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Effects of Waste - Dumping Site on Water Quality of Ado-Ekiti Metropolis, Southwestern Nigeria

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Abstract - **Right from World creation, there is no way man as one of the living organisms can live without water – bathing, cooking, drinking etc. Thus, drinking water is one of the necessities for all living organisms and one of its basic requirements is cleanliness. Dumping of waste causes environmental pollution by deteriorating the water quality and ultimately affects the health of local inhabitants – This is very rampant in developing countries in which Nigeria as a country is no exception. This study was carried out in Ado-Ekiti Metropolis of Nigeria with intention of analyzing and assessing the effects of dumped waste site on (ground) water qualities. Some water samples were taken from the selected waste dumping site and some laboratory tests were conducted on them. The results showed the presence of leachates and E – coli bacteria in both surface and subsurface water. Conclusively, the waste-dumping site has great negative effects on the water quality of Ado – ekiti. It shows that the water is not fit for consumption and may not be suitable for some Civil Engineering works unless undergo rigorous treatment. There is also need for quick intervention by government and individuals to avert outbreak of epidemic diseases.**

Keywords **– Environmental Pollution, Developing Countries, Waste Dumping Site, Leachates.**

I. INTRODUCTION

Waste is defined as any garbage, refuse, sludge from waste treatment plant, water supply treatment plant, or air pollution control facility and other materials, including solid, semisolid, contained gaseous resulting from industrials, commercials, mining and agricultural operations from community activities. Characteristics of Waste include corrosiveness, ignitability, reactive, toxicity etc. Waste can also be classified into hazard, non – hazard, radioactive and mixed. The wastes leading to environmental pollution are classified according to their composition into gaseous wastes, liquid wastes and solid wastes and usually result from our daily activities [1], [4], [10].

The sources of Water supply in nature include ground and surface water – lakes, ponds, rivers, streams, springs and rain. Absolutely, pure water is unavailable in nature. The impurities in water vary from dissolved gases and chemical compound to suspended matter such as disease organisms and dirt. In general, these impurities acquired through contact with environment exist in solution, colloid and suspension. Depending on method of detection, water impurities can be characterized as biological, physical and chemical while the pathogenic presence describes biological characteristics of such water [1], [4].

In the modern hydro-geologic literature, Pollution is regarded as the occurrence of contaminants in such a high dosage or concentration as to render the contaminants very hazardous or highly delirious to biota. While contamination may occur in lesser magnitude when compared to pollution, it may render the contaminated medium useless or become slightly hazardous to life. Environmental pollution is classified into three - atmospheric, water and land pollutions. Increase in waste and pollution are as a result of population growth, increase in industrial manufacturing, urbanization and modernization [1], [4].

The problem of solid waste management in Nigeria has a complex issue as a result of high population growth accelerated urbanization and industrialization. It is estimated that each Nigerian generates about 0.85kg of waste per day totally about 119 million tons municipal and industrial waste per annum. There is problem of how to manage these wastes in reaching critical proportion in the recent past. The present democratic government has gone extra mile to invest in the services of waste management companies especially in urban areas, which have led to quantum improvement in the level of urban cleanliness but unfortunately waste dumps keep on emerging and proliferating at different parts of the urban landscape [3].

Reference [3] identified a total of 150 authorized and illegal dumpsites in the urban and sub urban areas of the south- west geopolitical zones of Nigeria. Their results showed that most of these dumpsites were usually haphazardly located without careful consideration of environmental and public health. These sites are usually open, subjected to burning, poorly managed, unsightly and are located at undeveloped plots, farm land, residential areas and river banks, and constituting breeding ground to disease, vectors and pathogens with leachate seeping ceaselessly into the soil [7], [8], [9].

This is essentially unhygienic and hazardous because most of these surface waste bodies still serve as sources of waste supplies to many urban and rural communities down – stream. It is expected that there will be certain level of quality for their sustainable use by these population [1], [3], [4].

The past related works of [1], [3], [7], [8], [9], [10] etc looked into how waste dumping sites affect the ground and surface water quality (ies) especially in developing countries where problems related to waste disposal and managements are very common and serious.

This study intends to assess and analyze the effect of waste dumping site on water quality (surface and ground) in Ado-Ekiti metropolis and to investigate whether the closeness of a waste dumpsite will significantly affects its water quality and the surrounding soil all through the year.

The results of this study will provide dependable Engineering information on the properties and quality (ies) of water available in Ado-Ekiti Metropolis of Southwestern part of Nigeria.

