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Assessment of water quality in Canaanland, Ota, Southwest Nigeria

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ABSTRACT

In this study, water points in Canaanland, Ota, and nearby Iju River were analyzed for biological and physicochemical properties including heavy metal content. Water quality parameters examined were pH, alkalinity, salinity, conductivity, turbidity, total hardness, total solids (TS), total dissolved solids (TDS), total suspended solids (TSS), dissolved oxygen (Do), biochemical oxygen demand (BOD), iron (Fe), lead (Pb), zinc (Zn) and chromium (Cr). All the water samples were slightly acidic (5.96 – 6.54) except the bottled/ sachet Hebron water and Iju River water. The results were compared against drinking water quality standards laid by World Health Organization (WHO) and Nigerian Standard for Drinking Water (NSDW). The potable water samples were within the standards for consumable water and so are considered safe for human consumption. The surface waters, on the other hand, have high levels of total dissolved solids, conductivity and salinity. The BOD of the effluent water showed that the water was contaminated and the use of the water for domestic purposes by the inhabitants could lead to hazardous side effects.

Keywords: CanaanLand Ota, physicochemical properties, potable water, surface waters

INTRODUCTION

Water is an essential natural resource for sustainability of life on earth. Humans may survive for several weeks without food, but barely few days without water because constant supply of water is needed to replenish the fluids lost through normal physiological activities, such as respiration, perspiration, urination, (Murray *et al.*, 2003). Though the hydrosphere is estimated to contain about 1.36 billion Km^3, only about 0.3% of the water, existing as fresh water in rivers, streams springs and aquifers, is available for human use; the remaining 99.7% is locked up in seas and oceans (Wilson, 1978). The geological constraints limit accessibility of many human communities to water that is adequate in terms of quantity, quality and sustainability. Lack of adequate supply of potable water is a critical challenge in developing countries such as Nigeria. Potable water, also called drinking water in reference to its intended use, is defined as water which is fit for consumption by humans and other animals (Tchobanoglous, *et al.,* 2003). The usual source of drinking water is the streams, rivers, wells and boreholes which are mostly untreated and associated with various health risks (Agbarie and Obi, 2009). Paucity of infrastructure for effective treatment and distribution of water accounts for the incidence of high morbidity and mortality rate associated with water borne diseases in developing countries (Mark *et al* 2002). One of the targets of the millennium development goals (MDG) in terms of healthy living for the masses can be achieved through the supply of safe and convenient water (Orewole *et al.*, 2007). The quality of water influences the health status of any populace, hence, analysis of water for physical, biological and chemical properties including trace element contents are very important for public health studies.

Groundwater is an important water resource in both the urban and rural areas of Nigeria (Adekunle *et al.*, 2007). Governmental and non-governmental agencies, corporate organizations and individuals are involved in sinking of boreholes to provide water for their families, staff, companies and communities. Canaanland, Ota, in Ogun State, South-West, Nigeria, is the international headquarters of Living Faith Church, world-wide (a.k.a. Winners' Chapel International). The rapidly growing city houses the Faith Tabernacle, a 50,000 capacity church auditorium, Kingdom Heritage Model Schools (a primary school), Faith Academy (a full-boarding secondary school) and Covenant University (a full residential tertiary institution with a population of over 10, 000 people). An integrated system of boreholes and distribution networks ensures efficient water supply all through Canaanland. Water run-off from Canaanland and the surroundings generally flow into the nearby Iju River. In this study, water samples taken from different points in Canaanland and Iju River were analyzed for biological and physicochemical properties. Water quality parameters examined were pH, alkalinity, salinity, conductivity, turbidity, total hardness, total solids (TS), total dissolved Solids (TDS), total suspended solids (TSS), dissolved oxygen (Do), biochemical oxygen demand (BOD), iron (Fe), lead (Pb), zinc (Zn) and chromium (Cr). The results indicate that potable water at Canaanland is safe for human consumption whereas Iju River is not suitable for domestic, industrial or agricultural uses.

MATERIALS AND METHODS

Chemical and reagents: All chemicals and reagents used fro the study were of analytical grade.

Study area: Canaan land and its neighboring communities such as the Iju community, Industrial sites e.g. Intercontential distillers were used in this present study. Also used are the receiving rivers from which effluents of Canaan land are emptied into.

