

*Journal of Medicinal and Chemical Sciences 2019 (2) 96-100**J. Med. Chem. Sci.***Assesment of Groundwater Samples from Sa'adatu Rimi College of Education, Kumbotso, Kano**S. A. A. Shawai ^{a,*}, M. S. Nahannu ^a, H. I. Mukhtar ^b, I. M. Isma'il ^a^a Department of Chemistry, School of Science Education, Sa'adatu Rimi College of Education, Kumbotso, P.M.B 3812, Kano state, Nigeria^b Department of Biology, School of Science Education, Sa'adatu Rimi College of Education, Kumbotso, P.M.B 3812, Kano state, Nigeria**ARTICLE INFO****ABSTRACT***Article history:*

Received 25 October 2018

Revised 21 February 2019

Accepted 18 February 2019

Keywords:

Alkalinity

Ammonia

Groundwater

Physicochemical

Sa'adatu Rimi

Water Analysis

Human activities are a major factor determining the quality of surface and groundwater through atmospheric pollution, effluent discharges, use of agricultural chemicals, eroded soil and land use. The purpose of this research was to determine the physicochemical parameters of water samples collected from Sa'adatu Rimi College of Education, Kumbotso Kano and to compare with the standards given by World Health Organization (WHO) and Nigeria Standard for Drinking Water Quality (NSDWQ). Four samples were collected from different locations within the college premises for the analysis. The analyzed parameters are pH, temperature, Total dissolved solids, Total suspended solids, Suspended solid, Electrical conductivity, Alkalinity, Mg^{2+} , Ca^{2+} , ammonia, sulphate, Nitrate, Nitrite, Turbidity, Salinity, Total hardness, free carbon dioxide, Iron and Chloride. The results indicated that all the analyzed parameters are within the permissible limits recommended by WHO and NSDWQ with exception of turbidity level at A sampling station, pH concentration at B, C, and D sampling point and nitrite concentrations at C and D sampling point. The results also showed that, the concentration of total hardness were slightly above the maximum permissible limit (MPL) recommended by NSDWQ. This paper also recommended that, the college management should provide a basis for the regular monitoring of water quality status.

1. Introduction

Safe drinking water is a basic need for good health and it is also a basic right of humans. According to^{1,2} the need to ascertain the quality of water used by humans has become very intense in the past decade and it is difficult to imagine any programme for human development that does not require a readily available supply of water. Besides, the need of water for drinking, water resources play a vital role in various sectors of economy such as agriculture, livestock production, forestry, industrial activities, hydropower generation, fisheries and other creative activities.³ The availability and quality of water, either surface or ground, have been deteriorated due to some important factors like increasing population, industrialization, urbanization etc.³ Groundwater contamination may be due to improper dwelling of well and waste disposal.⁴ Imam⁵ reported that, most of the environmental pollution arise from anthropogenic sources, mainly from domestic and industrial activities. He further explained that, failure to halt continuous deterioration of environmental quality might jeopardize the health of a large proportion of the population, resulting in serious political and socio-economic implications.

Several studies were carried out in order to ascertain the quality of water used for drinking, domestic, irrigation purposes. A brief literature would be considered in this article. The physicochemical parameters measured for river Challawa are potential for profound effect on the water body and

resident aquatic life as reported by.⁶ Dike *et al.*,⁷ in their study in water samples from Jakara River detected high values of BOD, DO, SS, and chloride and reported the unsuitability of the river for irrigation and other purposes.

Mustapha *et al.*,⁸ analyzed the physicochemical parameters of 27 samples from the riverine network of the upper Jakara River. Parameters like pH, temperature, conductivity, TDS, turbidity, salinity, BOD, COD, ammonia, TSS, SS, Cr, Cd and Pb were studied and compared with WHO standard.

Saeed and Mahmoud⁹ evaluated the physical and chemical parameters as well as heavy metals concentrations of drinking water used in Fagge local government area in Kano. The results indicated that, all the physicochemical and heavy metals are within the acceptable limits set by WHO except for pH level at Weather head and lead level in Kwaringogau sampling sites respectively.

