments/materials were used for determining total suspended solid.
- pH meter, distilled water, conical flask, etc were adopted for determination of pH of the samples.
- Volumetric flask, conical flask, pipette, hydroxylamine hydrochloride, distilled water, 0.25% 0-phenanthroline, spectrophotometer, phosphoric acid, etc. were used for determination of Fe and Mn contents of the samples.
- Murexide indicator solution, 0.01N EDTA solution, distilled water, were used for determination of the calcium content of the samples.
- 1 mL of potassium chromate indicator solution, measuring cylinder, pipette, conical flask, burette, distilled water, 0.0141N of $AgNO_3$ solution, etc. were used for determination of chloride content of the samples.
- Crucible water bath, Nessler tube, Nitrate disc, phenol disulphonic acid, ammonia, distilled water, etc. was used for determining nitrate in the samples.
- Petri dish, nutrient agar, incubator, glass rods, colony counter, etc. were used for determination of plate or colony count in the water samples.
- Mac Conkey broth, Durham tube, water bath autoclave, culture tubes, cotton wool, culture tube, Mac Cready's table, incubator were used for determination of total coli form
- Presumptive tube, Durham's tube, gas burner, inoculation loop and holder, water bath, etc. were used for determination of E- coli in the water samples.

WATER SAMPLE COLLECTION

Water samples were collected for laboratory analysis using plastic cans (bottles) that were initially washed with clean water and soap. These cans were also rinsed several times with clean water before rinsing them with distilled water to avoid recontamination or change in the quality of the water samples to be collected. Thereafter, the water bottles were used to collect water samples from Nsudu River in different locations of the river to ascertain the impact of effluent and some domestic wastes discharged in the river at such locations. After sample collection, they were labeled with useful information such as samples' name, collection location, date and time of collection for easy identification of the different samples collected.

WATER SAMPLES ANALYSIS

Collected samples were conveyed to the water quality laboratory of Enugu State water co-operation, quality control unit 3 at constitution road GRA Enugu, Enugu State for analysis. The samples were analyzed for their physio-chemical and biological parameters in order to obtain the quality status of Nsudu River.

PHYSICAL ANALYSIS OR TEST

The following physical tests were conducted on the water samples

TURBIDITY

The turbid meter was switched on, and one covert was filled with distilled water to a mark used to standardize the meter. Covert containing distilled water was later replaced with another containing water sample to be analyzed, the sample was allowed to stabilize and its reading was taken.

ELECTRICAL CONDUCTIVITY (EC) AND TOTAL DISSOLVED SOLID (T.D.S)

Ec of the samples were obtained with the aid of a digital conductivity meter (model DDS-307). Similarly, total dissolved solid was determined using the mathematical relationship between electrical conductivity and total dissolved solid. However, the equation is given as:

$$T.D.S = K \times Ec$$

(1)

Where;

K is a constant (0.65).

Ec is Electrical conductivity reading

TOTAL ALKALINITY

This was determined by simple titration method using 100 ml of water sample and 0.02N of tetraoxosulphate IV acid (H₂SO₄). Total alkalinity is measured by measuring the amount of acid required to bring the sample to a pH of 4.2. At the said pH value, all the alkaline compounds in the sample were exhausted. The obtained result is given in milligrams per litre of calcium carbonate (mg/L CaCO₃). Equation 2 was used to determine the total alkalinity as CaCO₃ equivalent (mg/L)

$$CaCO_3 = \frac{Vol.of\ acid(v1) \times N \times 50 \times 1000}{Vol.of\ sample\ taken\ (V2)}$$

(2)

N = Normality of acid (0.02N)

TOTAL HARDNESS

Hardness is a measure of the ability of water for precipitation of soap. It can be seen as a characteristic of water representing the total concentration of just the Ca and Mg ions expressed as calcium carbonate. Total hardness in the water sample was determined using EDTA titration method, (Goetz *et al.*, 1950). The end point of the reaction is the change of color from wine red to steel blue. A concordant titre value was obtained by repeating the titration. This method was adopted in the study because it measures the Ca and Mg ions and may be applied with appropriate modification to any kind of water. The procedures involved in the EDTA titration method entail rapid analysis of water sample. The equation for calculation of the quantity of total hardness in the water sample is given in equation 3.

$$Hardness\ (EDTA)\ as\ CaCO_3\ \frac{mg}{L} = \frac{A \times B \times 1000}{mL\ Sample}$$

Where:

A = mL titration for sample

B = mg CaCO₃ equivalent to 1.00 mL EDTA titrant.