Sample collection and preparation: The water samples were collected at two weeks intervals for a period of two months. The water sources include: precipitation rain ,borehole , tap water, iju river, unchlorinated water from Covenant University swimming pool, the University cafeteria, Water from the production line and effluent of Intercontential distillers Limited , Vended bottled and Sachet water from Hebron and Gohi production company. Samples were collected in 2 liter plastic containers and 200 cm3 reagent bottles properly cleansed with distilled deionized water prior to usage. Collection was carried out by careful immersion of the sample containers in the lotic water and by aseptic collection for the lentic water. The containers were then sealed with tight fitting corks and stoppers after collection, in order to avoid air bubbles. Samples were transferred to a refrigerator (4°C) prior to analysis.

Physicochemical analysis: The samples collected were analyzed for pH, Turbidity, Total dissolved solids, electrical conductivity, salinity, BOD, alkalinity, acidity and Total hardness, Presence of calcium, Trace metals.

Determination of pH: The pH of the water samples was determined using the Hanna microprocessor pH meter. It was standardized with a buffer solution of pH range between 4-9.

Measurement of temperature: This was carried out in-situ at the site of sample collection using a mobile thermometer. This was done by dipping the thermometer into the sample and recording the stable reading

Determination of conductivity: This was done using a Jenway conductivity meter (4510 model). The probe was dipped into the container of the samples until a stable reading was obtained and recorded.

Determination of acidity: Following the procedure in the American society for testing and materials (1982), acidity was determined by titration. 50mL of the sample was pipetted into a clean 250mL conical flask. Two drops of phenolphthalein indicator were then added and the solution titrated against a standard 0.01M NaOH solution to a pink end-point.

Calculation

$$\text{Acidity (mg/L)} = \frac{V \times M \times 100{,}000}{\text{mL of sample used}}$$

Where V = volume of NaOH used
M = molarity of NaOH used

Determination of Alkalinity: 50mL of the sample was pipetted into a clean 250mL conical flask. Two drops of methyl red indicator were then added and the solution titrated against a standard 0.01M NaOH solution to a pink end-point. (American society for testing and Materials, 1982).

$$\text{Total alkalinity (mg/L)} = \frac{V \times M \times 100{,}000}{\text{mL of sample used}}$$

Where V = volume of acid used
M = Molarity of acid used

Determination of Turbidity: This was determined using a standardized Hanna H198703 Turbidimeter. The samples were poured into the measuring bottle and the surface or the bottle was wiped with silicon oil. The bottle was then inserted into the turbidimeter and the reading was obtained.

Determination of total solids (TS) by gravimetric Method: 10mL of the samples were measured into a pre-weighed evaporating dish which was then dried in an oven at a temperature of 103 to 105^{o}C for two and half hours. The dish was transferred into a desiccators and allowed cool to room temperature and was weighed. The total solid was represented by the increase in the weight of the evaporating dish.

$$\text{Total solids (mg/L)} = \frac{(W2-W1)\text{ mg} \times 1000}{\text{mL of sample used}}$$

Where W1 = initial weight of evaporating dish
W2 = Final weight of the dish (evaporating dish + residue)

Determination of total dissolved solids (TDS) by Gravimetric Method: A portion of water was filtered out and 10mL of the filtrate measured into a pre-weighed evaporating dish. Following the procedure for the determination of total solids above, the total dissolved solids content of the water was calculated.

$$\text{Total dissolved solids (mg/L)} = \frac{\text{(W2-W1) mg x 1000}}{\text{mL of filtrate used.}}$$

Where W1 = initial weight of evaporating dish
W2 = Final weight of the dish (evaporating dish + residue).

Determination of dissolved oxygen: This was done using Winkler's method. In this procedure, an excess of Manganese (II) salt, iodide (I-) and hydroxide (OH-) ions were added to the samples causing a white precipitate of Mn (OH)2 to form. This precipitate was then oxidized by the dissolved oxygen in the water sample into a brown Manganese precipitate. In the next step, a strong acid (either hydrochloric acid or sulphuric acid) is added to acidify the solution. The brown precipitate then converts the iodide ion (I-) to iodine. The amount of dissolved oxygen is directly proportional to the titration of iodine with a thiosulphate solution.

