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ASSESSMENT OF GROUNDWATER QUALITY AROUND A DUMPING SITE IN IBADAN

Oladiran, G.F*, Raheem, S.B*, Adeniran, A.A*, Olasoji, S.O**

*Department of Civil Engineering, The Polytechnic, Ibadan, Oyo State, Nigeria.

Email: olafolafolaga@gmail.com

** Department of Architecture, The Polytechnic, Ibadan, Oyo State, Nigeria.

Email: olufemiolasoji1961@gmail.com

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Abstract:

Groundwater plays a vital role as an important source of potable water in both rural and urban areas of Nigeria. It remains the largest available source of fresh water, thus it forms a very important part of the water supply chain. There is a growing demand for groundwater in virtually all parts of Nigeria.

This research was aimed at assessing the quality of groundwater at Akorede area, opposite The Polytechnic, Ibadan, South Campus. The work was carried out on four wells around the dumping site in the area. Both physic-chemical and bacteriological parameters of the groundwater were examined thoroughly which include, pH, turbidity, colour, TDS, total hardness, lead, zinc, iron, magnesium, DO, BOD, COD, total coliform count. Most parameters conformed to WHO stated guidelines for drinking water while some deviated.

The study concluded that the wells around the study dumping site are not acceptable according to the bacteriological guidelines for drinking water provided by the World Health Organization (WHO). It was recommended that the community should relocate the dumping site to the area provided by the government because continuous dumping of refuse to the area in question will later through leachate affect the groundwater. Also periodic water test of the wells are necessary.

Keywords — Water quality, Groundwater, Leachate, Dumping site, Akorede

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I. INTRODUCTION

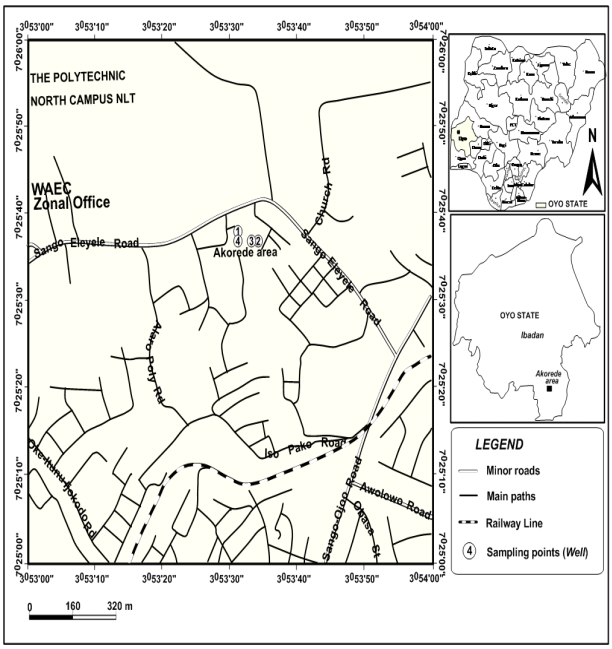
Groundwater plays a vital role as an important source of potable water in both rural and urban areas of Nigeria. According to Forster et al (1998) urbanization affects the quality and quantity of underlying sub-surface water by radically changing the pattern and rate of recharge, initiating new abstraction regimes and adversely affecting the quality. It remains the largest available source of fresh water, thus it forms a very important part of the water supply chain. There is a growing demand for groundwater in virtually all parts of Nigeria. This is due to rapid growth in population and increasing industrial activities. Naturally, surface water is highly susceptible to contamination, but groundwater is less susceptible. However, once groundwater is polluted, remediation is usually very difficult and expensive to undertake. African cities have a long history of water supply from surface and groundwater sources. However, due to deteriorating quality and quantity of surface water through increased urbanization and industrialization and high cost of developing new dams urban groundwater is viewed as a better option (Adelana et al, 2008). In recent times, the impact of leachate on groundwater and other water resources has attracted a lot of attention because of its