Yahaya *et al.*¹⁰, carried out a study to determine the physical and chemical parameters of water collected from different points of Minjibir River. The EC, concentration of chloride, sodium, calcium, magnesium, TDS, sodium adsorption rate (SAR), and sulphate recorded in the water samples lies in the impermissible limit sets by WHO and Food and Agricultural Organization (FAO), and the concentrations of carbonate, bicarbonate, nitrate and boron are unsuitable for irrigation purposes as recommended by WHO and FAO.

A research was undertaken by^{11, 12} in Gezawa, Nigeria to have an idea of the extent of ground water pollution due to

* Corresponding Author:

E-mail address: Sadiqaashawai2020@yahoo.com (S. A. A. Shawai)

contamination with industrial effluents as well as sewage water.

The research work carried out by¹³ investigated the contamination level of groundwater by determination of physical and chemical properties. The quality of groundwater is deteriorated because of higher concentration of EC TDS and hardness as compared with WHO standards.

Shawai *et al.*¹⁴ conducted water quality assessment in Unguwa Uku, Kano metropolitan Nigeria in October 2016

and reported that human, agricultural activities as well as effluents from domestic and abattoir werethe major causes of water pollution within the study area.

The present study aimed at determining some physicochemical parameters and some heavy metals of water samples collected from 4 hand dug wells in Sa'adatu Rimi College of education, Kumbotso, Kano state.

2. Results and Discussion

Table 1: Physicochemical parameters of water

S/No	Parameters	A	B	C	D	WHO	NSDWQ
1	Turbidity (NTU)	31.0	5.0	0.0	3.0	5	5
2	Temp °C	29.6	29.5	29.3	29.1		
3	EC (µS/cm)	191.2	310	379	383	1000	1000
4	pH	8.9	8.7	8.6	8.6	6.5-8.5	6.5-8.5
5	TDS(mg/l)	95.6	100.10	191.0	167.0		
6	SS(mg/l)	30.00	26.00	5.00	18.00		
7	TSS(mg/l)	125.6	126.10	191.0	185		
8	Salinity (mg/l)	0.1	0.0	0.1	0.1		
9	TH(mg/l)	158.36	90.650	89.784	96.45		
10	Alkalinity(mg/l)	275.00	228.00	60.00	186.0	500	500

Table 2: Physicochemical parameters of water

S/No	Parameters	A	B	C	D	WHO	NSDWQ
1	Nitrite (mg/l)	0.027	0.007	3.00	4.00		
2	Calcium (mg/l)	21.63	22.33	21.63	25.27		
3	Magnesium (mg/l)	46.00		10.95	10.95		
4	Chloride (mg/l)	44.87	45.62	79.95	31.58	250	250
5	Iron (mg/l)	0.25	0.30	0.09	0.30		
6	Free CO ₂ (mg/l)	48.00	45.00	40.00	48.00		
7	Nitrate (mg/l)	23.00	29.20	10.10	32.00	50	50
8	Sulphate(mg/l)	10.00	03.00	15.00	29.00		

Conductivity in all the water sampled analysed are below the maximum limits of 1200 µS/cm prescribed by.¹⁵ The values ranged between 191.2-383 µS/cm, high value was recorded at Sampling point D and low value at A. Conductivity in water is a measure of all ions dissolved (soluble salts).¹⁶ Turbidity measurements in water which are a key test of water quality as high turbidity in water may indicate ineffectiveness in filtration.¹⁷ The turbidity of the analyzed samples varied between 0-31NTU which falls within 5NTU recommended values by^{15, 18} except sample from sampling point A which is higher. Alkalinity is another parameter in water quality study; it is the acid neutralizing capacity of water and a function of all titratable bases present in water.^{17,19} The alkalinity values ranged between 60.00-275 mg/l, with

maximum values of 275 mg/l and minimum value of 60 mg/L at A and C sampling point respectively. All the values were found to be below the prescribed limit of 500 mg/L by¹⁵. pH is among the most important parameters in operational water quality study and is the measurement of acid base equilibrium in water.¹⁷ From the results, the highest values was recorded at A and lowest at C and D which is slightly above the recommended levels of 6.5-8.5^{15, 18} and the pH is slightly basic.