In this study, 300ml BOD bottles were filled with the samples respectively, 2mL of manganese sulphate and 2ml of alkali-iodide-azide solution added by inserting a pipette just below the surface of the liquid. The bottles were stoppered to avoid the introduction of air and were mixed by inverting several times. The bottles were left to stand for a few minutes. The presence of oxygen is indicated by the formation of a brownish –orange precipitate. Two millimeters (2mL) of H_2SO_4 was added to the samples. It was mixed again by inverting to dissolve the precipitate. Two hundred and one milliliter of the sample was then measured into a clean 250mL conical flask and titrated against sodium thiosulphate solution($Na_2S_2O_3.5H_2O$) using the starch indicator until the solution turned colorless.

Calculation

$$\text{DO (mg/L)} = \frac{16000 \text{ x M xV}}{V_2/V_1\ (_{V1-2})}$$

Where = Molarity of thiosulpahte used.
V = volume of thiosulphate used for titration
V1 =Volume of bottle with stopper
V2 = Volume of aliquot taken for titration.

Determination of Biochemical Oxygen Demand (BOD): The method involves filling the samples to overflowing, in an airtight bottle of the specified size and incubating it at the specified temperature for 5days .Dissolved oxygen (DO) is measured initially and after incubation and the BOD is computed from the difference between initial and final (DO). Because the initial (DO) is determined shortly after the dilutions is added, all oxygen uptake occurring after this measurement is included in the BOD measurement. One Millimeter (1mL) of $MgSO_4$, $CaCl_2$, phosphate buffer, $FeCl_3$ was added to 1L of water. The solution was then shaken thoroughly to saturate the dissolved oxygen. This solution was used to dilute samples. It should be noted that when effluent from a biological treatment process is used, inhibition of nitrification is recommended. This is done using a nitrification inhibitor. Also sample dilution is necessary before incubation to ensure that all the dissolved oxygen is not used during incubation. One hundred millimeters (100mL) of the samples were measured into different one Liter flask and made up to (1L) mark with the dilution water previously prepared. The dilution sample solution was then poured into BOD bottles and subsequently incubated at 20^{o}C in the dark for 5 days

Determination of initial dissolved oxygen: Three hundred millimeters (300ml) BOD bottles were filled with the diluted samples previously prepared and the initial dissolved oxygen (DO) is determined using the Winkler's method

Determination of Final Dissolved Oxygen: After incubation for 5days, the final dissolved oxygen (DO) was determined using the same procedure above

$$\text{BOD (mg/L)} = \frac{DO_1-DO_0}{B}$$

Where DO_0 = initial dissolved oxygen (immediately after preparation)
DO_1 = final dissolved oxygen (after 5days of incubation)
B = Fraction of sample used.

Determination of salinity: This was done using a multiple parameter Turbidimeter. The probe was dipped into the water samples until a stable reading was obtained and recorded.

Determination of total Hardness: 25mL of the samples was placed in different clean 250mL conical flask. To this were added 3mL of ammonium chloride in concentrated ammonia buffer (NH_4CL/conc.NH_3) and 2 drops of Eriochrome Black T indicator. This was titrated against 0.01M EDTA solution until there was a color change from violet to blue.

Calculation:

Hardness in mg/L $CaCO_3 = \frac{V \times M \times 1000}{\text{mL of sample used}}$

Were M = Molarity of EDTA Used
V =Volume of EDTA used.

Preparation of standards: Instrumental calibration was carried out prior to metal determination by using standard solutions of metal ion prepared from salts. Commercial analar grade 1000ppm stock solutions of Zn^{2+}, Cr^{2+}, $Pb^{2+}Fe^{2+}$ were diluted in 25cm3 standard flask and made up to the mark with deinonzed water to obtain working standard solutions of 2.0ppm, 3.0ppm and 4.0ppm of each metal ion.

Heavy metal determination: The sample water were digested using concentrated nitric acid HNO_3 and concentration of Lead (Pb), Zinc (Zn), Iron (Fe) and Chromium (Cr) measured with S series atomic absorption spectrophotometer (AAS) (Williams *et al.*, 2007; Essien *et al.*, 2006; Adekoya *et al.*, 2006) at Covenant University Instrumentation Room. The essence of the digestion before analysis was to reduce organic matter interference and convert metal to a form that can be analyzed by AAS.

RESULTS:

Table 1: The pH, Alkalinity, Salinity, Conductivity, Turbidity and Total Hardness values of potable and surface water samples in Canaan land, Ota.

