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MARSLAND PRESS
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"Assessment Of Leachate Pollution On Surface Water Quality In Abeokuta South Local Government Area"

[1]Adekitan Adetoun, [2]Oyewumi Johnson, [1]Dada Victoria, and [1]Sonde Gabriel

[1]Department of Water Resources Management and Agrometeorology, Federal University of Agriculture, Abeokuta P.O box 2240, Zip code: 110124 Abeokuta Ogun State, Nigeria.
[2]Department of Animal and Environmental Biology, Federal University, Oye Ekiti, Ekiti State, Nigeria
* Corresponding Author: adekitanaa@funaab.edu.ng, abimbolaadetoun@yahoo.com.
Other Authors: vickyng099@gmail.com, johnson.oyewumi@fuoye.edu.ng, gabrieladekunle100@gmail.com

Abstract: Leachate flow from municipal dumpsites into surface water sources, and can be detrimental to the urban population who use these water for various purposes. In Abeokuta South Local Government Area, the streams and rivers that drain through the town are the main sources of potable water for most residents. Surface water samples were collected from, Ilugun, Ogbaademola and Arakonga and from nearby stream located at the upstream, midstream and downstream of the three locations. Two samples of leachate were collected at the dumpsites close to each of the streams, making a total number of fifteen (15) samples collected in all locations. Result showed that the value of pH (8.76, 8.75, 8.42), Phosphate (0.88, 0.76, 0.76), Lead (3.31, 2.80, 2.80), Nickel (4.21, 3.58, 3.58) and BOD (12.30, 13.84, 13.84) were higher than the WHO, 2017 guideline for drinking water. From this study, the water quality were affected by the dumping of waste, by urinating and defecating into the stream. Result also showed that, the highest pollution occurred at Ilugun, because Ilugun is located in an area where the residents does not have access to good sanitary facilities such as toilets, and they do not dispose off their waste improperly. Therefore, water obtained from all the three locations are polluted and cannot be consumed.

[Adekitan Adetoun, Oyewumi Johnson, Dada Victoria, and Sonde Gabriel.**"Assessment Of Leachate Pollution On Surface Water Quality In Abeokuta South Local Government Area".** *N Y Sci J*2021;14(12):1-7]ISSN1554-0200(print);ISSN2375-723X(online)http://www.sciencepub.net/newyork.6.doi:10.7537/marsnys141121.06.

Keywords: Surface water, leachate, dumpsites, water quality, streams

1. Introduction

Solid waste management is a serious problem in Nigeria that need to be addressed immediately and it needs to be resolved, as most cities lack good standard engineered landfills, open landfills are the primary means of municipal solid waste disposal in many countries worldwide including Nigeria because they offer low economic costs and have capacity to accumulate large amounts of solid waste compared to other methods such as incineration, with this actions, dumping of refuse anywhere should be tackled in Nigeria "Mohanjeri, 2010", "Tsarpal, 2012" .

A number of activities have been reported in the past where leachates have been implicated in the contamination of surrounding soil and groundwater aquifer or nearby surface water, while several studies by "Longe, 2007", "Longe, 2010", "Olowogbere 2013" have shown that leachates outflow and percolation are source of ground and surface water pollution adjacent to or close to the landfill sites. It is therefore expedient that a comprehensive study need to be carried out on the assessment of pollution levels from these dumpsites, taking into account related parameters. So as to reduce the negative effect on human beings and animals.

The attitude and behaviour of a society towards the environment is a good indicator of its awareness and a level of development towards dumping of refuse anywhere. Scattered, abnormal dumping of landfills represent one of the largest pollutants of surface water, soil and atmosphere. Land filling is the easiest, simplest, cheapest and most cost effective method of disposing off waste in developed and developing nations of the world "Barret, 2013". Landfilling also remains one of the most commonly used methods for solid waste management in most parts of the world, so that people will not be dumping refuse anywhere. Several advances in landfill technology have been used and applied to improve its suitability for solid waste management "Edokpayi, 2018".

