Quality Assesment Of Domestic Water In Ekpoma.

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Abstract: The physico-chemical analysis of domestic water in Ekpoma environment shows that COD values of the sachet water are 1.60, 8.80, 1.60, 2.40, 0.80 Mg/l respectively; BOD values of the two rivers were 14 and 10 mg/l while the COD values were 41 and 38mg/l respectively. For the storage facilities (cemented concrete well, galvanized iron tanks and plastic tanks) the values of the parameters show that the water has good qualities and is fit domestic application. Rain or storm water is collected and store in cemented well, it is the main source of water during the dry season, because the is no pipe borne water in Ekpoma, where this study was carried out, hence the relevance of this research to Ekpoma community and it's environ.
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INTRODUCTION

Water is an important and most common substance on earth. It is essential requirement for plants, human and industrial activities. Water is a neutral compound; a molecule of it contains two atoms of hydrogen and one atom of oxygen it covers more than 70% of the earth surface, it exist on the surface as lakes, streams, rivers, seas, and ground water.

All living things are made up of mainly water example the human body and plants are made up of two third water. Water is the essence of life and safe drinking water is a basic necessity to all, especially for the well being of mankind.

Water contains impurities that are either in dissolved or suspended form. As water flows in streams, accumulate in lake and filter through layers of soil and rock on the ground, it dissolves or absorbs the substances it comes in contact with. Some of these substances are harmful while others are harmless. (Ogamba 2004).Minerals in water may be considered as contaminants at certain level, when they render water unpalatable or unsafe at this level it can be regarded as pollutant and causes water pollution. The sources of water pollution are varied, which involve almost all human activities, the most common of these human activities is the direct dumping of human wastes, sewage, agricultural waste and industrial effluents etc into our waterway (Ademoroti 1996).

The presence of impurities reduces the use to which water may be deployed. Water for drinking must be safe for consumption, and should posses the following qualities: It must be colorless, odorless, tasteless, freezes at 0^{oc} and boil at 100^{oc} it should have a maximum density at $4.^{oc}$ and should be free of suspended solids among other qualities etc.

Water can also be polluted by municipal waste, that is waste generated from human and animal activities, e.g. animal dung, liters, such as peelings from cassava, yam plantain etc, application of fertilizers, deposition of metals.etc.

Disturbance of all soil mantles by ploughing during cultivation, road construction, and stream. Irrigation and canalization can also pollute the water.

As a result of rapid industrialization arising from modern and sophisticated technology, many synthetic materials have been introduced into our environment, some of them may be toxic or carcinogenic etc these have found their way into the water bodies.

The fertilizers used by farmers to improve the quality of plant, contains Nitrogen and phosphorous, those that rear animals, feed them with various grains which contain phytate salt from phytic acid. They are not digested by animals hence are excreted. They cause water pollution when they get to the water body this leads to eutrophication.

Ekpoma is the headquarter of Esan–West local government area of Edo state, it is not an industrialized town, but houses a University, some secondary and primary schools, and health institution, hence there are lots of human activities in the environment.

The sources of portable water in Ekpoma are the Ibiekuma River (popularly known as river Orhionmwon) and the Ogedekpe River.

The Ibiekuma River is dammed and the water is channeled through pipes to the ujemen campus of the Ambrose Alli University, the water is transported from the campus to Ekpoma environment

through water tanks and plastic vessels such as Jerry cans.

The secondary, source of water is the rainwater, which is stored in cemented concrete wells, galvanized iron tanks and plastic water tanks.

The packaging water industries in Ekpoma depend on these sources especially the two rivers.

Since this research is interested in the assessment of the quality of water and its safety for consumption, waters must be analyzed to determine its suitability and acceptability for the intended purpose.

The maps below are the map of Nigeria and the area where Ekpoma town is located.

MATERIALS AND METHODS

Water samples were collected from Ibiekuma and Ogedekpe River, these were labeled as WR_1 and WR_2 respectively.