overwhelming environmental significance. During rainfall, the dumped solid wastes receive water and the by-products of its decomposition move into the water through the waste deposition. Groundwater is an important water resource in both the urban and rural areas of Nigeria but in the cities, pipe-borne water is also available. Rural dwellers rely basically on hand-dug wells for potable water supply as the streams usually dry up in dry season. These resources are under threat from pollution either from human life style manifested by the low level of hygiene practiced in the developing nations. Environmental health involves all the factors, circumstances and conditions in the environment or surroundings of humans that can influence health and well-being. The neglect of rural areas in most developing countries in terms of basic infrastructures such as pipe-borne water and sanitation facilities, expose the villagers to a variety of health related problems such as water-borne diseases. Ibadan, the Oyo State capital, like several other emerging cities in Nigeria, is faced with the problem of inadequacy of quality/ potable water supply from the public water works. This is invariably owing to the inability of the water supply capacity and infrastructure to keep pace with population growth and industrial demand. Consequently, an increasing number of households and industries are constrained to make alternative and private arrangements to meet their water supply needs.

Access to safe drinking water is essential to health, it is a basic human right therefore, an adequate and safe supply of water is essential for development. The world health organization 2002 estimate showed that more people die each year from the consequences of unsafe or inadequate water quality and water supplies than from all forms of violence WHO. Groundwater has become an indispensable source of drinking water worldwide and especially in developing countries like Nigeria.

STUDY AREA

The study area, Akorede Street, is found in Oyo state, southwest Nigeria, situated on longitude 7.5°N and latitude 3.25°N . The major climatic seasons are wet, rainy season, which begins in March or April, and ends in October and the dry season, which begins in November and ends in March or April.



Source: Researcher's Google map

II. MATERIAL AND METHODS

Four wells located around the dumping site were taken as underground water sources. Well point A with lat 7° 25' 38" N, 3° 53' 31" E, Well B, 7° 25' 37" N, 3° 53' 34" E, well C, 7° 25' 37" N, 3° 53' 33" E, well D, 7° 25' 37" N, 3° 53' 31" E. Water samples were sourced from the hand-dug wells, whose depths varied from 4 to 12 m. Water quality parameters analysed in accordance to W.H.O standard were pH, temperature, conductivity, total solids (TS), total suspended solids (TSS), total dissolved solids (TDS), turbidity, nitrate (NO_3^-), sulphate (SO_4^{2-}), phosphate (PO_4^{3-}), copper (Cu), lead (Pb), cadmium (Cd), dissolved oxygen (DO), chemical oxygen demand (COD), biochemical

oxygen demand (BOD), faecal coliform (FC) and total coliform (TC) count

IV. RESULTS AND DISCUSSION

TABLE I

The Result of Physico-chemical Analysis of Hand dug wells in Akorede Area.

PARAMETERS	W1	W2	W3	W4	WHO
PHYSICAL					
Temperature	**26.5**	**25**	**26.4**	**25.5**	**-**
Colour (HU)	**1.2**	**0.5**	**1.2**	**1.2**	**5**
Turbidity (NTU)	**1.5**	**1.3**	**1.8**	**1.5**	**10**
T S (mg/L)	**1250**	**1337**	**1147**	**1427**	**500-1500**
T D S (mg/L)	**388**	**282**	**333**	**458**	**500**
T S S (mg/L)	**862**	**1055**	**813**	**968**	**-**
Conductivity (µS/m)	**511**	**424**	**450**	**533**	**400**
Odour (Qual.	**-**	**-**	**-**	**-**	**-**
CHEMICAL					
pH	**6.6**	**6.3**	**6.9**	**4.8**	**6.5-8.5**
D O (mg/L)	**3.6**	**3.7**	**3.6**	**3.1**	**-**
Acidity (mg/L)	**0.3**	**0.6**	**0.4**	**0.8**	**-**
Alkalinity (mg/L)	**0.4**	**0.2**	**0.3**	**0.3**	**-**
Total Hardness (mg/L)	**65.5**	**72.6**	**68.3**	**78.5**	**-**
BOD (mg/L)	**1.8**	**1.6**	**1.2**	**1.5**	**-**
COD (mg/L)	**4.0**	**3.6**	**2.3**	**2.7**	**-**
Ca^{++} (mg/L)	**65**	**67**	**62**	**72**	**75-200**
K^{+} (mg/L)	**23**	**30**	**22**	**27**	**-**
Pb^{++} (mg/L)	**0.01**	**0.02**	**0.02**	**0.03**	**0.01**
Fe^{++} (mg/L)	**0.2**	**0.36**	**0.3**	**0.23**	**0.3**
Zn^{++} (mg/L)	**0.23**	**0.2**	**0.3**	**0.36**	**5**
Mg^{++} (mg/L)	**25**	**28**	**18**	**27**	**-**
Mn^{++} (mg/L)	**0.023**	**0.013**	**0.02**	**0.26**	**0.4**
PO_4^{---} (mg/L)	**0.4**	**0.3**	**0.2**	**0.3**	**-**
NO_3^{-} (mg/L)	**0.23**	**0.23**	**0.13**	**0.3**	**25-50**
Cl^{-} (mg/L)	**15.6**	**9.5**	**10.5**	**17.6**	**250**