In Africa solid waste disposal is given priority over water quality according to the World Health Organization, which means that in Africa they take it to be important "Zerbock, 2003". In urban Africa explosive population growth rates is seen to translate into generation of noxious toxic chemicals "UNEP, 2010". Regardless of this kind of situation in Africa there is lack of infrastructural endowments to face challenges associated with huge amounts of solid waste and this is a terrible situation "Ogwueleka, 2012" and as a result, heaps of solid wastes are common in the urban centers. Selection of open dumping is based on geographical rather than geological and hydrogeological considerations, which will have effect on surface water quality "Widmann, 2006".

2. Materials and Methods

2.1 The Study Area

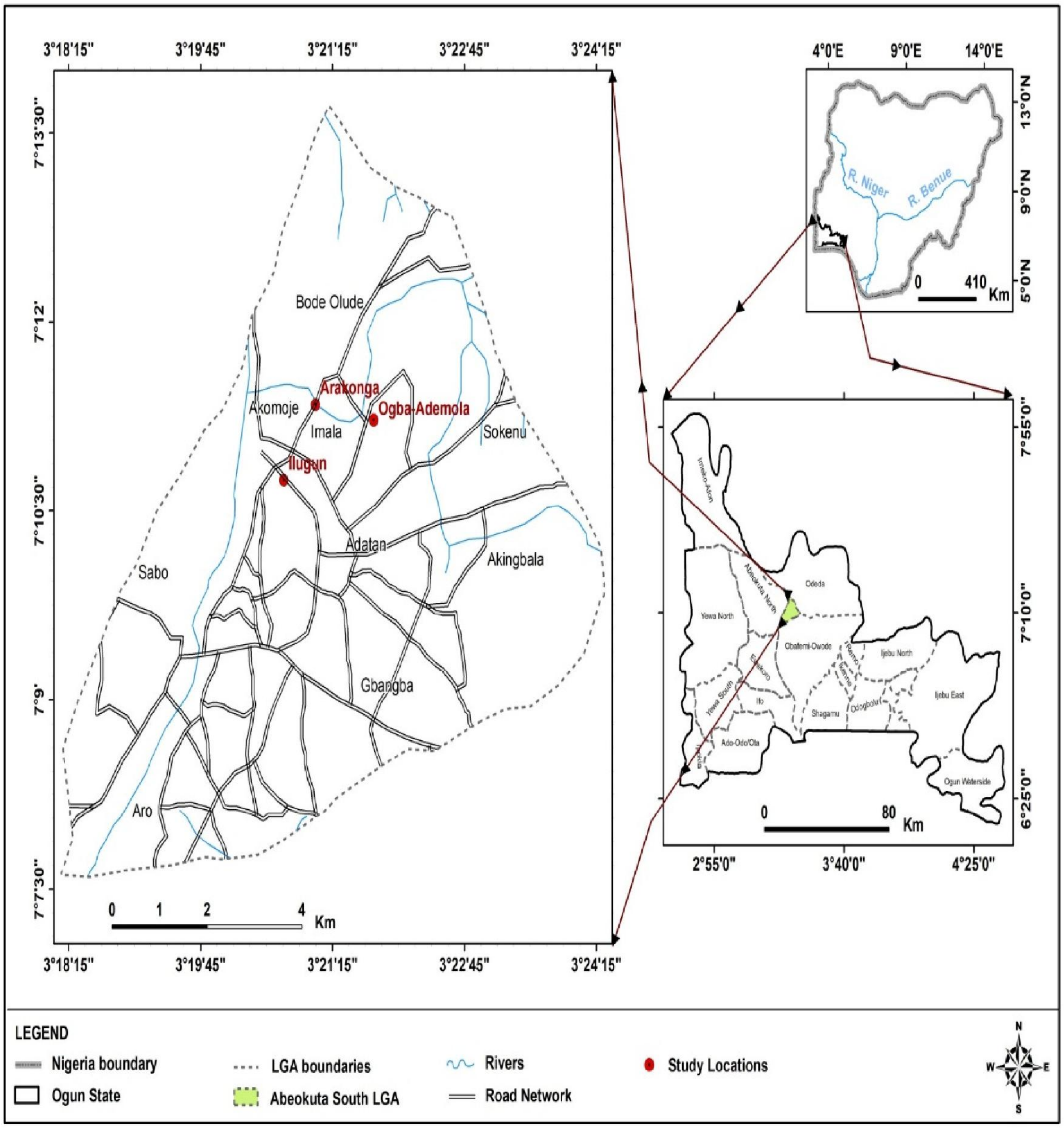
The study area is located in Abeokuta South Local Government Area, Ogun State, Nigeria. The headquarters of LGA is located in Ake with Latitude 7.09N 3.21E. It has an area of 71km square and a population of 250,278 at the 2006 census.