Sampling was also carried out in some selected cemented concrete wells galvanized iron tanks and plastic Tanks and were labelled as Wc, W_1 and W_p respectively for easy identification.

These samples were stored in plastic containers, which were washed thoroughly and rinsed with water prior to collection.

Packaged water samples (popularly known as pure water) were collected randomly from five selected water processing and packaging company in Ekpoma.

. These were also labeled for easy identification.

Some parameters were determined on site, these are pH and temperature.

ANALYTICAL TECHNIQUES

The physical parameters determine were appearance, temperature, taste, odor, Total solid (dissolved and suspended solid) and color.

The chemical parameter determine were dissolved Oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), Ammonium Nitrogen, alkalinity, nitrate, phosphate etc.

The pH of the water samples was determined by electrometric method using pH meter (Jenway 3150) (Ademoroti 1996).

Dissolved oxygen was determined using Alkaline Azide modification of Winkler's method (Winkler 1888).

Total solid was determined by evaporating 50ml of the water sample to dryness at a temperature of 103^{oc} to 105^{oc} using the electric hot plate, the residue was dried for one hour at 103^{oc} to105^{oc} and stored in a dessicator for total solid analysis.

Total solid is calculated using the formula below.

$$\text{Total solid (mg/l)} = \frac{\text{mg. Total solid}}{\text{ml sample}} \times 1000$$

Biochemical oxygen demand (BOD) was determined by dilution method (Hanson 1973).

This is done by measuring the oxygen level of the water on collection and then, 5days later, after storage in the dark (to stop photosynthetic activity at constant temperature usually 20^{oc}).

The division of the difference between the two values of oxygen demand by the percent dilution is the demand for consumption of oxygen by chemical and biochemical processes.

This is represented by the equation below

$$\text{BOD mg/l} = \frac{(DO_0 - DO_d)}{\text{Percent dilution}}$$

Where DO_o = Dissolved oxygen present in the water sample on the initial day (day zero).

DO_d = Dissolved oxygen present in the dilution of the sample after titration on the final day.

Chemical oxygen demand (COD) was determined using the dichromate reflux method (Dobbs and Williams 1963).

Sulphate ion was measured using the turbidimetric method (sheen etal1935).

Nitrate ion was determined using the phenol disulphonic method (APHA 1995).

Ammonium ion was also determined by the Nesslerrization method (APHA 1950).

Total alkalinity was analyzed by titrimeteric method (Ademoroti 1996).

