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Effects of Industrial Waste on Water Consumption in Ile-Oluji Local Government Area, Ondo State, Nigeria.

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Abstract

This paper focused on the causes, effects and the solutions to the problem of industrial waste in Ile –Oluji local Government area of Ondo State, Nigeria. The water samples were collected from five (5) different locations and analysed. Olorungbohunmi street (dumpsite) water sample had the highest colour value (2.3) and below the NIS standard for drinking water. The pH was low in Cocoa Industry (tap water) (5.6) and high in Ejamikemo (6.5). Conductivity was low in Olorungbohumi ($2.45x10^2$) and high in Ayeyemi Street ($4.13x10^2$). Gboluji cassava industry has the lowest total hardness (72.0) and high in Ayeyemi Street with the value of 134. The water quality parameter varies significantly in each sample. From the analysis, water from the dumpsite (Olorungbohunmi well) is not suitable for human consumption due to seepages from domestic wastes, cassava effluent from the industry and wastewater from cocoa industry in the area into well. The water from other locations should be chlorinated due to corrosion and contamination.

Keywords: Industrial waste, water samples, NIS, water quality, consumption

1.0 Introduction

Water pollution is one of the major problems in life which can affect man, animal and plant. When water is polluted or contaminated, the recipient will definitely suffer the consequences. Human and industrial activities can result in the pollution of the aquatic environment (water) thereby threatening people's life and damaging the quality of the environment by rendering water bodies unsuitable (Imoukhuede and Afuye, 2016). Water pollution is a major problem in the global context (*Yang et* al., 2004). According to Medina (2002), the major models of disposal of solid waste in the United States are land filling or dumping and incineration. Dumpsites emit bad odours and smoke that cause illness to people living in around or closer to them. More than 14,000 people die daily due to dumpsite emission (World bank, 1990).

Adamu and Balabe (2014) reported that surface water pollution could be a threat to human, animal

and ecosystem at larg. Water pollution or contamination also places other resources at risk, fisheries and land resources for example, has already been affected significantly. The UNCH (Habitat) (1998) identified urban problems throughout the less developed countries to include environmental degradation, inadequate shelter, infrastructure, water supply, poverty and un-employment. Therefore, water is a necessity and one of the basic requirements for people's welfare in any urban settings.

Long retention time and natural filtering capacity of aquifers makes groundwater to be often unpolluted, however leachates from dump sites are now observed to be potential source of contamination of both ground water and surface water (Odukoya *et al*., 2002). Wrench (1990) further stated that in some sites, volatile organic chemical has been detected in odoured air of homes nearby dumpsites. Some organic material, such as food, wood products, remnants of plant decay are now formed in the environment as carbon dioxide, water or ammonia. It was observed that plastics which are sources of organic synthetic polymer are resistant to biodegradation thereby causing significant economic and environmental problems when everywhere even the landfills sites are littered with plastics.

Poor water quality is still a significant problem which is of major concern in many parts of the world. Poor water quality can reduce the use of some major resources and extreme cases can have adverse effect on human, animal and plant (Forum and Entwicklung, 2001). Salam Abdul (2010) reported that Switzerland is planning to address the issue of solid waste disposal because there has been a great concern about the environment in which man lives. Solid waste, mount of rubbish, garbage and sewage are being produced everyday by our society (Ololade *et al*. 2009). Waste water from different industries originates from liquors gotten from grains and yeast recovery and also has the characteristic odour of fermented malt which is slightly acidic, (Kanu *et al*., 2006).

Brewery effluents, high in carbohydrate; nitrogen and the cleaning and washing reagents, have been proved as water pollutants (Kanu *et al*. 2011). According to Ekhaise and Ayansi (2005), high bacteria counts were discovered in Ikpoba River in Benin City, Nigeria receiving a brewery industrial effluent. Similar results were reported on the effect of brewery discharged into Eziama River, Aba, Nigeria (Kanu *et al*., 2006). Brewery effluents therefore are found to be one of the sources of water pollution.

The aims and objectives of this research are to analyse the physicochemical parameters of water samples in Ile-Oluji local government area of Ondo State and to know the effects of industrial waste on water consumption in the study area.