2.2 Climate

Ogun State, where Abeokuta South is located is one of the coldest regions in Nigeria with an average daily high temperature of only 31^{0}c. High humidity and high temperatures makes the weather pleasant at times, but also and partly tropically hot and humid. It is warm to hot all year round and invites to bathe at average water temperatures of 27^{0}c. Due to the lesser rain the best time for travelling is from November to March. Most precipitation decrease from June to October "Stellar, 2005".

2.3 Geology and Hydrology

The geology of the Abeokuta South Local Government comprises mainly of basement complex and sedimentary rocks, which underlie the remaining area. The sedimentary rocks of the study area Abeokuta South Local Government are then in turn overlain by the coastal plain sands "Ayoade, 2012".



"Figure 1: Map of Abeokuta South Local Government showing the sampling points".

2.4 Results and Discussion

Result of the physical, chemical and bacteriological parameters obtained from Ilugun, Arakonga and Ogbaademola and the nearby streams.

2.4.1 pH

From Table 1**,** the result of pH of surface water samples from the three locations ranged from 8.76, 8.75 and 8.42. The mean value fell within the WHO guideline for drinking water. This findings is in conformity with the findings of "Tiny, 2014" which states that pH is within the WHO guideline indicating the presence of foreign bodies such as active micro-organisms.

2.4.2 Electrical Conductivity

The results obtained for Electrical conductivity ranged from 82.0, 110.0 and 140.0, and fell within the WHO guideline for drinking water. This could be due to the presence of inorganic dissolved solids like nitrate, phosphate, magnesium and iron. This findings conforms to the findings of "Muhammed, 2010".

2.4.3 Total Dissolved Solids

Total Dissolved solids are found to be within the range of WHO standard due to the presence of salt in the surface water. The mean values obtained in all locations include; 78.00, 120.0 and 140.0. The findings is conformity with the findings of " Sekly, 2017" which says that TDS are also within the range of WHO guideline because there are little mineralized solids from the dumping site that percolated in stream water.

2.4.4 Temperature

From Table 2, THE mean values of temperature in the three locations showed that, temperature fell within the WHO guideline for drinking water. The mean values for all the locations ranged from 29.32, 29.14 and 29.14 respectively.

2.4.5 Phosphate

Table 1, shows the Phosphate value in all locations. The result obtained showed that, it's values were higher than the WHO guideline for drinking water, this could be due to bank erosion occurring during floods which can transport a lot of phosphorous from the stream banks into the stream. The mean values for the three locations ranged from 0.88, 0.76 and 0.76. This findings is conformity with the findings of "Fluty, 2014" which states that phosphate is higher than WHO guideline because more rains and runoff resulted in the increase of phosphorous nutrient in the stream.

2.4.6 Iron

From table 2, the value of Arakanga and Ogbaademola showed that, the value obtained for iron is higher than the WHO guideline at Ilugun, while it fell below the WHO guideline at Illugun This could be due to some soils and rock Minnesota containing minerals very high in iron, which increases as rain falls on the land surface and water seeps through the soil and rock. Iron can be dissolved into the water and runoff will also transport it into the stream. The mean values for all locations are; 0.34, 0.17 and 0.17. This findings is conformity with the findings of "Staly, 2013" which states that: The presence of Iron when in excess can flows through sulfide-rich soils and is characterized by high average total iron.

2.4.7 Ammonia

.The mean values for ammonia in all locations also ranged from; 0.004, 0.005, and 0.005 and fell within the WHO guideline for drinking water.