TOTAL SUSPENDED SOLID (TSS)

Total suspended solid was determined according to the Standard Methods (2005), 2540D and US. EPA (1983) Method 160.2 (Residue, non-filterable). An adequately mixed, measured volume of sample was filtered through a pre-weighed glass fiber

filter. The filter was heated to a constant mass at 104 ± 1°C and then weighed. Increase in the mass divided by the volume of water filtered is equal to the TSS in mg/L. The equation for calculation of TSS is shown in equation 4. Every parameter was in their S. I. unit of measurement to ensure accurate result.

$$TSS\ \left(\frac{mg}{L}\right) = \frac{(w_2 - w_1) \times 1000}{V}$$

(4)

Where:

Weight of clean filter paper (g) = w₁

Weight of clean filter paper plus residue (g) = w₂

Weight of residue alone (g) = w

Volume of sample (mL) = v

CHEMICAL ANALYSIS

The followings were the chemical tests conducted on the samples

pH

The pH of the samples was determined using electronic pH meter manufactured by Metler Toledo Switzerland (seven compact series). 50ml water sample to be tested was poured into a clean and dried 100ml beaker and a well washed meter probe inserted to obtain the pH result of the water sample.

DETERMINATION OF FE AND MN IN THE WATER SAMPLES

10ml of water sample was pipette into 100ml volumetric flask and 1ml of hydroxylamine hydrochloride (10%) was added into the volumetric flask. Again, distilled water of about 50 ml and 0.25% o-phenanthroline were added to the solution. The entire mixture was made up to 100ml mark and was stirred and shaken thoroughly and allowed to stay for 15 minutes. Thereafter, the absorbance was read off using spectrophotometer wave length having been set to 510nm. Manganese was obtained in the same manner. 25ml of water sample was put into a conical flask with 5 drops of phosphoric acid added to it and were boiled. Furthermore, addition of sodium periodate to the solution resulted to a permanganate coloration of the sample. Manganese was measured with spectrophotometer at wavelength of 525nm.

DETERMINATION OF CALCIUM CONTENT OF THE WATER SAMPLES

EDTA titration method was also adopted in the determination of the calcium content of the samples. 100ml of sample was measured into a rinsed 250ml Erlenmeyer flask. 1 ml of buffer solution and 2 drops of murexide indicator solution were added to the solution. The sample solution turned pink. Titration was carefully done with standardized 0.01N EDTA solution; this made the pink color to change to purple coloration. The volume of EDTA used was recorded. Equation 5 was adopted in calculating the quantity of Ca present in the samples.

$$CaCO_3\ mg/L = \frac{A \times B \times 1000}{mL\ Sample}$$

(5)

DETERMINATION OF MAGNESIUM

Magnesium hardness of the water samples were determined by a simple calculation method, since the total hardness in terms of Ca and Mg has been determined and hardness of the water samples in terms of its Ca content alone has also been determined. However, simple subtraction of the total Ca

obtained from total hardness resulting from Ca and Mg was done. Nonetheless, Mg hardness was obtained as shown in equation 6.

$$Mg = T - Ca$$

(6)

Where:

Mg = Magnesium hardness

T = Total hardness in terms of Mg and Ca

Ca = Calcium hardness

DETERMINATION OF CHLORIDE CONTENT OF THE SAMPLES

Argentometric titration method or Mohr’s method was used to determine chloride ion concentration found in the water samples. 100 mL of the sample was poured into a well washed 250 mL conical flask that was rinsed with distilled water. The flask was allowed to dry before pouring the water sample. Moreover, 1 mL of potassium chromate indicator solution was added to the solution which gave it a yellow coloration. Afterwards, titration of the solution was carefully done against 0.0141N of AgNO₃ solution used. Equation 7 was used to determine the chloride content of the sample.