TABLE 2

The Result of Microbiological Analysis of Hand dug wells in Akorede Area.

MICROBIOLOGICAL	W1	W2	W3	W4	WHO
Total Viable Count (CFUs/ml)	2.9 x 10^3	3.2 x 10^2	1.1 x 10^3	1.8 x 10^2	-
Organisms Isolated	*B spp; P ssp*	*B spp; P ssp*	*B spp; P ssp*	*B spp; P ssp*	-
Total Coliform Count (CFUs/ml)	5.2 x 10	Nil	5.2 x 10	Nil	10
Organisms Isolated	A sp	-	A sp	-	-
Total E coli Count (CFUs/ml)	1.0 x 10	Nil	1.0 x 10	-	0

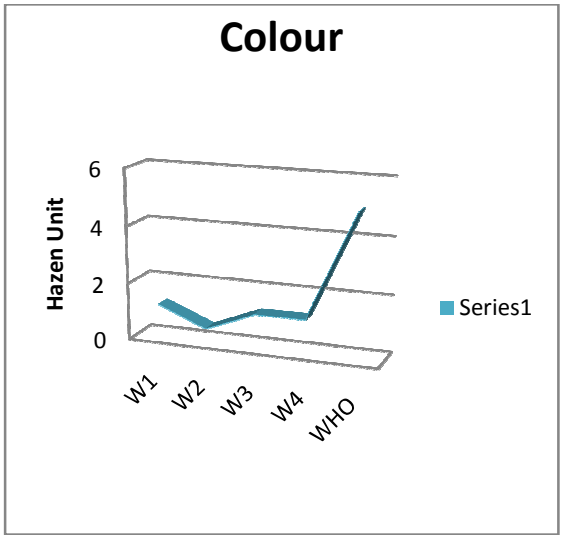


Fig. 1 The colour of the water samples

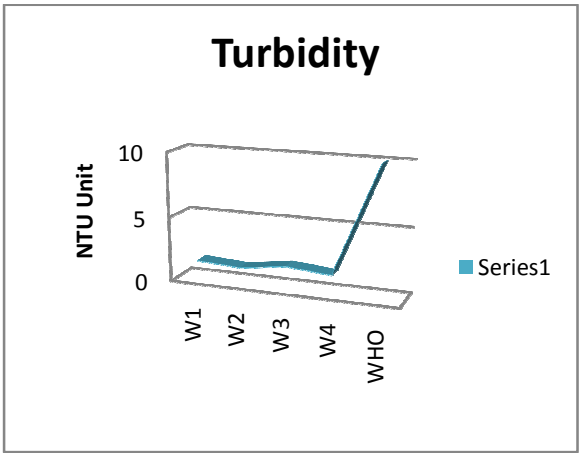


Fig. 2 The turbidity of the water samples

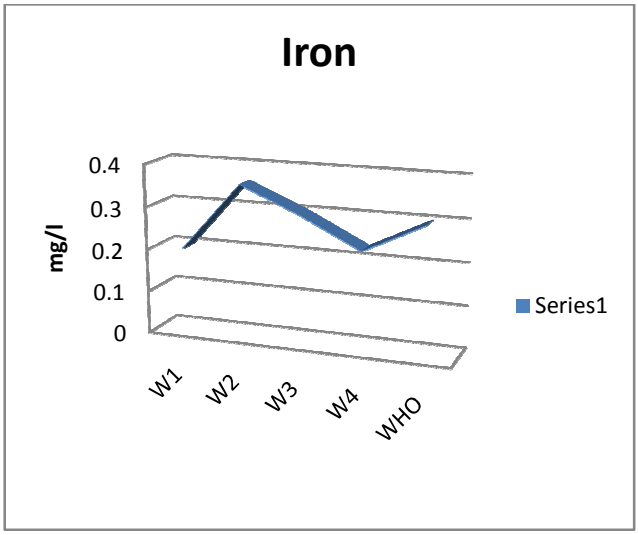


Fig. 3 The Iron of the water samples

Fig 1 and 2 show part of the physical parameters subjected to water analysis during the study. The colour revealed that the four samples are within the WHO guide for drinking water. They range between 0.5-1.2HU while the guide speculate 5HU. Turbidity lies between 1.5-1.8NTU, WHO says 10HTU. In Fig, 3, Iron present in the watter rose above the limit of 0.3 mg/l in W2, has 0.36 mg/l, while others were within the limit.. In the aspect of bacteriological, The presence of *E, Coli in wate s*hows that there is traces of faecal in the water and hence the water is unsafe for drinking. WHO says 0/100ml of sample. Wells W1 and W3 are totally not potable.

Plate 1: TDS meter reading

Plate 2: EC meter reading

III. CONCLUSIONS

The study revealed that the concentration of waste materials in the dumpsite had systematically polluted the soil and groundwater. The extent of the effect of such pollution as determined from the study showed that the contamination of the groundwater was more dependent on proximity to dump sites, topography, type, state of waste disposal systems and to some extent, the hydrogeology of the area. Table 2, provided the clue that wells, W1 and W3 had traces of the presence of E. Coli, which is the presence of feacal in the water samples. This implies that the wells were not safe for human consumption. They are not potable. Ikem et al (2002) evaluated groundwater quality characteristics near two waste sites in Ibadan and Lagos found the concentrations of nitrate, ammonia, chemical Oxygen Demand, aluminium, cadmium, chromium iron lead nickel and total coliform to exceed WHO prescribed limit for drinking. Persistence raining of refuse to the area will affect the remaining wells. The hand dug wells in Akorede Street, Sango, Ibadan were not found to be acceptable according to the biological guidelines for drinking water provided by the World Health Organization (WHO). The quality of groundwater supplied by the wells had been contaminated through leachate and had made the groundwater unsafe for drinking in the area.

