Network for Research and Development in Africa
International Journal of Pure and Applied Science Research
ISSN: 2384-5918. Volume 13, Number 1
Pages 36-40 (February, 2023)
DOI: 45727711313
www.arcnjournals.org

Assessment of Groundwater Quality in Maiduguri North-Eastern Nigeria: A Case Study of Ramat Polytechnic Maiduguri and its Environment

Ibrahim Mustapha
Department of Agricultural Technology, Ramat Polytechnic, Maiduguri Borno, State, Nigeria

Abstract: *The research was conducted to determine the assessment of groundwater quality in Maiduguri North-eastern Nigeria, a case study of Ramat Polytechnic and its environment, was undertaken in order to ascertain the suitability of groundwater in the area, for various uses. To understand this detailed hydrogeological mapping was conducted in which seven (7) groundwater samples were collected and analysed for physicochemical analysis. The result shows physical and chemical parameters are within the World Health Organisation (WHO) standard and Nigerian standard (NIS) during the wet and dry seasons.*

Keywords: *hydrogeology, Physico-chemical, Mapping, Groundwater.*

INTRODUCTION

Access to potable water (quantity and quality) is inadequate worldwide, currently; 884 million people in the world especially in developing countries still do not get their drinking water quality from improved sources (Cobbina *et al*., 2013). Providing portable drinking and irrigation water to all citizens who are deprived access to quality water will serve as the breaking point of poverty alleviation in most developing countries, especially in Nigeria, where a substantial amount of national budgets is used to treat preventable waterborne diseases (Cobbina *et al*., 2013). Groundwater is one of the most important natural resources which contribute to the global freshwater supply. In Nigeria, groundwater provides much of the public and domestic water supply, supports agricultural and industrial economies, and contributes its flow to rivers, lakes, and wetlands; this helps in maintaining balance in the ecosystem (Aizebeokhai, 2011). Groundwater is the primary source of potable water in most parts of Nigeria, particularly in rural areas, which rely on domestic (private) hand-dug wells (Aizebeokhai, 2011).

In urban areas, inadequate public water systems and ineffective functioning of water facilities have made it impossible for most of the population to have access to sufficient potable water. Understanding the quality of groundwater is a very important factor in determining whether the source could be used to supply suitable water for human consumption and use. As a scarce resource, groundwater requires continuous monitoring through quality assessments and management for sustainable use against contamination. Groundwater is the primary source of potable water in most parts of the Maiduguri metropolis, which relies on domestic (private) hand-dug wells from the upper aquifer (Bakari, 2014).
Water scarcity has become a global phenomenon for both urban and rural communities, and the associated problem in many developing countries, the majority have no access to clean drinking water, while those that do, often spend considerable time walking and queuing to collect it (Bakari, 2014). The absence of surface water supply has resulted in the rapid increase of hand-dug wells with some located within the premises of open dumpsites in Maiduguri. These problems potentially pose a significant threat to the upper unconfined aquifer system of the Chad formation around Maiduguri and this aquifer is the major water supply source for the city. This consequently poses health risks to the local population, more especially the urban poor who largely depend on the groundwater as a source of drinking and small-scale irrigation without any form of treatment (Bakari, 2014). The need for water quality monitoring and management is fundamental to safeguarding public health and protecting the groundwater resource in Maiduguri. In the study area, a small-scale irrigation system is being practiced during the wet and dry season irrigation.

MATERIALS AND METHODS

The Study Area

Maiduguri is located between latitude $11^0\ 5''$ – $11^0\ 55''$ N and longitude $13^0\ 02''$ -$13^0\ 16''$ E. It lies on a vast sedimentary basin, with a gentle undulating gradient of altitude 345m above mean sea level. Hence, the people depend on groundwater for meeting the water needs of the metropolis. The city dominantly derives its groundwater resources from the Chad Formation. Maiduguri is estimated to have had a population of about 1,197,497 in 2009 (NPC, 2006). More than 80% of this population depends on groundwater resources, with per capita water consumption of 10-40 litres of water per day (UN, 1988). According to Hess *et al.* (1996), the climate is semi-arid with three distinct seasons, a cool-dry season (October to March), a hot season (April to June), and a rainy season (July to September). The annual rainfall ranges from 560 to 600mm and the Mean monthly rainfall of Maiduguri from 1995 – 2014 as shown in Figure 4. The cold (dry harmattan) season runs from November to March when temperatures fall to about 20°C and a dry dusty wind blows from the Sahara Desert (Jaekel, 1984). The area is fragile and highly susceptible to drought with a relative humidity of 13% in dry seasons and 65% in rainy seasons.

Sample collection

The collection of topographical maps of the study area and measurement of the depth to the water table from shallow hang-dug wells for groundwater configuration maps will be achieved during wet and dry seasons. Using field instruments and software for analysis, collection of water samples for physicochemical analysis of the water samples. Sampling bottles will be pre-cleaned before sampling, and the sample will be collected in 1litre high-density cleaned polythene containers and rinsed 3 times before sampling. Each pair of water samples will be collected near the wellhead of each of the 10 boreholes and well samples by filling the sample bottle to the brim before corking it to ensure that dissolved CO_2 was retained and also to minimize O_2 contamination. Water samples for the determination of cations were stabilized by adding a few drops of dil, HCl after collection. To maintain the integrity of the water samples, physicochemical parameters sensitive to environmental changes such as PH, Conductivity, dissolved oxygen, and temperature will be measured and recorded in situ using portable digital meters. The samples will be transported to the laboratory in an ice chest for analysis.

Geographical information system (GIS) will be used to map out the soil and water sampling point in the study area. Physio-chemical variables of the soil and water samples will be analysed using descriptive statistical analysis to produce a table, which contains the minimum, maximum, mean, and standard deviation (SPSS V. 20). Correlation coefficient of physic-chemical variables of the soil and water samples will be compared using Microsoft excel (2013).