$$Cl \left(\frac{mg}{L} \right) = \frac{T \times N \times 35450}{V}$$

(7)

Where:

T = Titration value

N = Normality of Ag/NO₃

V =Vol. of sample used

Determination of nitrate

Phenoldisulphonic acid method was used for determination of nitrate. 50 mL of the sample was poured in to a clean dry crucible and was evaporated in a water bath to dryness. It was allowed to cool and 15 drops of the phenol disulphonic acid was added to the sample in a crucible. It was allowed for about two minutes to enable re-dissolution of caked nitrate compounds in the crucible. After re-dissolution, the solution was washed with distilled water into Nessler tube. 10mL of 10% ammonia solution was added to the sample solution for color development and was made-up to 50mL mark with distilled water, the Nessler tube containing the sample solution was consecutively placed at the right side of Nesslerizer white, another Nessler tube containing distilled water as blank sample was placed at the left side of the Nesslerizer. The color was then matched using nitrate disc. The value at which the two Nessler tubes matched in color was noted.

DETERMINATION OF SULPHATE

Barium sulphate method was used for determination of sulphate in the water sample. 1 mL of conditioning reagent was first added to 50mL water sample. It was stirred for 2 minutes and then used

to correct the zero error of the turbid meter. Furthermore, a spoon of barium chloride salt was added to the sample solution and stirred, the sample solution was then inserted into the turbid meter and its reading was taken.

BACTERIOLOGICAL ANALYSIS

The biological tests carried out for the purpose of the study are as follows:

PLATE OR COLONY COUNT

This was determined using sterile pipette. 1 mL of water sample was delivered into a sterile Petri dish and 20 mL of nutrient agar that was melted and cooled to 45°C was poured into the dish. The content (water sample and nutrient agar) of the dish were carefully mixed together. The mixture was allowed to set (solidity) and the Petri dish was incubated at 35°C for 24 hours and the number of colonies of bacteria formed were counted using colony counter.

DETERMINATION OF TOTAL COLI FORM

The method adopted for the test mentioned above is known as presumptive Coli form test. Media (Mac Conkey broth) were distributed into culture tubes containing inverted Durham tubes each containing 10 mL of media double or single strength. The tubes with the medias were covered with cotton wool and sterilized in an autoclave at 121°C for 15 minutes. Thereafter, five different tubes containing 10mL of double strength broth and another 5 tubes containing 10 mL of single strength broth were inoculated with 10 mL, 5 mL and 1 mL of water samples. The mixture of the sample and media were incubated for 48 hours and the culture tubes were examined for gas or evidence of fermentation. The tubes in which gas or evidence of fermentation occurred were noted and marked as positive (+ve) while tubes without evidence of fermentation were marked negative (-ve). The probable organisms found were noted by referring to the Mac Cready’s table for MPN index.

Determination of E- coli

Sequel to the coli form test, the positive presumptive tube was picked and a portion of it inoculated into a fresh broth. This was incubated in a water bath at a temperature of 45°C for a period of 24 hours. At the time of the incubation, the Durham’s tube was checked for gas or evidence of fermentation. The presence of trap red gas showed evidence of fermentation which indicated positive result.

RESULTS AND DISCUSSION

RESULT OF THE PHYSICAL CONTAMINANTS

The results of the physical tests carried out on the water samples used for the study revealed that all the samples were not turbid. The results revealed also that the total solid found in the water samples i.e. 1, 2 and 3 were 100.33 Mg/L, 100.28 Mg/L and 100.52 Mg/L respectively. These values are below the standards stipulated by WHO (2008) and NSDW (2007) for drinking water quality. Thus, all the physical parameters tested for the study are found in Table 1.