2.0 Methods and Procedures

2.1 The Study Area.

Ile-Oluji is the headquarters of Ile-Oluji /Oke-Igbo Local government area of Ondo State, Nigeria. It lies between longitude 6°40' N and 7°14' N, and latitudes 4°38' E and 4°53' E. It has an area of 698 km² and a population of 172,870 as at 2006 census. It is bounded in the south by Otasun hills, Okurughu and Awo rivers, south west by Oke-Igbo; North East by Oni rivers and Ikeji hills in the East, partly by river Owena and partly by Ondo town; and in the West by the tributary of the Oni River. Her immediate neighbours are Ondo, Oke-igbo, Idanre (Ondo State) and Ipetu- Ijesha (Osun State). Ile-Oluji has a variety of land forms which can be classified into three broad physical units; the plains, the undulating highlands, and river valleys. The highlands however dominate the landscape. The township is surrounded by many granite rocks such as Ota-Ororo, Ota-Akoko, Ota-Didu, Ota-Upote and Iguruguru

Figure 1: Map of Ondo state

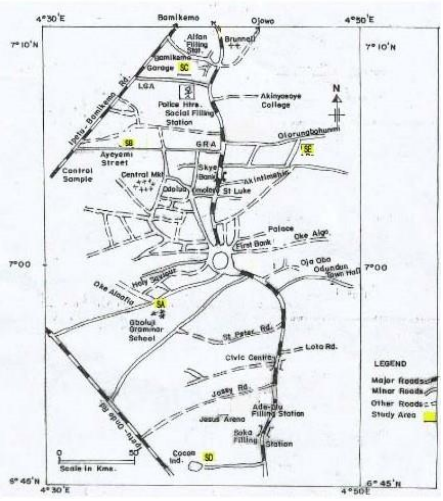

Figure 2: Map of Ile- Oluji Local Government

Keys
Sample A: Gboluji
Sample B: Ayeyemi Street
Sample C: Ejamikemo garage
Sample D: Cocoa Industry
Sample E: Olorungbohumi Street

2.2 Methods

The water samples were collected from different locations in Ile-Oluji during the raining season. The samples were collected at the cassava, grating and processing industry where peeling, grating and pressing of cassava product is carried out, other areas are dump sites around the local government area and the cocoa industry all located in the town. The water samples for laboratory analysis, were collected using sterilized plastic bottles of 5 litres and labelled accordingly before taken to the laboratory for analysis.

The analysis of physicochemical parameters on water samples such as the pH, Total Solids, Electrical Conductivity, Total Dissolved Solid, Turbidity, Sulphate, Nitrate, Nitrite, and Heavy metals were carried out in the laboratory.

3.0 Results and Discussion

The results of the physico-chemical analysis of water samples from Ile-Oluji are shown on table 1 above. The water samples from the five (5) different locations were analysed and the result shows the values for the colours, the NIS standard for drinking water is 3TCU and all the five locations have their colours to be less than the NIS standard. A good water must be colourless, whenever water is observed to be coloured, it may be caused by the presence of minerals such as iron and manganese or by substances like algae and weeds. Olorungbohumi (sample 5) has the highest colour value of 2.31 which may be due to erosion or dirt from industry, cocoa industry has the least, with the value 0.92. This shows that the water from all the location are below NIS standard for drinking water. The odour and taste of water as it applies to water quality, are associated with the presence of living microscopic organisms or decaying organic matter that include industrial wastes in the area. The taste of water always makes the water unpalatable, unsuitable for drinking and generates irritating odour. The taste and odour are unobjectionable in all the samples that were analysed. This shows that the colour, odour and taste are relatively good.

Table 1:Physico-Chemical Analysis Of Water Sample (NIS STANDARD)

TEST	Gboluji sample 1 well	Ayeyemi street sample 2 tap water	Ejamikemo garage sample 3 stream	Cocoa industry sample 4 tap water	Olorungbohunmi sample 5 dump site well water	NIS 977:2017
Colour	1.27	1.97	1.06	0.92	2.31	3 TCU
Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
Taste	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
Turbidity	2.46	2.54	1.68	1.42	3.15	5 NTU
Conductivity(umhos/cm)	2.86 x 10^2	4.13 x10^2	2.93 x 10^2	3.26 x 10^2	2.45 x 10^2	1.0 x 10^3
Chemical Parameters						
Volume (cl)	4000⊣ 5					
pH	5.7	6.4	6.5	5.6	5.6	6.5 – 8.5
Chloride (mg/L)	52.5	82.3	63.8	73.7	45.3	100
Fluoride (mg/L)	NIL	NIL	NIL	NIL	NIL	1.0
Hardness (mg/L)	72.0	134.0	80.0	94.0	90.0	100
Sulphate (mg/L)	21.2	34.7	41.3	17.9	58.6	100
Nitrate (mg/L)	3.1	3.4	2.6	3.7	6.2	10
Nitrite (mg/L)	0.02	0.07	NIL	0.03	0.14	0.1
Manganese (mg/L)	ND	ND	ND	ND	ND	0.1
Total suspended solids(mg/L)	246.1	301.4	258.3	272.1	282.3	500
Total dissolved solids(mg/L)	183.4	264.3	187.5	208.6	156.8	500
Calcium (mg/L)	58.3	109.2	63.4	71.8	68.7	75
Magnesium (mg/L)	1.6	2.7	1.8	2.2	2.1	2
Copper (mg/L)	NIL	0.01	0.01	0.03	0.06	1.0
Zinc (mg/L)	0.13	0.34	0.17	0.26	0.32	0.5
Iron (mg/L)	0.24	0.38	0.09	0.13	0.51	0.3
Toxic Chemicals						
Lead (mg/L)	ND	ND	ND	ND	ND	0.01