The temperature is one of the most essential parameters in water. It has significant impact on growth and activity of ecological life and it greatly affects the solubility of oxygen in water.²⁰ The values obtained ranged from 29.1-29.6 °C. The highest value was found to be 29.6 °C. Chlorides are common

constituents of all natural waters. Higher value of it impart a salty taste to water making it unacceptable for human consumption²¹. The values of chlorides range from 31.58-79.95 mg/L. The maximum value of 79.95 mg/L was recorded at C and minimum value of 31.58 mg/L at D. In the present study, the value of chlorides was found to be below the prescribed limit of 250 mg/L recommended^{15, 18}. Free CO₂ was found within the range of 40.00-48.00mg/L. the maximum value of 48 mg/L was recorded at the sampling site C and minimum at A and D. This might be depends upon alkalinity and hardness of water body as reported by²².

From the obtained results, it was observed that, the values of suspended solids varies between 5.00-30.0 mg/L with higher value at A and lower at sampling point C. The result shows that TDS ranged from 95.6-191.00 mg/L. According to Lukubye and Andama²³ high concentrations above the WHO recommended value affect the taste and quality of drinking water. The TDS in all the water samples were far below the WHO maximum allowable limit of 1000mg/L, making these water sources suitable for drinking. Total dissolved solids indicate the salinity of groundwater. TSS values presents a minimum value of 125.6 at A and a maximum value of 196.0mg/L atC. The values obtained varies from 125.6-196.0mg/L.

The lowest value of calcium 21.63 mg/L was recorded at sampling point A, C, and the highest value was found to be 25.27 mg/L at sampling point D. The results shows that, the value falls within the maximum permissible limits of 100-300mg/L set by [15]. The magnesium in the water samples was found to be in the ranged of 10.95-46.00 mg/L. The result shows that sampling point A recorded the highest value of 46.00 mg/L while C and D have the lowest value of 10.95 mg/L. the results, also indicated that all the samples falls within the recommended levels set by¹⁸.

The hardness levels were also analyzed and presented in table 1, based on the classification of water conducted by⁹ with regard to water softness or hardness almost all the water samples, analyzed are soft. The results indicated that the water samples are safe for drinking and other domestic purposes. The minimum value of 89.784 mg/L was recorded at C and maximum of 158.360 mg/L at A.

Nitrite exists normally in very low concentrations and even in waste treatment plant effluents levels are relatively low, principally because the nitrogen tends to exist in the more reduced (ammonia) or more oxidised (nitrate) forms. Nitrite is an intermediate in the oxidation of ammonia to nitrate, such oxidation can proceed in soil, and because sewage is a rich source of ammonia, waters which show any appreciable amounts of nitrite are regarded as being of highly questionable quality²⁴. Levels in unpolluted waters are normally low, below 0.03 mg/L NO₂. Values greater than this indicate sewage pollution²⁴. The nitrite levels were generally low and below the 0.007 mg/L and 0.027 mg/L MPL of NSDWQ for water samples from A and B respectively. It can be seen from Table 2 that only the water sample from point C and D revealed a nitrite level of 3.00 mg/L and 4.00 mg/L above the MPL of NSDWQ respectively. Thus the source may not be safe for domestic and livestock use.

The sources of sulphate in underground waters may be rocks, geological formation, and so on. Excess sulphate has a laxative effect, especially in combination with magnesium and/or sodium²⁴. Sulphates exist in nearly all natural waters, the concentrations varying according to the nature of the terrain through which they flow²⁴. The sulphate contents (3.0-29.00 mg/L) of all the water samples fall below the MPL (200 mg/L) of NSDWQ. Well sample, B showed a 3.00 level of sulphate, while sample from sampling point D showed the highest level of 29.00 mg/L. Sulphate concentration in the area is low and therefore poses no problem for the groundwater quality. The low values are mostly due to the removal of SO₄ by bacterial action²⁴.

3. Conclusion

The results indicated that all the analyzed parameters are within the permissible limits recommended byWHO and NSDWQwith exception of turbidity level at A sampling station, pH concentration at B, C, and D sampling point and nitrite concentrations at C and D sampling point. The results also showed that, the concentration of total hardness was slightly above the maximum permissible limit (MPL) recommended by NSDWQ. Further research should be carried out to assess the levels of microbial contaminant, inorganic constituents and other parameters not considered in this research. This paper also recommended that, the college management should provide a basis for regular monitoring of the water quality status around the college environment and beyond.