Potable Water	pH	Alkalinity (mg/l)	Salinity (mg/l)	Conductivity (µS/cm)	Turbidity (NTU)	Total Hardness (as$CaCO_3$)
Potable Water						
Distilled Water	6.30 ±0.26	0.15 ±0.05	14.55 ± 1.15	21.5 ± 0.1	0.57 ± 0.04	20.5 ± 0.5
Borehole Water	6.40±0.23	0.95±0.15	81.10± 0.30	30.10± 1.6	0.30± 0.17	25.0± 1.0
Tap Water	6.54±0.20	0.95 ± 0.15	86.45 ± 4.95	35.6 ± 7.7	2.25 ± 1.70	19.0 ± 1.0
Hebron Bottled Water	7.16±0.24	0.85 ±0.15	160.5 ± 13.50	123.0 ± 13.5	0.11 ± 0.03	17.0 ± 1.0
Hebron Sachet Water	7.35 ±0.50	0.55 ±0.35	162.50 ± 4.5	149.1 ± 18.8	0.17 ±0.02	21.0 ± 1.0
Surface Water						
Rain Water	5.96 ±0.52	0.26 ± 0.15	75.9 ± 2.70	16.7 ± 2.3	8.18 ± 1.53	21.0 ± 1.0
Chlorinated Swimming Pool	6.36± 0.57	14.20 ± 1.6	158 ± 4.00	142.6 ± 6.3	4. 43 ±0.33	51.0 ± 3.0
Un-chlorinated Swimming Pool	6.29±0.43	0.30 ± 0.10	138.9 ± 4.10	107.8 ± 3.0	3.47 ± 0.07	24.0 ± 2.0
Iju River Water	7.17± 0.52	1.40 ± 0.10	133.8 ± 2.90	97.3 ± 1.1	10.25 ± 0.55	31.0 ± 1.0
Standards						
WHO	-	120-600	200		-	100-500
Nigerian Standard for Drinking Water (NSDW)	6.50-8.50			1000	5	150

Table 2: Total Solids (TS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) values of potable and surface water in Canaan land, Ota.

Potable Water	**TS**	**TDS**	**TSS**	**DO**	**BOD**
Potable Water					
Distilled Water	5.00	0.00	5.00	6.10	0.20
Borehole Water	130.00	100.00	20.00	5.00	0.40
Tap Water	120.00	20.00	100.00	5.70	0.45
Hebron Bottled Water	125.00	15.00	110.00	5.75	0.20
Hebron Sachet Water	295.00	30.00	265.00	6.10	0.20
Surface Water					
Rain Water	85.00	15.00	70.00	5.84	1.04
Chlorinated Swimming Pool	2205.00	5.00	2200.00	5.40	0.35
Un-chlorinated Swimming Pool	3005.00	95.00	2910.00	5.65	0.40
Iju River Water	260.00	20.00	240.00	4.25	3.40
Standards					
WHO					
Nigerian Standard for Drinking Water (NSDW)			500		

Table 3: Metal ion (calcium, iron, lead, zinc and chromium) levels in potable and surface water in Canaanland, Ota.

Potable Water	Iron (Fe) (mg/l)	Lead (Pb) (mg/l)	Zinc (Zn) (mg/l)	Chromium (Cr) (mg/l)
Potable Water				
Distilled Water	0.002	0.024	ND	ND
Borehole Water	0.145	ND	0.006	ND
Tap Water	0.077	0.086	0.030	ND
Hebron Bottled Water	ND	0.011	ND	ND
Hebron Sachet Water	ND	0.054	ND	ND
Surface Water				
Rain Water	0.100	0.183	ND	ND
Chlorinated Swimming Pool	0.074	0.072	ND	ND
Un-chlorinated Swimming Pool	0.091	0.043	ND	ND
Iju River Water	0.302	0.179	0.007	ND
Standards				
WHO	-	0.01	5.0	0.05
Nigerian Standard for Drinking Water (NSDW)	0.3	0.01	3.0	0.05

