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ASSESSMENT OF GROUND WATER QUALITY AT KOFAR SAURI QUARTERS, KATSINA URBAN AREA, KATSINA STATE, NIGERIA

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ABSTRACT

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The analysis of some physicochemical parameters of well water from various locations at Kofar Sauri quarters in Katsina Metropolis, Katsina local Government Area of Katsina State, Nigeria, was conducted. The aim of the work was to assess the level of pollution of the water and compare the results with standard values recommended by WHO and SON. The samples were collected from six different locations at least 1km apart. Result of the analysis revealed a wide range of values such as; water turbidity 1.131.7 FTU, alkalinity 35.0-116.3mg/L, Total Hardness 156.3-390.0mg/L, and electrical conductivity 36.5-110.0µs/cm. while some of the parameters did not show any variation in their concentration in all samples analysed; these include BOD, Temperature and pH. From the results obtained, It can be concluded that, the water is polluted based on certain water quality parameters. Therefore, a better source of drinking water should be provided to the community for their domestic and other activities

INTRODUCTION

Water is essential in the survival of all living organisms. Ground water is among the common sources of drinking water, especially in developing countries, such as Nigeria. The quality of the ground water depends on various chemical constituents and their concentration which are mostly derived from the geological data of the particular region (Chindo et al, 2013). The study area is among the places that use well water for most of their domestic activities.

Although, ground water is believed to be comparatively cleaner and free from pollution compared to shallow surface water, however, its quality is often deteriorated by anthropogenic activities. Prolonged discharge of domestic sewage and solid wastes pollute the underground water and cause health

problems. The rapid growth of urban areas has further affected ground water quality due to over exploitation of resources and improper waste disposal practices. Hence, there is concern over the protection and management of surface and ground water quality. The analysis of physical and chemical properties of water is essential to determine whether the quality of the water is fit for consumption or not. The analysis of physicochemical properties of groundwater in Nigeria has been carried out at different locations. Some of the results did not show any possible contamination (Bernard and Ayeni, 2012), (Chukwuma, et al, 2014), (Longe and Balogun, 2010), (Ahmed and Eyaife, 2014). Some results indicated possible contamination (Sa'eed and Amira, 2013), (Ezeribe, et al., 2013).

Physicochemical analysis of well water samples from certain villages in South Eastern Nigeria with established cases of strained and motile teeth did not show any possible contamination (Ezeribe, *et al.*, 2013), which means the disease was not related to water contamination. A correlation coefficient analysis on various sources of water and their physicochemical parameters was carried out to predict the water quality. The Total Dissolved Solids, Na⁺ and Cl⁻ ions showed perfect correlation with Electrical Conductivity (EC) values in all the water sources. Similarly, Ca²⁺ and HCO₃⁻ ions were highly correlated in both the shallow and deep groundwater, but showed relatively low correlation with the surface water samples. It was also observed that Ca²⁺, Mg²⁺, Cl⁻ and NO₃⁻ ions were highly correlated with EC in the surface water samples (Gabriel and Donatus, 2010). Similar comparative analysis of level of contamination between open and bore hole wells did not show much variation in their results as reported by Murhekar, (2011), except in few

areas.

Ground water is a very important resource in Katsina Urban Area and the issue of water and its use has been a subject of much research inquiry. Katsina Urban Area lies between N12° 41' 45" to N13° 9' 20" and E007° 22' 10" to E007°52' 45" (Fig. 1). Katsina Urban Area is located at the centre of Hausa plains, at the extreme Northern part of Nigeria, 30kms from the Nigeria-Niger border. Katsina Urban Area is part of the headquarters of Katsina Local Government Area and it is also the capital of Katsina State. It has a total area of about 2,448km².

Thus, this research was aimed to assess ground water quality from a typical metropolitan settlement in Katsina Urban Area.

In specific terms, the research seeks to realize the following objectives: Determine the level of some physicochemical parameters in the well water; Compare these levels with International Standard of World Health Organization (Nkansah, *et al.*, 2010).

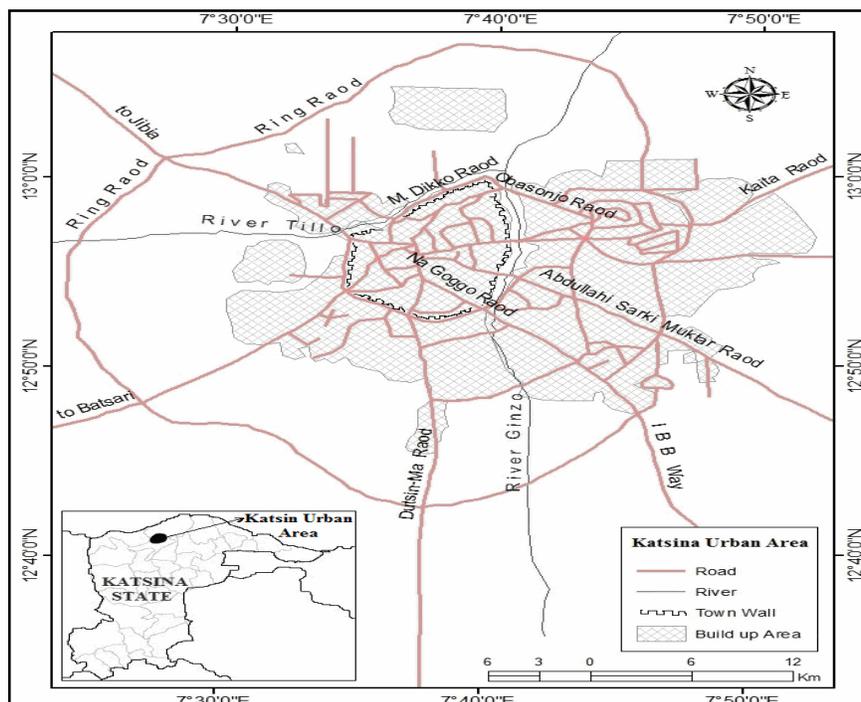


Fig. 1: Map of Katsina urban area
Source: NASA/NOA Spot Image, 2014

MATERIALS AND METHODS

Sampling procedure

The water samples were collected from six randomly selected open tube wells (Fig. 2). Two samples per well were obtained each, during morning and evening hours (07 hours and 21 hours respectively). The samples were