4. Materials and Methods

4.1 Sampling Techniques

Four samples of well water were randomly collected from Sa'adatu Rimi College of Education, Kumbotso Kano using clean new polythene plastic containers (10L) which were covered with black polythene bags to prevent growth of algae. The temperature was determined immediately after sampling and the sample was stored at a cold temperature, this is to prevent the growth of microorganism. However, the sampling was conducted between the hours of 9pm to 11pm⁹.

4.2 Study Area

Sa'adatu Rimi College of Education Kumbotso, Kano is the largest college of education in the northern part of the country. It geographically lies between 12.22⁰N and 12.33⁰S and between 10.00⁰N and 10.00⁰E. Kumbotso local government area lies between 11053'17" N latitudes and 8030'11" E longitude. It has an area of 158 km² and a population of 295979 as at 2006 census. It shares boundaries with Gwale, Tarauni, Kano Municipal and Ungogo to the north, Dawakin Kudu and Warawa to the east, Madobi Local Government to the south, while Tofa and Rimingado to the west²⁵.

4.3 Physicochemical Analysis

The pH of the water sample were determined using digital pH meter (Model Lab Tech. 3320) after the meter had been duly calibrated with standard buffers. The conductivity of the samples was determined using a digital conductivity meter (model Jenway, 4010). Total dissolved solids (TDS) were estimated gravimetrically. EDTA titration method was used to determine the total hardness, calcium and magnesium of the water samples²⁶. The concentrations of the chloride, nitrite, nitrate, sulphate, phosphate and other chemical parameters were estimated by the standard methods of water and waste water using the HACH DR 2000 direct reading spectrophotometer²⁴.