ND = Not Detected

DISCUSSION

The acceptability and use of potable water for recreational and other domestic needs are influenced by physicochemical parameters such as pH, total dissolved solids and conductivity. Inorganic minerals however constitute the greatest source of raw water contaminants, of which mineral salts are introduced as water moves over the soil structure. A major factor affecting water quality is anthropogenic activities arising from rapid industrialization and urbanization (Ubalua and Ezeronye, 2005). For instance, trace metals gain access into rivers possibly through anthropogenic and natural sources. These trace metals can be accommodated in three basic reservoirs: water, biota and sediments (Florea and Busselberg, 2006; Hung and Hsu, 2004). Some trace metals are potentially toxic because they act on the cell membrane or interfere with cytoplasmic or nuclear functions after entry into the cell. Hence, their accumulation in the human body could result to malfunctioning of organs (Jarup, 2003). At high concentrations, they cause acute systemic poisons. Use of raw water with high salts result to nauseous, saline taste with purgative tendency and dehydration. Of great concern are salts containing nitrates and nitrites. These are known to cause methaemoglobinemia in children; high fluorides may result in dental fluorosis. The total alkalinity value of water is expressed as the acid neutralizing ability of the water and is determined by how much carbonate, bicarbonate and hydroxide is present. Excess alkalinity results to a distinct flat and unpleasant taste, scale formation. Orewole *et al.*2007. From Table 1 the alkalinity of the surface water ranged between (0.26 $\pm$ 0.15 – 14.20 $\pm$ 1.60 mg/L) and the potable water 0.15 $\pm$ 0.05 – 0.95 $\pm$ 0.15 mg/L), these results fall within the WHO specifications (120mg/L) allowed for domestic and recreational purposes of water. pH is the measure of hydrogen ion concentration or hydroxide ions concentrations in a solution. From the result in Table 1 the pH of the surface water ranged between (5.96 ±0.52 - 7.17± 0.52) and potable water (6.30 ±0.26 - 7.35 ±0.50). The results were within the normal acceptable range (6.0-9.0). The pH of the surface water (6.30 ±0.26 - 7.35 ±0.50) was within the Nigerian Standard for Drinking Water (NSDW) range acceptable for normal consumption. The result compares well with studies of Adefemi *et al.* (2007) in water samples from Ureje, Egbe, Ero and Itapaji dams, South West of Nigeria. Asaolu (1997) also obtained similar results from water samples from the coastal regions of Ondo State ,South West of Nigeria In this study, the surface water has some level of acidity, were the rain water recorded a pH of (5.96 ±0.52). Consumption of such acidic water could have adverse effects on the digestive and lymphatic systems of human. This results recorded for the surface water is agreeable to the fact Ota that is a fast growing industrial location, of which such area are characterized by high presence of CO_2 and SO_2. These compounds when mixed with rain results to acid rain. The high presence of these green house gases in supplied potable water can cause scale build up in water pipes and often has lead to bitter taste in water causing a laxative effect on humans and young livestock (Orewole *et al.,* 2007). Acid water can also lead to corrosion of water could also lead to corrosion of copper pipes which could in turn, lead to copper poisoning. Copper contaminated water is responsible for health hazards such as abdominal pains, nausea, vomiting, diarrhea, headache, and dizziness

(Chinwe *et al.,* 2010). Copper poisoning principally influences formation of liver cirrhosis, known as non-Indian childhood cirrhosis (Zietz *et al.*, 2003). Moreover high copper concentration in industrial domestic and recreational waters water influences the rapid deterioration of aluminum utensils and galvanized steel fittings. This exacerbates the process of final disposal of sludge produced in wastewater treatment plants containing these fittings from the effluents of most industries.