Governmental policies on waste disposal and management should be enacted and strictly enforced, citing of dumpsites far away from residential areas to minimize pollution of nearby well. waste sorting and treatment before disposal are encouraged. Re-designing of sanitary landfill with plastic liners to prevent leachate from getting in contact with the water table, is also suggested. There is the need for continuous monitoring of Nigerian urban groundwater to determine its quality status. This will serve as a guide to the public and water managers on action plans to be taken. All land use activities capable of polluting water sources both surface and underground should be properly regulated to safe guide their quality. Hand dug well should have protective covers and sanitary environment kept free of stagnant waters and animal/human defecation. Industrial effluents to be properly treated before they are discharged to the environment or the water body. Wastes generated should be promptly removed and disposed of.
Groundwater exploitation systems such as boreholes and hand dug wells should only be sited after proper sanitary inspection and approved recommendation. water analysis should be done periodically in the area..

REFERENCES

1. Adelana, S.M.A., T. A. Abiye., D.C.W. Nkhuwa., C. Tindinugaya., and M.S. Oga. 2008. Urban groundwater management and protection in Sub-Saharan Africa in: Adelana, S. M. A and MacDonald, A.M Applied groundwater studies in Africa, International Association of Hydrogeologists, selected papers, pp.222-259.
2. Forster, D., A.R. Lawrence., and B.B.Morris.1998. Groundwater in urban development. World Bank Technical Paper No.390, Washington D.C, 121.
3. Ikem, A., O. Osibanjo. M.K.C.Sridhar., and A.Sobande.2002. Evaluation of groundwater quality characteristics near two wastes sites in Ibadan and Lagos, Nigeria. Journal of Water, Air and Soil pollution, Vol.140, No.1-4, pp.307-333.
4. WHO, Guidelines for Drinking Water Quality. 3rd Edn.Vol. 1 Recommendation, Geneva, 2004, 515.