References

1. Udom G.J., Nwankwoala H.O. and Daniel T.E. Physicochemical evaluation of groundwater in Ogbia, Bayelsa state, Nigeria. *International Journal of Weather, Climate Change and Conservation Research*, **2018**, 4(1): 19-32.
2. Fashola, F.I; Nwankwoala, H.O & Tse, A.C. Physicochemical Characteristics of Groundwater in Old Port Harcourt Township, Eastern Niger Delta. *International Journal of Physical Sciences*, **2013**, 1(3): 047 – 055.
3. Shweta T., Bhavtosh S., Prashant S. and Rajendra D. Water Quality Assessment in Terms of Water Quality Index. *American Journal of Water Resources*, **2013**, 1(3): 34-38.
4. Aiyesanmi, A. F., Ipinmoroti K.O. and Adeyinwo C.E. Baseline Water Quality Status of Rivers within Okitipupa Southeast Belt of the Bituminous Sands Field of Nigeria,” *Nigerian Journal of Science*, **2006**, 40: 62-71.
5. Imam, T.S. Assessment of heavy metals concentrations in the surface water of Bompai-Jakara drainage basin, Kano state, northern Nigeria. *Bayero Journal of Pure and Applied Sciences*, **2012**, 1(5): 103-108.
6. Akan J.C., Abdulrahman F.I., Ayodele J.T., and Ogugbuaja V.O. Impact of tannery and textile effluent on the chemical characteristics of Challawa River, Kano state, Nigeria. *Australian Journal of Basic and Applied Sciences*, **2009**, 3(3): 1933-1947.
7. Dike N.I., Ezealor A.U., Oniye S.J., and Ajibola V.O. Pollution studies of river Jakara in Kano Nigeria, using selected physicochemical parameters. *International Journal of Research in Environmental Science and Technology*, **2013**, 3(4): 122-129.
8. Mustapha A. et al., River water quality assessment using environmental techniques: Case study of Jakara river basin. *Environmental Science Pollution and Research*, **2013**. DOI 10.1007/s11356-013-1542-z.
9. Saeed M. D. and Mahmoud A. M. Determination of some Physicochemical Parameters and some Heavy Metals in Boreholes from Fagge L.G.A. of Kano Metropolis Kano State -Nigeria. *World Journal of Analytical Chemistry*, **2014**, 2(2): 42-46.
10. Yahaya M.N., Umar F.G., Jibrin D.M., and Idris U.D. Assessment of water quality of river Minjibir for irrigation purposes in Kano state, Nigeria. *Nigerian Journal of Agriculture, Food and Environment*, **2015**, 1(3).
11. Nahannu M.S., Shawai S.A.A., Ibrahim M.S., Muhammad U.L., Yahaya A.S., Nuhu A. and Abdullahi I.I. Physicochemical analysis of groundwater samples in Gezawa local government area of Kano state of Nigeria. *Advances in Bioscience and Bioengineering*, **2017**, 5(6): 92-95.
12. Shawai S. A. A., Nahannu M.S., Mukhtar H. I., Idris A., and Abdullahi I. I. Assessment of heavy metals concentration in groundwater from various locations in Gezawa local government area of Kano state. *Advances in materials*, **2017**, 6(5): 73-76.
13. Bataiya A.G., Habiba M., Ahmad S.I., and Muazu J. Analysis of Water Quality Using Physicochemical Parameters of Boreholes Water Taken from Areas around Dala Hills, Northwestern Nigeria. *American Journal of Water Science and Engineering*, **2017**, 3(6): 80-83.
14. Shawai S.A.A., Musa R.K., Bilkisu B.A. and Muazu J. Evaluation of physicochemical characteristics of groundwater from selected areas in UnguwaUku, Kano metropolitan, northwestern Nigeria. *International Journal of Biomedical Materials Research*, **2018**, 6(1): 8-12.
15. WHO. Guidelines for Drinking Water quality 3rd Edition, WHO Press, Geneva, **2006**, 398.
16. Dahiru M. and Enabulele O.I. Microbiological and Physicochemical Evaluation of Jakara canal Wastewater used for Irrigation in Kano. *International Journal of Microbiology and Application*, **2015**, 2(2): 25-30.
17. Abdullahi, U.A and Indabawa I.I. Study of Physicochemical and heavy metals (Pb, Fe, Mn) Concentrations of Tap Water in Dutse, Jigawa State, Nigeria. *Bayero Journal of Pure and Applied Sciences*, **2012**, 5(2): 89-82.
18. Yakasai, H.M. and Atiku, M.K. Study on Physicochemical Characteristics of Industrial Effluents from Bompai industrial areas, Kano Metropolis. *BEST Journal*, **2010**, 7(3): 81 -86.
19. NSDWQ. Nigerian Standard for Drinking Water Quality. NIS 554, Son, Lagos, **2007**, 30.
20. APHA. Standard methods for analysis of water and wastewater. 18th Ed. American Public Health Association, Inc., Washington D C. **1998**.
21. Hassan A.S., Abubakar I.B., Musa A., and Limanchi M.T. Water Quality Investigation by Physicochemical Parameters of Drinking Water of Selected Areas of KurekenSani, Kumbotso Local Government Area of Kano. *International Journal of Mineral Processing and Extractive Metallurgy*, **2017**, 2(5): 83-8.
22. Basavaraja, S., Hiremath, S.M., Murthy, K.N.S., Chandrashekarappa, K.N., Patel, A.N., and Puttiah, E.T. Analysis of Water Quality Using Physico-Chemical Parameters Hosahalli Tank in Shimoga District, Karnataka, India. *Global Journal of Science Frontier, Research*, **2011**, 1(3): 31-34.

23. Lukubye, B. and Andama M. Physicochemical Quality of Selected Drinking Water Sources in Municipality Uganda. *Journal of Water Resources and Protection*, **2017**, 9, 707-722.
24. Chindo I. Y. *et al.*, Physicochemical Analysis of Groundwater of Selected Areas of Dass and Ganjuwa local Government Areas, Bauchi State Nigeria. *World Journal of Analytical Chemistry*, **2013**, 1(4): 73-79.
25. Yelwa, N. A. *et al.*, Groundwater Prospecting and Aquifer Delineation Using Vertical Electrical Sounding (VES) Method in the Basement Complex Terrain of Kumbotso LGA of Kano State Nigeria. *Journal of Applied Geology and Geophysics*, **2015**, 3(1): 01-06.
26. Uduma A.U. and Uduma M.B. Physicochemical analysis of the quality of sachet water consumed in Kano metropolis. *American Journal of Environment, Energy and Power Research*, **2014**, 2(1) 01-10.

How to cite this article: S. A. A. Shawai*, M. S. Nahannu, H. I. Mukhtar, I. M. Isma'il. Assesment of Groundwater Samples from Sa'adatu Rimi College of Education, Kumbotso, Kano. *Journal of Medicinal and Chemical Sciences*, **2019**, 2(3), 96-100. **Link:** http://www.jmchemsci.com/article_82893.html