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Quality of groundwater from five different locations in Badagry Local Government Area of Lagos State, Nigeria

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Abstract: This study was carried out to investigate the quality of groundwater from five different locations in Badagry Local Government Area of Lagos State, Nigeria. Fifty borehole water samples were collected and analyzed to ensure safe and continuous consumption by residents in the communities. The investigated physico-chemical parameters include: p H, alkalinity, total hardness, and anions (nitrate, sulphate and chloride). The presence of metals such as Cu, Cr, Cd and Pb, were also determined, using Flame Atomic Absorption Spectrophotometer (AAS).

The highest mean concentrations values for alkalinity, total hardness, calcium, magnesium, chloride, sulphate, nitrate, cadmium, chromium, copper, and lead were: 137.5,155.2,129.00,43.10,42.39,2.68,20.980.0167,0.0145,0.42 and 0.016 mg/L respectively. The highest pH was also observed to be 7.34. Of all the measured parameters, two of the five distinct locations did not fall within the WHO/NAFDAC permissible limits. The Results of this research activity have therefore shown that all the water samples fell within the physicochemical standard limits for drinking water, but are not recommended for drinking purposes, as they all contain one or more of the trace elements.

Keywords: groundwater, heavy metals, physico–chemical, permissible limits, anions.

I. Introduction

Man's survival and industrial development largely depend on the availability of surface and groundwater, whose quality is defined by the composition of the recharge components, and geological and hydrological variations [1]. Recent reports have shown that groundwater serves as the primary source of potable water for over 200 million urban dwellers, as access to potable water is proven abortive. Hence, groundwater, which is believed to be less susceptible to chemical and microbial contamination, is therefore used for many agricultural, domestic and industrial purposes [2]. Universally, groundwater is regarded as a vital natural resource, which is less polluted, unlike surface water bodies. Moreover, remediation of polluted groundwater is very difficult. It, therefore, is important to control its pollution [3]. Groundwater is also known to contain impurities, whose properties vary with the sources. Plants require trace amounts of metals (essential nutrients, such as copper, zinc, cobalt, iron and manganese) in water for the execution of certain biological processes [4]. However, the increase in population and industrialization has led to high concentrations of these metals in our ecosystem, leading to underground pollution of the groundwater sources [5].

In order to promote the good health of the residents of Lagos metropolis, the quality of groundwater must be frequently monitored. Therefore, this research work is aimed at assessing the quality of water from five locations in Badagry Local Government, Lagos State-Nigeria.

Study Area

Badagry Local Government (BLGA) is situated at the latitude 7°15´ N and 7°0´ N and longitude 5°0´W and 7°0´ W. it is bounded in the west by the Benin republic, east by Ologe lagoon, south by the Atlantic Ocean and north by Ogun State. The environment is made up of grey sandy soil with disperse vegetation mainly comprising coconut, oil palm and Shrubs. Fishing appears to be the major occupation of the people living in the environment. Groundwater in Badagry is highly susceptible to underground pollution due to the predominant sandy soil, which is known for low absorption potentials. As a result of this, foreign toxic chemicals are easily leached down the soil profile into the aquifer, thereby polluting the groundwater.

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II. Materials and Methods

Fifty borehole water samples were collected from five communities (Povita, Akarakumo, Topo, Idale and Marina) located at Badagry Local Government Area of Lagos – Nigeria into sterile white plastic sampling bottles, and then taken to the laboratory and kept at 4^0C until the time for analysis. The fifty groundwater samples were analyzed following the physicochemical parameters, which include: pH, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Nitrate, Sulphate and Phosphate in accordance with the Standard Analytical Methods (APHA,2005). Heavy metal concentrations were as well determined using the Atomic Absorption Spectrophotometer (AAS) [7].

III. Results and Discussion

The summary of the investigated parameters is shown in the Tables below:

Table 1.0: Physicochemical parameters of groundwater samples from five riverine areas of Badagry division, Lagos-Nigeria.

