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Water quality assesment of groundwater samples from sa'adatu rimi college of education, kumbotso, kano metropolis

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ABSTRACT/RESUME

Abstract:*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 parameters analyzed 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 parameters analyzed 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 nitriteconcentrations 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 regular monitoring of water quality status.*

I. Introduction

Safe drinking water is a basic need for good health and it is also a basic right of humans. According [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]. Imam [5] reported that, most of the environmental pollution arise from anthropogenic sources, mainly from domestic and industrial activities. He further explain 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 river Jakara 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 river Jakara. 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 Mahmoud [9] 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 river Minjibir. 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). While 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 contamination with industrial effluents as well as sewage water.

The research work carried out by [13] to investigate the contamination level of groundwater by determination of physical and chemical properties,observed that the groundwater quality is deteriorated because of higher concentration of EC TDS and hardness as compared to WHO standards.

Shawai *et al*., [14] conducted water quality assessment in UnguwaUku, Kano metropolitan Nigeria in October 2016 and reported human, agricultural activities as well as effluents from domestic and abattoir are the major causes of water pollution within the study area.

The present study was aimed to determine 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.

II. Materials and methods

II.1.SamplingTechniques

Four samples of well water were collected from different areas of 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 11pm [9].

II.2.StudyArea

Sa'adatuRimi College of Education Kumbotso,Kano is the largest college of education in the northern part of the country. It geographically lies between 12.22^0N and 12.33^0S and between 10.00^0N and 10.00^0E.Kumbotso local government area of Kano State, Nigeria. Kumbotso 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. 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 west [15].

II.3.Physicochemical Analysis

The pH of the sachet water samples 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 were determine 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 samples. The colour, odour and taste were analyzed by physical observation, using sensory organs [16]. 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 spectrophotometer [17].

III.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 0C	29.6	29.5	29.3	29.1		
3	EC	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	95.6	100.10	191.0	167.0		
6	SS	30.00	26.00	5.00	18.00		
7	TSS	125.6	126.10	191.0	185		
8	Salinity	0.1	0.0	0.1	0.1		
9	TH	158.36	90.650	89.784	96.45		
10	Alkalinity	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	0.027	0.007	3.00	4.00		
2	Calcium	21.63	22.33	21.63	25.27		
3	Magnesium	46.00		10.95	10.95		
4	Chloride	44.87	45.62	79.95	31.58	250	250
5	Ammonia						
6	Iron	0.25	0.30	0.09	0.30		
7	Free CO2	48.00	45.00	40.00	48.00		
8	Nitrate	23.00	29.20	10.10	32.00	50	50
9	Sulphate	10.00	3.00	15.00	29.00		

Conductivity in all the water sampled analysed are below the maximum limits of 1200 µS/cm prescribed by [18]. 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)[19]. Turbidity measurements in water are a key test of water quality as high turbidity in water may indicate ineffectiveness in filtration [20]. The turbidity of the samples analyzed varied between 0-31NTU which falls within 5NTU recommended values by [18, 21] 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 [20, 22]. 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 by [18]. pH is among the most important parameters in operational water quality study and is the measurement of acid base equilibrium in water [20]. From the results, the highest values was recorded at A and lowest at C and D which isslightlyabove the recommended levels of 6.5-8.5 [18, 21] and the pH was slightly basic.

The temperature is one the most essential parameters in water. It has significant impact on growth and activity of ecological life and is greatly affects the solubility of oxygen in water[23]. The values obtained ranged from 29.1-29.6 ^{0}C. The highest value was found to be 29.6 ^{0}C. Chlorides are common constituents of all natural waters. Higher value of it impart a salty tasty to water making it unacceptable for human consumption[24]. 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 value of chlorides was found to be below the prescribed limit of 250 mg/L recommended [18, 21]. Free CO_2 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 may be depends upon alkalinity and hardness of water body as reported by [25].

From the results obtained, 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 Andama[26] high concentrations above the WHO recommended value affect the test of drinking water quality. 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 125.6-196.0 mg/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 values falls within the maximum permissible limits of 100-300mg/L set by[18]. 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 has the lowest values of 10.95 mg/L. the results, also indicated that all the samples falls within the recommended levels set by [21].

The hardness levels were also analyzed and presented in table 2, based on the classification of water conducted by [9] in 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 will tend 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 quality[17]. Levels in unpolluted waters are normally low, below 0.03 mg/L NO2. Values greater than this indicate sewage pollution[17]. 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 well C and D that 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 sodium[17].Sulphates exist in nearly all natural waters, the concentrations varying according to the nature of the terrain through which they flow[17]. 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 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 the action of bacteria [17].

IV-Conclusion

The results indicated that all the parameters analyzed 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 nitriteconcentrations 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. 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.

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