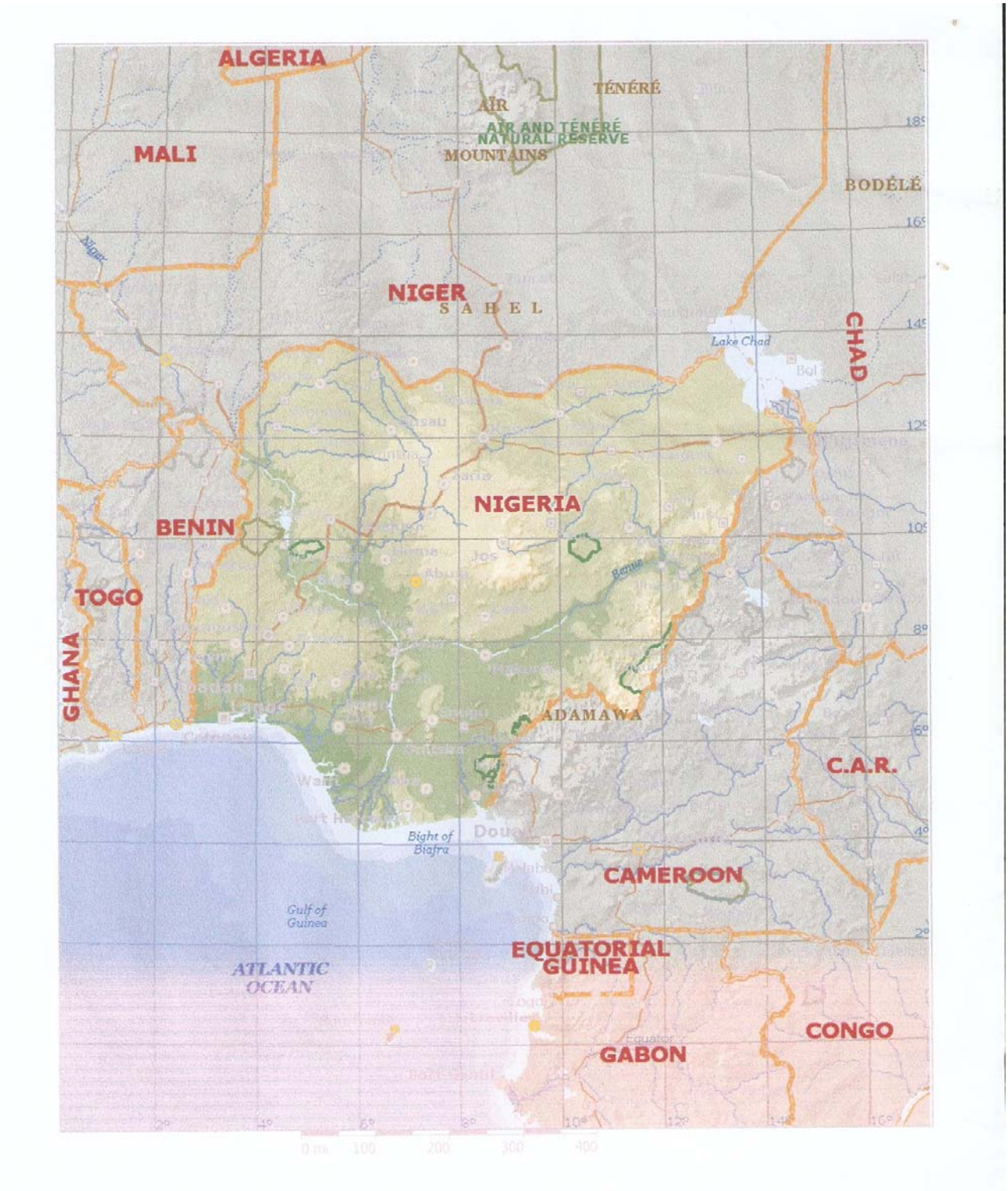

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Fig. 1: Map of Nigeria

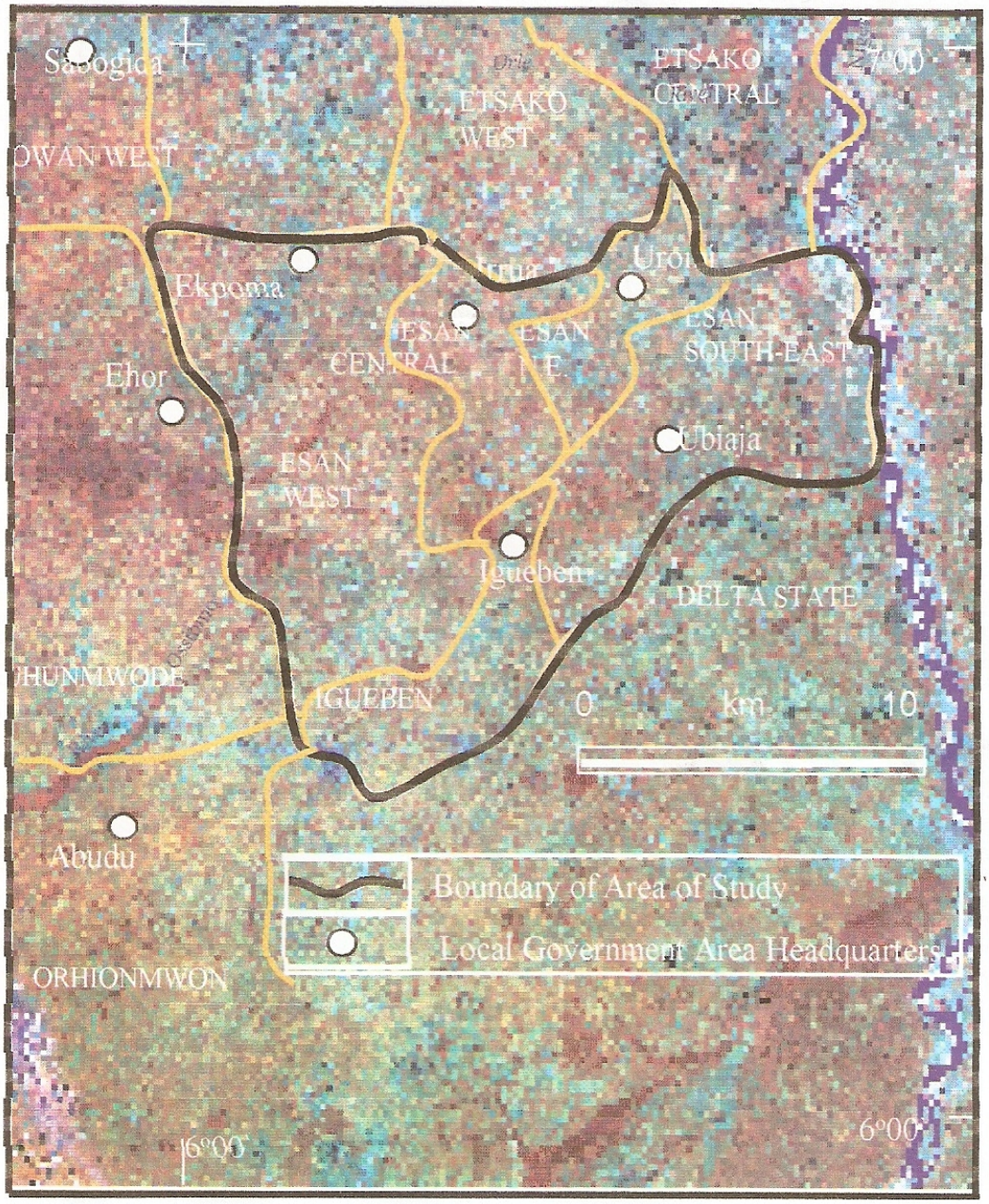

Figure 2.2: Political Map of Area of Study superimposed on Satellite Imagery NigeriaSat-1

RESULTS AND DISCUSSION.

TABLES

TABLE I: PHYSICO-CHEMICAL ANALYSIS RESULT OF WATER SAMPLES FROM CONCRETE CEMENTED WELL, GALVANISED IRON TANKS AND PLASTIC TANKS

Parameters	Concrete cemented well	Galvanized iron tanks	Plastic tanks	Units
Temperature	30.2	30.1	30.2	Oc
pH	7.8	7.7	7.8	-
Alkalinity	12.7	1.8	5.5	Mg/l
Total solids	1.3	2.3	0.8	Mg/l
Total suspended solids	0.2	0.4	0.2	Mg/l
Total dissolved solids	1.1	1.9	0.6	Mg/l
Dissolved Oxygen	6.1	8.3	4.6	Mg/l
BOD	4.0	12.8	2.0	Mg/l
COD	432.0	472.0	432.0	Mg/l
Nitrates	0.009	0.002	0.012	Mg/l
Phosphates	1.69	2.07	2.09	Mg/l
Calcium	7.44	0.33	0.29	Mg/l
Magnesium	3.99	2.11	2.40	Mg/l

TABLE II: PHYSICO-CHEMICAL ANALYSIS RESULT OF SOME PACKAGED WATER SAMPLES (SATCHET WATER)