QUALITY PARAMETERS	POVITA	AKARAKUMO	TOPO	IDALE	MARINA	NAFDAC	WHO Permissible limit
pH	6.74	6.83	7.33	7.34	6.17	6.8-8.5	6.5-8.5
ALKALINITY (mg/L)	65.00	86.50	103.00	60.00	55.5	--	500
TOTAL HARDNESS (mg/L)	126.2	109.80	114.7	137.50	155.2	150	500
CALCIUM (mg/L)	92.6	81.8	75.20	96.40	129.00	150	200
MAGNESIUM (mg/L)	33.60	38.00	39.50	43.10	26.20	150	250

Table 2.0: Levels of anions concentration (mg/L) in groundwater samples from the study areas

QUALITY PARAMETERS	POVITA	AKARAKUMO	TOPO	IDALE	MARINA	NAFDAC	WHO
CHLORIDE (mg/L)	21.32	23.22	35.64	42.39	38.86	250	250
SULPHATE (mg/L)	1.92	2.68	2.30	1.82	2.20	100	400
NITRATE (mg/L)	20.98	19.76	19.82	19.76	19.03	50	45

Table 3.0: Comparison of results of heavy metals (mg/L) in groundwater samples from the study areas with NAFDAC/WHO standards for drinking water.

QUALITY PARAMETERS	POVITA	AKARAKUMO	TOPO	IDALE	MARINA	NAFDAC	WHO
Cd (mg/L)	ND	0.0167	ND	ND	0.0167	--	0.003
Cr(mg/L)	ND	ND	0.0145	0.015	0.018	0.05	0.05
Cu(mg/L)	0.42	0.65	0.836	1.14	1.42	1.0	1.0
Pb(mg/L)	ND	ND	ND	0.015	0.016	0.01	0.01

ND: Not Detected

IV. Results and Discussion

The average range values of pH of the samples taken from five geological zones in Badagry were recorded between 6.17 and 7.34, which all fell within NAFDAC and WHO permissible standards. However, the average mean values from Marina were observed to be slightly acidic, 6.17, which falls below the World Health Organization, WHO (2017) regulatory standard for drinking water [7]. Acidic water is known to cause skin and eye irritation, serious damage to the cells of mucous membranes as well as metal

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corrosion [8]. Also, reports have shown that heavy metals exhibit a high level of solubility at low pH of the groundwater [9]. Alkalinity is a measure of the ability of the groundwater to neutralize the acidity of acid rainfall pollution or the water. It was also observed that Samples from Marina have the least average mean value of alkalinity, while Samples from Arakumo have the highest mean value of 103 mg/L, although, all the samples conform to the NAFDAC and WHO standards for potable water. Hence, excessive alkalinity could result in the formation of scales as well as an undesirable taste in the groundwater [10].

Table 1.0 shows that the sample from Marina is hard compared to the NAFDAC regulatory limits, the sample from Akarakumo is moderately hard, and the rest are soft. Of all the investigated groundwater samples, the groundwater sample from Marina showed the maximum concentration of Calcium ions, while the minimum was seen in the samples taken from Topo (75mg/L). Groundwater samples from Marina exhibited the lowest value of magnesium concentration, while that of Idale, appears to possess the highest mean concentration of the magnesium ion of 43.10 mg/L. Hence, the magnesium ion concentration of all the samples was seen below the NAFDAC and WHO permissible limits. The Ca^{2+} and Mg^{2+} are known to be among the cation species which are frequently involved in the cations exchange process and interactions with the aquifer materials. Hence, the total hardness of groundwater indicates soap precipitation and is usually caused by the hardness of water due to the presence of calcium and magnesium ions in the water [11]. Sulphate is detected at low concentrations in all the investigated groundwater samples and also falls within the NAFDAC and WHO stipulated tolerance limits.