Cyanide (mg/L)	NIL	NIL	NIL	NIL	NIL	0.01
Cadmium (mg/L)	ND	ND	ND	ND	ND	0.003
Microbiological Analysis						
Total plate count(cfu/m)	0.39 $X10^2$	1.27 X 10^2	0.41 X 10^2	0.63 X 10^2	2.39 X 10^2	100
Clostridium perfringes	NIL	NIL	NIL	NIL	NIL	NIL
Chormobacterium violaceum	NIL	NIL	NIL	NIL	NIL	NIL
E. coli	NIL	NIL	NIL	NIL	NIL	NIL
Faecal streptococci	NIL	NIL	NIL	NIL	NIL	NIL
Klebsiella aerogenes	NIL	NIL	NIL	NIL	NIL	NIL
S. aeurus	NIL	NIL	NIL	NIL	NIL	NIL

Turbidity normally occurs in water due to the presence of suspended solids and colloidal matter. It may also occur due to eroded soil caused by dredging or due to the growth of microorganisms. Cocoa industry (tap water) has the least turbidity value with the least value, Olorungbohunmi has the highest value in turbidity which ranges between (1.42 and 3.15), and the NIS standard for drinking water is 5NTU and the values are all below the standard. Conductivity (EC) of the water increases as the concentration of ions in the water sample increases. High conductivity can cause water borne diseases because contaminants like bacteria and viruses in the water can be attached to suspended solids. Conductivity was highest in value in (sample 2) Ayeyemi Street (well water) and the conductivity was low in (sample 5) Olorungbohunmi (well water) which ranges between (2.45 $x10^2$ and 4.13 x 10^2). The NIS standard for conductivity is 1.0 X 10^3. The conductivity values are higher than the NIS standard for drinking water which rendered the water unsuitable.

pH is a measure of the hydrogen ion concentration, indicating the acidity or alkalinity of water. A low pH value helps in effective chlorination but there can be problems with corrosion. Drinking water should have a pH of between 6.5 and 8.5 according to the NIS standard. From the table (1) the pH value was low in cocoa industry (tap water), Ejamikemo garage has the highest pH value from the range of (5.6 to 6.5) from the NIS result the pH value is given as (6.5-8.5) which means the samples were more acidic. Chloride (CL^-) was low in Olorungbohunmi (well water) while Ayeyemi has the highest in chloride value in the sample which ranges between (45.3 and 82.3) this means that it is within the permissible limit since the concentration of chloride is less than the NIS standard. Gboluji (well water) cassava industry has the least value in total hardness (TH), Ayeyemi street (tap water) has the highest total hardness which ranges between (72.0 and 134.0). The hardness of water is very high in Ayeyemi and can be reduced by boiling or addition of slake lime so that it can be suitable for domestic purposes. Sulphate values for all the samples are less than the permissible limit for drinking water which is 100mg/l. The nitrate values are below the NIS standard, the nitrite values are below too, except for Olorungbohunmi well which is 0.14 but still within the limit which is 0.1. Low nitrite and nitrate values indicates that sewage intrusion into the well or water.

Total suspended solids and total dissolved solids are less than the permissible limit. Ayeyemi tap water has the calcium value of 109.2mg/L which means it is greater than the NIS limit for drinking

water since it is a tap water it is good for the repair of teeth and also good for the pipes. The magnesium value for Ayeyemi, cocoa industry (well) and Oluwagbohunmi (well) are more than the NIS standard for drinking water which is 2.0mg/l thereby making the water unsuitable for consumption. The values for copper and zinc are within the permissible limit. Ayeyemi has the value 0.38 while Olorungbohunmi has 0.51 which is greater than the permissible limit, the other samples are within the limit which is 0.31. Total plate count at Gboluji, Ejamikemo and cocoa industry are less than the NIS limit (100) but Ayeyemi (127) and Olorungbohunmi (239) are more, making the water unsuitable for consumption. The samples with high counts indicate that the water has to be chlorinated to lower the count. The other microbiological analysis was not detected in any of the samples. The water quality parameters vary significantly in each of the samples.

4.0 Conclusion

This research work based on the analysis of water parameters using the various analytical techniques, shows that water quality varies significantly in each sample. It is concluded that the water from the dumpsite (Olorungbohunmi well) is not suitable for human consumption due to domestic wastes, cassava effluent from the industry and wastewater from cocoa industry in the area. The water from other locations too should be chlorinated due to corrosion and contamination from suspended and dissolved solids.

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