Salinity is a measure of the salt content of water. From Table 1.the salinity of the potable and surface water were between (14.55 ± 1.15 - 162.50 ± 4.5; 75.9 ± 2.70 - 158.00 ± 4.00 mg/l) respectively. The potable waters (Hebron Bottled Water and Hebron Sachet Water) recorded high salinity when compared to other sample waters that serve as potable water. This may be due to the fortification of this vended water with essential minerals that would be beneficial to human welfare. Furthermore, the recorded results were within the maximum permissible limit prescribed by World Health Organization (WHO). When an individual consume water with high amount of salinity beyond the maximum permissible limit of WHO and other relevant agencies, such individual may be be prone to hypertension. Aside from human intoxication, it may affect the dissolved oxygen level of water as fresh water holds more oxygen than salt water. Conductivity is the ability to conduct electricity, heat or sound. Pure water is a bad conductor of electricity. Conductivity increases as the concentrations of ions in water sample increases. From the results obtained for conductivity in Table 1 the potable and surface waters ranged between (21.5 ± 0.1 - 149.1 ± 18.8; 16.7 ± 2.3 - 142.6 ± 6.3(µS/cm) respectively. This result serve as an indication of the total dissolved solid content of the water samples in some cases. Hard water is water with high mineral content mostly calcium, and magnesium ions. Calcium occurs in the form of calcium carbonate (CaCO3). The surface water contained about (21.0 ± 1.0 - 51.0 ± 3.0) hardness while the potable water ranged between (17.0 ± 1.0- 25.0± 1.0) in Table 1. This result shows that the treatment facility employed in the treatment of the water that serve the community is functioning at an optimal rate. However, when untreated surface and waste water find its way into the water bodies, utilized by man such hard water can lead to dry itchy skin and also influence osmoregulation in fish. Turbidity is the cloudiness or haziness of water sample. It is usually caused by suspended solid particles which can be as a result of the presence of phytoplankton in open waters or in drinking water. The more turbid water is the greater the chances of water borne diseases. This is because contaminants like bacteria and viruses can become attached to these suspended solids and are protected by these solids from disinfection by chlorination or UV sterilization (USEPA, 1986). From Table 1 the Nigerian Standard for Drinking Water (NSDW) acceptable standard is 5 NTU. From results the turbidity of the potable water ranged between (0.11 ± 0.03 - 2.25 ± 1.70 NTU).The result from the tap water was high when compared to other potable water (2.25 ± 1.70 NTU), the increase may possibly be due to corrosion effect of some of the pipes utilized in the distribution of the water. Aside from the corrosion effect there are possibilities of biofilm formation which may contribute to leakages of pipes and contamination of the supplied water. The surface water which include: Chlorinated Swimming Pool (4. 43 ±0.33NTU), Un-chlorinated Swimming Pool (3.47 ± 0.07 NTU), Rain Water (8.18 ± 1.53 NTU) and Iju River Water (10.25 ± 0.55) had a progressive increase in turbidity. From the results, the increase in value of turbidity from water sample in Iju river is possibly due to effects of runoff waters which carries with it several compounds (bacteria, suspended solids, hydrocarbons and heavy metals). These compounds can impede the rays of light entering the river (chinwe *et al.,* 2010). This effect can influence the dissolved oxygen level in water bodies. This is possible because suspended particles absorb sunlight and increase the temperature of the water and this reduces the oxygen level of such water. The inhibited rays of sunlight by suspended particles can influence the rate of photosynthetic activity and thus reduce the dissolved oxygen level of the water. Total solids are the combined content of all the organic and inorganic substances contained in a liquid which are present in ionized molecular or micro-granular form (Beychok et al 1967). Total suspended solids are solids that cannot pass through a sieve of 2 micrometers and yet are indefinitely suspended in the solution. Expectedly from Table 2 the surface water had very high values of total solids and total suspended solids. The high values of TS and TSS can affect the organisms living in water bodies as these can influence the level of dissolved oxygen. Furthermore, the amount of total suspended solids expected in Nigeria Nigerian Standard for Drinking Water (NSDW) is about 500 whereas in the Chlorinated Swimming Pool and Un -Chlorinated Swimming Pool waters it is about four times higher. This increase may be explained by open exposure of such pools to suspended particulate matter in the air, were such particles settle on the surface of these pools. Dissolved oxygen analysis measures the amount of gaseous oxygen dissolved in an aqueous solution. Biochemical oxygen demand is a chemical procedure for determining how fast biological organisms use up oxygen in a body of water (Clair N Sawyer et al .2003). From the results obtained in Table 2, the values were relative between the potable and the surface waters. The results in Table 3 showed that chromium and zinc ranged from Not Detected (ND) to about 0.030 mg/L. However, Iron (Fe) was present in all the water samples except for the Hebron treated bottled and sachet water. This result agrees to previous works of (Asaolu and Olaofe, 2004; Nwajei and Gagophien, 2000 and Asaolu *et al*., 1997) were they reported that iron occurs in high concentration in Nigerian soils. Results for Lead (Pb) were similar for both potable and surface waters which fell within the maximum permissible limits prescribed for drinking water by World health Organization (WHO) and Nigerian Standard for Drinking Water (NSDW).In conclusion, the potable water samples contain minimal amount of contaminants and dissolved organic matter and was within the acceptable standard for consumption. Thus, the potable water is considered safe for consumption .The surface water contained high level of suspended solids and high salinity both of which could lead to minor to severe health effects in biological communities. Thus the surface waters may not be suitable for domestic, industrial or agricultural uses. It is advisable that the regulatory agencies should ensure that waste waters from the surface and potable waters be properly treated before it is released into the environment to avoid contamination of the rivers and streams that most of the populace particularly in developing world rely on for human sustenance

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