II. Materials and Methods

Water samples were collected randomly from the upstream and downstream of the streams and wells in Ajilosun study area of Ado-Ekiti Metropolis during the day before sun set using sterilized plastic containers of two litres capacity. The stoppers of the collection containers were carefully removed and dipped into the river by holding it through the base. At about 0.3m depth, their mouths were directed to the direction of flow (current) and when enough water had entered, they were brought out and stoppers replaced, while the temperature were determined immediately.

The sampling containers were properly labelled using different identification marks. The containers were properly rinsed with distilled water before used, immediately covered and on-site examinations were carried out. The samples were then brought to Water/Public Health Laboratory, Civil Engineering Department, The Federal Polytechnic, Ado-Ekiti for laboratory tests.

All tests were conducted in accordance with [2] standard methods. All the necessary properties were established putting into consideration all relevant factors. The tests carried out on each of the selected samples are physical, chemical and bacteriological tests. The physical tests carried out are on appearance, colour, hardness, odour, temperature, turbidity and dissolved solids. The chemical tests carried out are on Potentials of Hydrogen (PH), contents of calcium, chloride, iron and magnesium, total alkalinity, nitrates, dissolved oxygen and phosphate levels. While the bacteriological tests carried out are on the excremental pollution and bacteria density of the water samples of the study area - Plate count (Agar) and Colony counter tests. The results were then compared with the World Health Organisation [5] water quality standard values.

III. Results and Discussion

Table 1: Summary of Physical test results on the water samples (Location: Ajilosun area of Ado – Ekiti Metropolis)

S/NO.	TESTS	SOURCE			WHO WATER QUALITY STANDARD VALUES (SOURCE : WHO, 2011)
		UPSTREAM	DOWNSTREAM	WELL	PERMISSIBLE / TOLERABLE LIMIT
1	Appearance	Cloudy	Turbid	Clear	Unobjectionable
2	Temperature (^{O}C)	22	22	24	Cool temperature values
3	Colour (TCU)	20	25	5	< 15.0
4	Turbidity (NTU)	45.4	30.5	12.8	< 1.0
5	Total Dissolved Solids (mg/l)	54.2	64.7	99.2	< 600
6	Total Hardness (mg/l)	200	180	60	500 - 1000
7	Odour	Deep odour	Deep odour	Odourless	Unobjectionable

Results of the tests of selected water samples are presented in Tables 1 to 3. From Table 1, it is observed that the Temperature values of the water samples varied between 22^{O}C and 24^{O}C. While both samples from the stream have temperature of 22^{O}C, that of the well sample is 24^{O}C. This is due to the presence of faecal organisms and the dumping of the waste from factories, nearby houses (domestic wastes) and the nearby commercial waste. In appearance, the water samples from the stream are not clear while the one from well is clear. The Colour values range between 5 - 25 TCU. Only the well water was within the permissible limits when compared with WHO standard values, the upstream and downstream water of the stream were not (i.e. 20 and 25 TCU). This shows that only the well water is fit for consumption. Variation in impurity level at different location is considered to be the reason for the variations in the colour values of the water samples. However, finer particles may not be visible to the naked eye but their finest forms impart colour to the water (Colloids usually remain in a suspension even when the water is virtually at rest).

All the samples have turbidity values higher than the tolerable or permissible WHO limits, which is between 12.8 – 45.4 NTU. There is also variation in turbidity values due to the level of impurity (i.e. Upstream water sample has 45.4 NTU; Downstream water sample has 30.5 NTU; while the Well water sample has 12.8 NTU). The turbidity values reduce as the stream water flows and the well turbidity value is the lowest. This might be due to reduction in impurities and soil filtration of the water as it flows. Total Dissolved Solid values varied between 54.2 – 99.2mg/l. Though it is within the WHO limits, it is observed that the total dissolved solids increase in value with the length of river course with the well water having the highest total dissolved solid and the upstream water having the lowest. The stream water picks up substances, which are soluble gases, which renders the water unfit for consumption.

The values of hardness obtained from the analysis of the water samples ranges from 60mg/l to 200mg/l. The lowest value of the hardness is from the well water sample and the highest value from the upstream water sample. Though these values of hardness are within recommended WHO

limits, the result shows that the well water is the softest of all the water. The upstream water has deep odour. The effluents from the nearest abattoir and decaying waste deposits at the bank of the river is suspected to be the factors responsible for the type of odour experienced at the location. This odour gets a little bit worse at the downstream because of its high level of pollution. Though none of the stream water samples is pleasant, that of well water is odourless and pleasant which is acceptable in accordance with WHO standards.