Chromium and Copper are essential metals known for important biological roles in the human body. All the investigated metals (Cd, Cr, Cu and Pb) occur at trace levels in samples Povita, Akarakumo, and Topo. However, Cu and Pb were observed at higher concentrations in Samples from Idale and Marina respectively. Pb at higher concentrations in groundwater is known for the damage to certain vital organs in the body and as well leads to the disorder of important systems in the body, such as the central nervous system (CNS), gastrointestinal, neurological and reproductive systems. While long-term exposure to copper at higher concentrations leads to gastrointestinal disorders. Research studies have shown that after a long period of exposure of the body system to Cadmium at higher concentrations, could lead to serious health issues, such as lung cancer, kidney damage, high blood pressure and so on [8]. Chromium at high concentrations can as well affect the liver and kidneys in humans [12].

V. Conclusion

The present study examined groundwater samples from five different locations in Badagry Local Government Area of Lagos State, Nigeria for some selected physico – chemical parameters. The result of this has shown that all the samples conform to WHO/NAFDAC limits, which could be attributed to subsistence farming and low level of industrial and anthropogenic activities in those communities, as most of the residents are local fishermen and farmers. However, all the investigated samples contained one or more heavy metals, with water samples from Idale and Marina higher than the NAFDAC/WHO safety regulation for drinking permissible limits. The water sample from Marina is acidic, which promotes the solubilities of the trace metals in the communities' groundwater. There is, therefore, a need for the control and continuous quality monitoring of the groundwater in Badagry to ensure the safety of the residents.

References

1. Shahnawaz M.D, Singh K.M (2009). Groundwater quality of Piro and Jagdishpur Blocks Bhorps district, a middle gigantic plain. International Journal of Pharmaceutical Quality Assurance (1):9–10.
2. Gronwall, J.T.; Mullenga, M; McGranaham, G. (2010). Groundwater, Self-Supply and Poor Urban Dwellers: A Review with Case Studies of Bangalore and Lusaka. Human Settlements Programme, International Institute for Environment and Development (IIED), London.
3. Olushola M. Awoyemi, Albert C. Achudume, Aderonke A. Okoya [2014]. The Physicochemical Quality of Groundwater in Relation to Surface Water Pollution in Majidun Area of Ikorodu, Lagos State, Nigeria. American Journal of Water Resources, (2). 127
4. Ogundele, O. and Mekuleyi, G. O. (2018). Physico-chemical properties and heavy metals discharged from two industries in Agbara, Lagos State, Nigeria International Research Journal of Public and Environmental.Health, 5 (3): 32-37.
5. Khodapanah L, Sculaiman W., Khodapanah N (2009). Groundwater quality assessment for different purposes in Eshtehard district, Tehran, Iran. European Journal Scientific Research. 36(4):543−553.
6. APHA, 1992. Standard Methods for Examination of Water and Wastewater. 18th Edn., American PublicHealth Association.
7. WHO (2017). Guidelines for drinking water quality,4th edition incorporating the first addendum.World Health Organization Geneva. 631
8. Lekan T.P, Adeyinka S.· Tajudeen A. A. (2019). Assessment of natural groundwater physicochemical properties in major industrial and residential locations of Lagos metropolis. Applied Water Science.192.
9. Anyanwu E.D, Onyele O.G (2018). Occurrence and concentration of heavy metals in rural spring in southeastern Nigeria. Journal of Applied Science and Environmental Management. 1474-75.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS | Volume VIII Issue IV April 2023

10. David Adeyemi, Emmanuel Olafadehan and Chimezie Anyakora (2015). Assessment level of Physicochemical properties and trace metals of water samples from Lagos, Nigeria. International Journal of Advanced Research in Biological Sciences.169.
11. Abdulrahim O. M, Adeleke A.A, Lateef. O. G. (2011). Quality assessment of groundwater in the vicinity of dumpsites in Ifo and Lagos, Southwestern Nigeria. Pelagia Research Library.296
12. Anyanwu E.D, Onyele O.G (2018). Occurrence and concentration of heavy metals in rural spring in southeastern Nigeria. Journal of Applied Science and Environmental Management. 1474-75.