2.4.8 Cadmium

The mean values of cadmium also fell within the WHO guideline for drinking water, and their values ranged from 0.00, 0.01 and 0.01. This findings is conformity with the findings of" Praistly, 2011" which says that there is little contamination from municipal waste, cadmium contamination from sources such as cadmium containing batteries and plastics, or cadmium-plated steel and electronic wastes is low.

2.4.9 Nitrate

Table 3 showed that, all samples obtained from the 3 locations fell below the WHO guideline for drinking water and their mean values ranged from; 0.18, 0.21, and 0.21. This findings is conformity with the findings of "Flenk, 2011" which says nitrate is below the WHO standard because there is low discharge from sewage systems and animals wastes.

2.4.10 Biological Oxygen Demand

Biological Oxygen Demand fell within the WHO guideline. The mean values of the locations ranged from; 12.30, 13.84 and 13.84. This findings is conformity with the findings of "Frex, 2015" which says BOD is within the WHO standard because less oxygen is being removed from water due to bad activities going on the stream.

2.4.11 Lead

Lead was observed to be higher than the WHO guideline in the surface water samples in all locations, because metal and steels are dumped on the stream and on the dumpsites too. The mean values for all locations are; 3.31, 2.80 and 2.80. This findings is conformity with the findings of "Hanly, 2012"which says lead is above the WHO standard because ingested of lead contaminated dust, water and food have occurred in the surface water.

2.4.12 Magnesium

The result obtained for magnesium from the three locations fell below the WHO guideline for drinking water, due to the effect of runoffs that leached into the into stream. Their mean values ranged from; 13.51, 5.23, and 5.23. This findings is conformity with the findings of " Tony, 2010"which says magnesium is below the WHO standard because there is little amount of magnesium salts in the stream water due to low runoffs.

2.4.13 Nickel

Nickel values in all locations showed that, all the values were higher than the WHO guideline for drinking water, this could be due to leaching from metals. The mean values for this locations ranged from: 4.21, 3.58 and 3.58. This findings is conformity with the findings of "Bonsey, 2009" which says nickel is above the WHO standard because direct leaching from rocks and sediments produces high concentration of nickel in water.

"Table 1: Result of the Physical, Chemical and Bacteriological parameters for all the locations"

PARAMETERS	ILUGUN Mean	Standard Deviation	ARAKONGA Mean	Std. Deviation	OGBAADEMOLA Mean	Standard Deviation	WHO Standard
pH	8.76	0.12	8.75	0.11	8.42	0.01	6.5-8.5
EC	49.18	0.08	49.20	0.15	49.20	0.15	1250
TDS	20.00	0.00	20.00	0.00	20.00	0.00	30
Temperature	29.32	0.10	29.14	0.05	29.14	0.05	35-40
Phosphate	0.88	0.09	0.76	1.12	0.76	1.12	0.05
BOD	12.30	12.58	13.84	13.71	13.84	13.71	<5.0mg/l
Ammonia	0.004	0.001	0.005	0.009	0.005	0.009	1.5
Magnesium	13.51	4.23	5.23	3.63	5.23	3.63	150
Nitrate	0.18	0.04	0.21	0.39	0.21	0.39	50mg/l
Iron	0.34	0.04	0.17	0.11	0.17	0.11	0.3
Lead	3.31	1.71	2.80	1.18	2.80	1.18	0.015
Cadmium	0.00	0.00	0.01	0.01	0.01	0.01	0.3µg/l
Nickel	4.21	4.56	3.58	2.92	3.58	2.92	0.02

BOD- Biological Oxygen Demand
EC- Electrical Conductivity
TDS- Total Dissolved Solids

"Table 2: Result of the Physical, Chemical and Bacteriological parameters obtain at Ilugun"

Parameters	Minimum	Maximum	Mean	Standard Deviation	WHO Standard
pH	8.61	8.89	8.76	0.12	6.5-8.5
EC	49.10	49.30	49.18	0.08	1250
TDS	20.00	20.00	20.00	0.00	30
Temperature	29.20	29.40	29.32	0.10	35-40
Phosphate	0.77	0.97	088	0.09	0.05
BOD	2.80	28.00	12.30	12.58	<5.0mg/l
Ammonia	0.003	0.006	0.004	0.001	1.5
Magnesium	8.41	17.95	13.51	4.23	150
Nitrate	0.13	0.25	0.18	0.04	50mg/l
Iron	0.30	0.41	0.34	0.047	0.3
Lead	1.98	5.44	3.31	1.71	0.015
Cadmium	0.00	0.00	0.00	0.00	0.3µg/l
Nickel	0.23	11.70	4.56	0.02	0.02