Table 1: Result of the physical analysis for the water samples

Test	Sample 1	Sample 2	Sample 3	WHO Standard	NSDW Standard	Remark
Turbidity (NTU)	4.00	3.89	4.23	5.00	5.00	Not turbid
Total solid (Mg/L)	100.33	100.28	100.52	1000	1000	Adequate

T.D.S (Mg/L)	100.23	100.20	100.37	500-1000	500	Adequate
EC($\mu\text{s}/\text{cm}^3$)	154.20	151.12	157.00		1000	Normal
Total hardness(Mg/L)	26.00	25.52	26.41	100-200	200	Not hard
T. S. S (Mg/L)	0.10	0.08	0.15	500	500	Insignificant
pH	6.80	6.68	6.85	6.5 – 9.5	6.5 – 8.5	Adequate
Alkalinity mg/L	22.00	21.87	22.38	1000		Adequate

In Table 1, the result of the physical contaminants showed that all the parameters tested for the samples collected at different location in Nsudu River were found to be within the acceptable limit for both World Health Organization (2008) and Nigerian Standard for Drinking Water Quality (2007). Table 2 contains the results of the analyzed water samples for chemical contamination.

Table 2: Result of the chemical contaminants

Test	Sample 1	Sample 2	Sample 3	WHO Standard	NSDW Standard	Remark
Calcium (mg/L)	9.60	8.70	10.01	100 - 300	100 - 200	Adequate
Magnesium (mg/L)	0.60	0.54	0.68	50.00	100 - 200	Adequate
Calcium Hardness (mg/L)	24.00	23.14	24.04	500	150	Not hard
Magnesium (mg/L)	02.00	02.38	2.37	50	200	Adequate
Iron (mg/L)	0.25	0.23	0.27	0.05 – 0.3	0.3	Adequate
Chlorides (mg/L)	10.64	10.02	11.13	250	250	Adequate
Sulphate (mg/L)	12.05	11.78	12.94	200	100	Adequate
Nitrate (mg/L)	0.15	0.12	0.17	50	50	Adequate
Dissolved Oxygen (mg/L)	6.70	6.68	6.71	5	5	Adequate
Sodium Chloride	17.55	16.58	17.92	200	250	Adequate

The results of chemical analysis conducted on the samples shown in Table 2 indicated that all the chemical parameters tested were found within the acceptable range given by WHO

RESULT OF THE CHEMICAL CONTAMINANTS

The chemical contaminants' tests carried out for the purpose of the study showed that Ca, Mg, Fe etc. were found to be within the stipulated range proposed by the two standards adopted for the study. Thus, the water samples' chemical results can be found in Table 2.

and NSDWQ standard for drinking water. Thus, the result is an indication that there is no much deposit of toxic chemicals in the river or that there may be oxidation and reduction reaction taking

place by the microorganisms associated with the water body. Moreover, sample 2's result gave a lower value in all the analyzed chemical parameters with the exception of DO. This can be correlated to the presence of some aquatic plants at the point where sample 2's water sample was collected. Increase in DO for the sample was as result of release of oxygen (increased aeration) as by product of photosynthesis. Nonetheless, adequate dissolved oxygen is necessary for good water quality. Reduction in the concentration of nitrate can also be attributed to the

presence of green plants in the point of collection of water for sample 2. Table 3 contains the results of the analyzed water samples for biological contamination.

RESULTS OF THE BIOLOGICAL CONTAMINANTS

Table 3 presents the results of all the biological contaminants' tests conducted for the study. It was observed that the biological contaminants were above the standards used for the study. However, the details of the biological contaminants' investigations are shown in Table 3.

Table 3: the results of the biological contaminants

Test	Sample 1	Sample 2	Sample 3	WHO Standard	NSDW Standard	Remark
Total Plate Count (CFU/mL)	139.00	136.00	141.52	100.00	100.00	Risky
Total Coli Form(CFU/mL)	23.00	21.93	23.39	3.00	10.00	Risky
E.Coli (CFU/mL)	3.50	3.20	5.21	0 per100ml	0 per100ml	Risky