RESULTS AND DISCUSSIONS

According to the result total dissolve solid (T.D.S) of the study area ranges from 265-330mg/l, it falls. Within the WHO standard and NIS standards. Ph ranges from 6.1 to 7.0 the alkalinity is moderate while dissolve oxygen (DO) ranges from 13.5v to 30.1 mg/l is within the WHO standard.

The mean Na content (50.1mg/l) of the water sample, was lower than the WHO. Stipulated standard similarly, Ca ranges from 0.123-3.03 with a mean of (2.25mg/l) which is lower than the WHO standard (75mg/l) i.e Ca is potable water (WHO, 2011). Mg is least to the WHO standard.

Cl ranges from (0.02-0.801mg/l) which is lower than the (WHO, 2011) standard (250mg/l). for Cl is potable water (WHO, 2011). K ranges from (11.3-50mg/l) from the water sample is below the (WHO, 2011) standard SO_4 lower value recorded (0.75-1.66mg/l) which the maximum limit of 500mg/l for sulphate (SO_4) is potable water (WHO, 2011), for the nitrate No_3 concentration in the water samples ranged from (10.1-21.3mg/l).

Table 1: Physical Parameters

S/N	LOCATION	TEMP (^{o}C)	PH	TDS/EC(MG/L)	DISSOLVE OXYGEN
R Poly 1	Ramat gate Wulari	30	7.0	315	29
R Poly 2	Civil dept.	31	6.5	301	13.5
R Poly 3	Agric Tech dept	31	6.3	275	15.5
R Poly 4	Central Mosque	30	6.5	290.5	28.1
R Poly 5	Ramat Water	31	7.0	330	14.5
R Poly 6	Admin Block	30	6.1	265	28.1
R Poly 7	Boys Hostel	30	6.2	321	30.1

Table 2: Chemical Parameters

S/N	Na	K	Ca	Mg	Cl	Co_3/mg/l	HCo_3mg/l	So4 mg/l	No_3mg/l	Po_2 mg/l
R Poly 1	22.5	50	2.25	0.231	0.012	12.5	140	1.66	12.6	0.66
R Poly 2	28.1	22.1	0.123	0.211	0.661	-	152.1	0.82	15.1	1.22
R Poly 3	30.1	11.3	3.01	0.151	0.225	13.1	70.2	1.235	21.3	1.65
R Poly 4	31.1	24	1.62	0.661	0.314	11.2	125	1.44	11.1	1.11
R Poly 5	62	28.1	0.326	0.711	0.612	-	55.7	1.35	9.06	2.33
R Poly 6	71.1	22.2	2.11	0.321	0.711	9.1	88.1	0.75	12.15	0.011
R Poly 7	73.2	30	3.03	0.551	0.801	7.2	92.3	0.88	10.1	1.99

CONCLUSION

The result of this research shows that the majority of physical and chemical parameters are within the limit of WHO, 2011, and NIS standards. Further investigation on groundwater analysis should be done for future propose; trace elements and levy metals.

REFERENCES

Aizebeokhai. A.P. (2011). Potential impacts of climate change and variability on groundwater resources in Nigeria. *African Journal of Environmental Science and Technology,* 5(10), 760-768,

Akinbile, O.C. (2012). Environmental impact of landfill on Groundwater Quality and Agricultural soils in Nigeria. *Soil and Water Resources,* 7(1), 18-26

Bakari, A. (2014). Hydrochemical assessment of groundwater quality in the Chad Basin around Maiduguri, Nigeria. *Journal of Geology and Mining Research*, 6(1), 1-12.

British Geological Survey, (2003). Groundwater Information Sheet: The Impact of Agriculture. Water AID.

Cobbina, S.J., Michael, K., Salifu, L. and Duwiejua, A. B. (2013). Rainwater quality assessment in the Tamale Municipality. *International Journal of Scientific & Technology Research,* 2(5).

Gupta, D. (2011). Physiochemical Analysis of Ground Water of Selected Area of Kaithal City (Haryana) India, *Researcher J.*, 1(2), 1-5.

Hess, T., Stephen, W. and Thomas, G. (1996). Modeling NDVI from decadal rainfall data in the north east arid zone of Nigeria. *J. Env. Manag.*, 4(8), 249-261.

Jaekel, D. (1984). Rainfall patterns and lake level variations at Lake Chad: in climatic changes on a yearly to millennial basis, Geological, Historical and Instrumental Records, Morner N, and Karlen W, Eds D. Reidel Publ. co. Dordrecht, Netherlands. 191-200.

Kumar, P. (2013). Tracing the factors responsible for arsenic enrichment in groundwater of the middle Gangetic Plain, India: a source identification perspective. *Environ. Geochem. Health*, 32(2), 129-146.

Nickson, R. T., McArthur, J. M., Shrestha, B., Kyaw-Myint, T. O., and Lowry, D. (2005). Arsenic and other drinking water quality issues, Muzaffargarh District, Pakistan. *Applied Geochem.,* .20(1), 55-68.

Ocheri, M.I., Mile, I.I. and Obeta, M.C. (2010). Seasonal variation in nitrate levels in hand dug wells in Makurdi metropolis. *Pakistan Journal of Nutrition*, 9(2), 539-542.

Schutte, F. (2006). Handbook for the operation of water treatment works. Water Institute of Southern Africa. Water Utilisation Division

UN. (1988). Ground Water in North and West Africa. Natural Resources/Water Series, 18, United Nations, New York.

World Health Organization (2008) Guidelines for Drinking-Water Quality, (3rd edition). Geneva. 87-94