PARAMETERS	SAMPLES					
	A	B	C	D	E	Units
Temperature	30.2	30.0	30.1	30.2	29.6	Oc
pH	7.8	7.5	7.2	6.6	6.6	-
Alkalinity	6.1	11.2	6.1	6.1	6.6	Mg/l
Total solids	5	3	7	1.0	2.0	Mg/l
Total suspended solids	0.001	0.0011	0.000	0.005	0.001	Mg/l
Total dissolved solids	4.009	2.009	7.000	0.995	1.999	Mg/l
DO	0.10	0.10	0.20	0.10	0.20	Mg/l
BOD	_	_	_	_	_	Mg/l
COD	1.60	8.80	1.60	2.40	0.80	Mg/l
Nitrates	3.85	2.43	1.77	1.79	1.24	Mg/l
Sulphates	0.28	1.46	2.05	2.28	1.08	Mg/l
Chlorides	2.9	1.5	2.7	3.3	3.5	Mg/l
Phosphate	_	_	_	_	_	Mg/l
Calcium	4.62	0.52	1.18	0.17	1.80	Mg/l
Magnesium	0.94	0.37	1.25	0.02	0.00	Mg/l

PHYSICO-CHEMICAL ANALYSIS RESULT OF WATER SAMPLE FROM IBIEKUMA AND OGEDEKPE RIVERS

PARAMATERS	IBIEKUMA	OGEDEKPE	UNIT
Temperature	29.0	30.0	Oc
pH	6.5	6.5	_
Alkalinity	1.5	1.5	Mg/l
Total solids	13.5	1.25	Mg/l
Total suspended solids	1.0	0.4	Mg/l
Total Dissolved Solids	12.5	0.85	Mg/l
DO	19	18	Mg/l

BOD	14	10	Mg/l
COD	41	38	Mg/l
Phosphate	2.01	1.52	Mg/l
Ammonium-Nitrogen	0.915	0.007	Mg/l
Nitrate-Nitrogen	0.008	0.006	Mg/l
Calcium	0.81	0.33	Mg/l
Magnesium	5.02	3.08	Mg/l

The results of the characterization of the water samples from cemented concrete wells, galvanized iron tanks and plastic tanks are presented in table 1.

Table II and III show the values of the characterization of packaged water samples (Satchet water) and water samples from the rivers.

The pH values of samples from all the sources were almost the same, it ranges from 6 to 8.5. This is one of the most important water quality parameter since it measures the acidity or alkalinity of solutions.

Optimal pH range is necessary to ensure clarification, Disinfecting and minimize corrosion of pipes, pH values outside the limit can result in the contamination of water. The acceptable pH range of drinking water is within 6.5 to 8.5.

pH value of water sample from the cemented concrete well was high, though not above the acceptable value of 8.0. This is as a result of the presence of calcium carbonate, and calcium hydrogen carbonate.

Most fishes in the two rivers can survive well because of the tolerable pH values of 6.5, since most fishes can tolerate pH value of about 6.0 to 9.0; hence the two rivers have water of little contamination.

The temperature values for the entire water sample were almost the same; the values range from 29.8oc to 30.2oc, at this temperature range, water is safe for consumption, since the temperature of water is affected by variable such as the color of water, the depth of water, the amount of shade received from shoreline vegetation, latitude of water, volume of water, temperature of effluents dumped into the water.

The values of the temperature of the water sample from the two rivers are 30.1oc and 30.2oc respectively. This means most fishes can strive well in this river and there is less pollution since increase in temperature leads to decrease in dissolved oxygen. Fishes use more oxygen at higher temperature due to increase in their metabolic activities, since they are cold-blooded animals.

The values of the total solid suspension of the water samples from the cemented concrete well, galvanized iron tanks and plastic tanks are 0.2, 0.4 and 0.2 mgll respectively .the low value shows that water is fit for consumption since a general indication of water quality is the amount of suspended solid content.