Table 2: Summary of Chemical test results on the water samples

S/NO.	TESTS	SOURCE			WHO WATER QUALITY STANDARD VALUES (SOURCE : WHO, 2011)
		UPSTREAM	DOWNSTREAM	WELL	PERMISSIBLE / TOLERABLE LIMIT
1	pH	5.5	6	5.5	6.5-8.5
2	Calcium (mg/l)	18.44	13.63	16.83	100 - 300
3	Magnesium (mg/l)	46	43	42	50 - 80
4	Iron (mg/l)	3.0	2.0	2.0	< 0.30
5	B.O.D	6.5	6	Nill	0.01-1.0
6	Nitrogen (mg/l)	0.5	0.2	0.2	50
7	Alkalinity (mg/l)	80	120	200	600
8	Chloride (mg/l)	184.34	233.97	1453.5	200 - 300
9	Dissolved Oxygen (ppm)	0.45	0.42	0.43	Very high level not accepted
10	Phosphate (mg/l)	20	40	20	50

From Table 2, it is observed that the pH values gotten from the tested water samples ranges from 5.5 to 6, which is below the WHO permissible limit. This shows that these waters are acidic in nature, though the acid is weak. The Calcium and Magnesium contents range from 13.63mg/l to 18.44mg/l and 42mg/l to 46mg/l, which are lower than the WHO limits. Though there is variation in their concentrations in all the water samples, it poses no hazard to them. The level of iron concentration obtained from the water samples ranges from 2.0mg/l to 3.0mg/l, which is higher than the WHO allowable limit. This implies that the water is not fit / palatable for consumption.

Chloride ions concentration in the water samples ranges between 184.34mg/l and 1453.5mg/l. Any concentration higher than the tolerable or permissible limit according to W.H.O standard causes taste, corrosion and renders the water non-palatable or unfit for consumption. The stream water samples have values that are lower than WHO limits (upstream water sample value is 184.34mg/l and downstream water sample value is 233.97mg/l). Thus, make them fit for consumption. However, the well water sample value of 1453.5mg/l is higher than the WHO limits. Thus, falls into the earlier mentioned category.

Phosphate concentration in the water samples ranges between 20mg/l and 40mg/l. The high concentration is because of regular dumping of hazardous wastes at the water banks. The dissolved oxygen content varies from 0.42ppm to 0.45 ppm, which is acceptable.

Table 3: Summary of Bacteriological test results on the water samples

LOCATION	SOURCE	COLIFORM (C.F.U × 10^{5})	E - COLI	Colonies	PLATE COUNT REMARKS	W.H.O BACTERIOLOGICAL STANDARD VALUES (SOURCE : WHO, 2011)
AJILOSUN AREA	UPSTREAM	10	Positive	14	Unsatisfactory	1. No Sample should contain E-Coli in 100ml 2. No sample should contain more than 10 Coliform organism per 100ml 3. Coliform organisms should not be detected in100ml in any consecutive samples
	DOWNSTREAM	14	Positive	23	Unsatisfactory	
	WELL	16	Positive	39	Unsatisfactory	

NOTE
E - COLI shows a sewage indicator of pollution and feacal organism originated from feaces of intensive parasite of man.

From Table 3, it is observed that all the bacteriological tests results showed that all the water samples are positive to E. coli and unsatisfactory. Thus, it is evident that the pollution or contamination of the sampled water is very high.

IV. Conclusion and Recommendation

This study shows that the presence of leachate in both surface and sub-surface water (well) proved that waste - dumping site has great negative effects on the water quality in Ado – Ekiti metropolis and any part of the World. The presence of some chemical elements /compounds and E-coli bacterial in the water samples (against the WHO standard limits) show that there are

faecal organisms and leachates in the water, and thereby rendering the water unfit for consumption and in extension unsuitable to certain extent for Civil Engineering works.

Therefore, it is advisable that this type of water should undergo rigorous treatment before use i.e. it has to undergo various stages of water treatment processes (physical, chemical and biological) for it to conform to the WHO standard. There is need for people enlightenment on waste effluent management and disposal in order to avoid or minimise water pollution, which may be detrimental to living organisms' health. Basic infrastructural amenities, strict laws and enforcement should be put in place by the government and in extension, house owners. This will aids in prevention of defecation on the waste dumping site near the water source hence, outbreak of epidemic diseases.

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