From Table 3, the quantity of E. coli count of the tested water samples of Nsudu River were obtained to be within 3.20 – 5.21, indicating faecal contamination (Ishii *et al.*, 2007; Wang *et al.*, 2013) by the pig droppings that find their way into the river. This is in line with studies conducted by Odonkor and Ampofo (2013). Their research highlighted that the existence of *E. coli* in food and water signals recent faecal contamination or inadequate hygiene in food processing facilities. Thus, faecal contamination, poor sanitation measures and poor storage conditions have a great influence on the population of *E. coli* (Agensi *et al.*, 2019, Kayembe *et al.*, 2018). Existence of *E. coli* in water does not necessarily imply the presence of disease causing microbes. It however, gives an indication of the possible existence of faecal borne micro-organisms like salmonella and hepatitis A, (Price and Wildeboer, 2017, Br'ussow, 2005). The presence of these microorganisms makes the river unfit for drinking purposes most especially when it is not subjected to appropriate treatment measures that will kill the pathogens found in it. Again, the growth and survival of *E. coli* in natural

environments can be affected by both abiotic and biotic factors (Rochelle-Newall *et al.* 2015). In addition to the presence of *E. coli* in the water samples, total coli form and the plate count were also found to be much higher than the limits stipulated by the two standards used as given in Table 3. The positive result of the total coli form may not necessarily be as a result of faecal contamination but could be because of the presence of other contaminants in the water body. This is because the river receives some domestic waste (solid and effluent) from Isieke village in Umuahia L. G. A. of Abia State. Total plate count obtained for the samples tested were between 136 CFU/ mL and 141.52 CFU/mL. These were above the safe limits given by both WHO and NSDWQ standards. It however poses risk to the surrounding inhabitants who may use it as a drinking water source without adequate treatments. Tables 4 and 5 are the ANOVA results conducted with the results of the biological contaminants.

Table 4: ANOVA Comparing the Results of the Biological Tests at Different Points of Sample Collection in the River

Source of Variation	SS	df	MS	F	P-Value	F- Crit
Biological test	32014.95	2	16007.48	12093.94	2.73E-08	6.944272
Test samples at different points of the river	13.47349	2	6.736744	5.089735	0.079579	6.944272
Error	5.294378	4	1.323594			
Total	32033.72	8				

Table 4 is the ANOVA comparing the results of the different samples (biological tests of samples collected from different locations of the river. It can be seen that the treatment samples

studied has very high significant difference between the biological tests conducted on the samples. However, the three biological tests have different standards. The ANOVA results

for the collected water samples from different points of the river showed ($P < 0.01$) and (F-test of 12094 > F-crit. of 6.9). The tested samples at different locations of the river indicated that

there is no significant difference between the means of the three samples collected from different locations.

Table 5: ANOVA of the Biological Tests

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	13.47349	2	6.736744	0.001262	0.998739	5.143253
Within Groups	32020.25	6	5336.708			
Total	32033.72	8				

Comparison of the variance of the samples treatment to the unaccountable variance (residuals) in Table 5 shows that F value (0.001262) is less than the F critical value (5.143253). This means that there is no significant difference between the results of the samples from different points of collection. The low F value also showed that the group means are close together i.e. low variability relative to the variability within each group, ($P < 0.01$). The biological contaminants are highly statistical significant. However, the biological contamination can be attributed to faecal contamination from the pig droppings.

CONCLUSION

The study revealed that all the physical contaminants tested were found to be adequate that is within the acceptable limit stipulated by the standards used. Thus, results of chemical analysis conducted on the samples indicated that all the chemical parameters tested were found within the acceptable range by the standards adopted for the study. Again, sample 2’s result gave a lower value in all the analyzed chemical parameters with the exception of DO. This can be correlated to the presence of some

aquatic plants at the point where sample 2’s water sample was collected. More so, the study revealed that most water samples analyzed were contaminated with bacteria pathogens surpassing recommended standards thereby suggesting that consumers are exposed to heightened risks and susceptibility to waterborne diseases or health complications. ANOVA test revealed that there is very high significant difference between the biological tests conducted on the samples. The ANOVA results for the collected water samples from different points of the river showed ($P < 0.01$) and (F-test of 12094 > F-crit. of 6.9). The tested samples at different locations of the river indicated that there is no significant difference between the means of the three samples collected from different locations. It is therefore, recommended that Nsudu River and other surface water bodies that receive animal faecal discharge and domestic waste should be well disinfected or boiled before drinking or used for some domestic purposes. Lastly, Nigeria as a developing nation needs to intensify her effort in provision of potable and quality water to her citizens in order to meet up with the water need of millions of people in the country.

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