The total solid suspension of the Ibiekuma River is 1mg/l, though this is a little higher than the values of solid suspension from other water sources but it is still at the permissible value. The reason for this high value is as result of the leaves and other solid particles that fell or in contact with the river through its course.

Total dissolved solid for all water samples are within the permissible range.

Package water samples contain high values of dissolved solid though not high enough to render it polluted, since the values are within the allowed range for purity. The high value is a result of dissolution of substance into the water samples as they flows through their filteration media which are the filtration sand bed, macrospores filtering system.

However water with high dissolved solid greater than 500ppm often have laxative effect upon people whose bodies are not adjusted to them. Dissolved solid can be removes from water by coagulation.

Alkalinity level of water samples from the cemented concrete well is 12.7mg/l while the values are 1.8, 5.5mg/l for the galvanized iron tanks and plastic tanks respectively.

The values were the same for sample A, C and D of the packaged water sample the value is 6.1mg/l, but 13.2 and 10.2 mgll for sample B and E respectively.

The alkalinity level of water sample from the concrete cemented well is as a result of the presence of the bicarbonate and a hydroxide component. Since the well is cemented, it contains calcium carbonate (CaC03) and calcium hydrogen carbonate (CaHCO3). This is not an indication that the water is polluted; alkalinity is a total measure of the substances in water that have acid neutralizing ability.

Alkalinity is important for fishes and aquatic life because it buffers against pH changes and make water less vulnerable to acid rain.

The alkalinity values for the water sample in all the sources can sustain aquatic life.

From the analysis, the dissolved oxygen values of the water sample from the three storage tanks are 6.1, 8.3 and 4.6mg/l. The value show that the water is not

polluted, a high dissolved oxygen level in community water supply is good because it makes drinking water taste better. The dissolved oxygen level of water from both rivers shows that the water is of high purity and fit for consumption, though the water may not be fit for industrial purpose, since high level of dissolved oxygen in water results to corrosion in water pipes. The values of dissolved oxygen of all the packaged water samples are also at the tolerable values.

Biochemical oxygen demand (BOD) values, of the three storage facilities (i.e. the concrete cemented well, galvanized iron tanks and plastic tanks), shows low values of 4.0, 12.8 and 2.0mgll respectively, it is observed that the BOD value of the galvanized iron tanks is quite high; which means there is little demand of the dissolved oxygen by organism in the water.

BOD values of the packaged water sample are nil it means there are absence of organic compounds, an indication of the purity of water for consumption.

The two rivers have BOD values of 10 and 12mg/l respectively, this is not a surprise because the water body contains high amount of organic and inorganic materials that are responsible for the high consumption of the dissolved oxygen, however the values are within the permissible value of potable water, but there is need for purification of the water from both rivers before it is finally consume.

The Nitrate levels of water sample from concrete cemented well, galvanized iron tanks and plastic tanks are 0.009, 0.003, and 0.12mg/l respectively; this is not much of a problem because the level is less than 10mg/l.

If the Nitrate value is higher than necessary, the water will not be fit for consumption, since nitrate ions in water can lead to methalmoglobalmia in infant. However the water from the source is fit for consumption.

Nitrate occurs naturally in surface waters which can get into the streams from soil and from decay organic material such as leaves etc.

It is present in the inorganic form as Nitrate (N03). Nitride (N02), ammonia and ammonium (NH3 and NH4), excess nitrate can also results to algae bloom in large water bodies and also proliferation of aquatic weeds often termed macrophytes.

The nitrate values of water samples from both rivers is at its permissible values, the value are low they are 0.013mg/l and 0.123mg/l respectively.

The water from these rivers can be consumed domestically, since the nitrate values are low, it cannot cause mathaemothoglobaemia, algae bloom and proliferation of aquatic weeds.

The phosphate values of water sample from concrete cemented well, galvanized iron tanks and plastic tanks are 1.69. 2.07 and 2.09mg/l respectively, the phosphate value is nil for the packaged water samples, while both rivers have phosphate values of 1.52 and 2.02mg/l respectively.