BOD- Biological Oxygen Demand
TDS- Total Dissolved Solids
EC- Electrical Conductivity

"Table 3: Result of the Physical, Chemical and Bacteriological parameters obtain at Arakonga"

Parameters	Min	Max	Mean	Std. Deviation	WHO Standard
pH	8.63	8.88	8.75	0.11	6.5-8.5
EC	49.00	49.40	49.20	0.15	1250
TDS	20.00	20.00	20.00	0.00	500
Temperature	29.10	29.20	29.14	0.05	500
Phosphate	0.03	2.76	0.76	1.12	0.05
BOD	3.20	31.00	13.84	13.71	<5.0mg/l
Ammonia	0.0002	0.02	0.005	0.009	1.5
Magnesium	2.51	10.32	5.23	3.63	150
Nitrate	0.008	0.93	0.21	0.39	50mg/l
Iron	0.08	0.35	0.17	0.11	0.3
Lead	1.74	4.24	2.80	1.18	0.015
Cadmium	0.00	0.03	0.01	0.01	3µg/l
Nickel	0.06	7.12	3.58	2.92	0.02

BOD- Biological Oxygen Demand
TDS- Total Dissolved Solids
EC- Electrical Conductivity

"Table 4: Result of the parameters obtain at Ogbaademola"

Parameters	Minimum	Maximum	Mean	Standard Deviation	WHO Standard
pH	8.4	8.45	8.42	0.01	6.5-8.5
EC	49.50	51.30	50.08	0.71	1250
TDS	20.00	20.00	20.00	0.00	500
Temperature	29.30	29.60	29.44	0.13	35-40
Phosphate	0.29	3.38	1.28	1.40	0.05
BOD	2.70	30.20	13.04	13.82	<5.0mg/l
Ammonia	0.0008	0.02	0.006	0.01	1.5
Magnesium	2.51	10.32	5.23	3.63	150
Nitrate	0.03	0.98	0.27	0.40	50mg/l
Iron	0..19	0.65	0.35	0.21	0.3
Lead	1.74	4.24	2.80	1.18	0.015
Cadmium	0.00	0.00	0.00	0.00	0.3µg/l
Nickel	0.06	7.12	3.58	2.92	0.02

BOD- Biological Oxygen Demand
TDS- Total Dissolved Solids
EC- Electrical Conductivity

2.5 Conclusion

From this study, result showed that the pH values for Ilugun and Arakonga were higher than the World Health Organization guidelines for drinking water, while the pH in Ogbaademola fell within the " WHO,2017" guidelines for drinking water.

The result obtained for Temperature, Electrical Conductivity, Total Dissolved Solids, Magnesium and Cadmium, also fell within the WHO guideline for drinking water.

In all the sampling locations, Lead was detected to be higher than the WHO guidelines for drinking water. This could be due to the presence of refuse that is continually dumped on the stream. The effect of lead in human can result to rise in blood pressure, kidney damage and brain damage.

Biological Oxygen Demand (BOD) was also detected to be higher than the WHO guideline for drinking water in all locations due to the presence of some microorganisms in the stream waters.

The value obtained for Iron was also higher than the WHO guideline at Ilugun, and fell below the WHO guideline in Arakonga and Ogbaademola respectively. Thus, the water quality were affected by lack of sanitary facilities around the study sites.

Result also showed that the highest pollution occurred at Ilugun, because Ilugun is a place where most people living there has no sanitary facilities at home and dump their refuses improperly into the stream channels,

Also there are lots of biological changes that occurred on the stream due to the dumping of decayed materials and rotten food waste.

Therefore, water flowing from the streams can neither be used for cooking or for human consumption due to the level of its toxicity of the water samples to human health.

Acknowledgements

The authors appreciate the contributions of the staff of the Department of Water Resources and Agrometeorology, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria for their contributions to this research.

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