Phosphate is the chemical compounds containing the element phosphorous, which is necessary for plant and animal growth.

A fertilizer, compound that is used to improve the productivity of plant contains phosphate. Most domestic animals feed on grains, these contains phatic acid that cannot be digested by these ruminant animals, hence it is excreted into the surrounding, during rainfall, varying amount of phosphate are wash from the farmland and our environment into the nearby water ways.

This stimulates the growth of plankton, and water plants that provide food for fish, however high amount of phosphate in our water may lead to eutrophication and there will be increase in demand of the dissolved oxygen thereby polluting the water.

Phosphate does not have harmful effect on human and animals unless they are present in high concentration even then, they will probably do little more than interfere with digestion.

The COD values of water samples from the three storage tanks are 432.0, 472.0 and 432.0 mg/l respectively. This is an indication that the water contains some chemical that are oxidized by the dissolved oxygen in water.

For the two rivers, the COD values are within the permissible values, the values are 41 and 38 mg/l, and marine organism can strive well in these rivers, its also an indication that the water from these rivers is fit for consumption.

For packaged water samples, the values are quite low, however water must contain some chemicals such as the hydrogen trioxocarbonate, the trioxocarbonate, of some metals such as calcium, magnesium etc. these undergo oxidation using the dissolved oxygen in water.

CONCLUSION

From the study carried out, it is clear that the water sample from the two rivers, that is the Ibiekuma and Ogedekpe river are fit for consumption that, does not eliminate treatment, before consumption. Fishes and organism can also strive well in these rivers.

The packaged water samples are fit for consumption from our study. The three storage facilities (i.e. concrete cemented well, galvanized iron tanks and plastic tanks) are recommended for the storage of water, since the values of the parameters studied indicate that the water is fit for consumption.

It is however recommended that the storage reservoir or well should be properly covered to avoid its contact with solid particles.

REFERENCES

1. Ademoroti C.M.A (1996). Environmental chemistry and Toxicology. Foludex press Ibadan pp.38- 45, 95-100.
2. Ademoroti C.M.A (1996). Standard methods for water and effluent analysis. Foludex press Ibadan pp. 159-161, 102-104.
3. America public health association (1995). Standard method for the examination of water and water environment federation 19th edition, Washington D.C pp1-5.
4. APHA, AWWA, WPCE (1985). Standard method the examination of water and waste water16th Edition pp286-287.
5. Ayoade J.O (1987), Tropical hydrology and water resources, Macmillan Education LIB. London pp5-6, 8.
6. Borne R.A (1987), the chemistry of our environment, J. Willy and sons Inc, New York pp320-330.
7. Daniel B. Betkin, Edward A.Keller (1997), Environmental science, Earth as a living planet 2nd Edition j.willy and sons inc .New York pp 392,426.
8. Dobbs R.A, Williams R.I (1963). Elimination of chloride interference in the chemical oxygen demand test, Analytical chemistry pp35, and 1064.
9. Hanson, N.W (1973), official standardized and recommended method of analysis, the society for analytical chemistry, London.
10. Linsley R.R, Franzini Y.B (1979); water resources and environmental engineering. I Willey and sons inc. New York pp 400-405.
11. Mombeshora C, Ajayi s.o osibonjo o. (1981) pollution studies on Nigerian rivers; Toxic heavy metal status of surface water in Ibadan city. Environmental inter.pp5, 49-53.
12. Osibonjo (1992). Present water quality status in Nigeria Federal environment protection agency (FEPA), Nigeria pp35-41.
13. Sheen R.T, kanler H.L, Ross E.M (1935).
14. Turbidimetrc determination of sulphate in water, Ind. Engng, chem. anal .Ed 7:262.
15. Winkler L.W (1988); the determination of dissolved oxygen in water.Ber.Otsch.chem Ges21.2843-2854.

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