placed in an acid washed polythene bottle, labelled with date, time and location. Each sample was brought to the laboratory and stored before analysis. The wells are located at approximate distance of 1 km from each other.

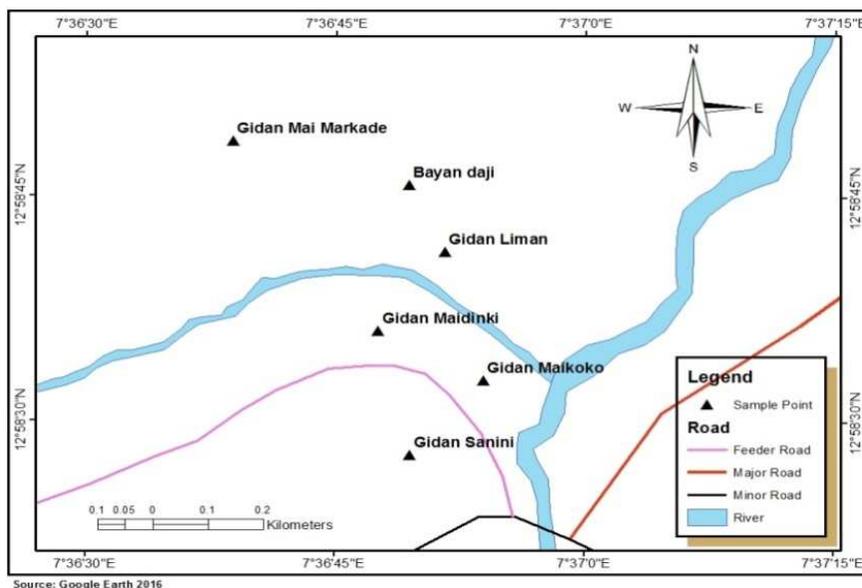


Fig. 2: Sampling Locations

Experimental Procedure

The various physical and chemical parameters of the water samples were analyzed as described below. Total Dissolved Solids (TDS) was determined using 20ml of the sample filtered using weighed filter paper (W_1). The filtrate was dried in hot air oven using weighed evaporating dish (W_2). To determine Total Suspended Solids (TSS), the filter paper containing the residue (W_1) was dried in hot air oven. The dried paper was cooled, reweighed and recorded as W_3 . For Electrical Conductivity, 20ml analysis bottle was filled with the water sample. Tip of the conductivity meter sensor was dipped into the bottle (containing the sample). The meter reading was taken. To determine pH, 20ml of the water sample was measured into a clean test tube. Tip of the pH meter electrode was dipped into the sample and the meter reading was taken. The Dissolved Oxygen (D.O) was determined as follows; 20ml of the sample was measured into a clean test tube. Tip of the meter sensor was dipped into the sample and

the meter reading was taken (APHA, 1998). The Biochemical Oxygen Demand (B.O.D) was estimated from the second reading of the samples from DO analysis and the reading was measured after five days preservation in a clean, air-tight bottle, in a dark environment. The Total Hardness was determined using 2ml of ammonium buffer solution in which 20ml of the water sample was added and titrated against 0.02M EDTA solution to the end point, using Eriochrome black-T as indicator. The Turbidity of each sample was measured using turbidity meter. The sample was placed inside a cuvet cell. The cell was inserted into the light path of the component. The meter was switched on and the reading was noted. The temperature of the water sample was determined using a thermometer. Tip of the thermometer sensor was dipped into the sample solution and the reading was noted. Alkalinity of the sample was measured by titrating 20 ml of the sample against 0.1N HCl to the end point, using methyl orange as indicator.

RESULTS AND DISCUSSION**Table1. Concentration of various parameters from the water samples**

Parameter	Gidan Sanini	Bayan daji	Gidan Maidinki	Gidan Liman	Gidan Maimarkade	Gidan Maikoko	WHO LIMIT	SON LIMIT
TDS (mg/L)	1472.5	1297.5	1112.5	1840.0	1020.0	530.0	500	500
TSS (mg/L)	150.2	27.23	80.0	42.2	97.2	33.3	40	30.0
Total Hardness (mg/L)	287.5	252.5	295.0	390.0	156.3	245.0	200	150
Alkalinity (mg/L)	35.0	65.0	68.75	96.3	45.0	116.25	120	100
Turbidity (FTU)	16.2	11.1	24.1	16.0	11.6	31.7	25	5.0
DO (mg/L)	0.3	0.26	0.3	0.19	0.3	0.21	5	-
BOD (mg/L)	0.1	0.1	0.2	0.02	0.1	0.01	5	50
Temperature (°C)	36.8	37.3	35.4	33.4	36.0	33.4	-	-
E. Conductivity (µm/cm)	57.2	66.1	56.3	110.0	36.5	61.0	1,500	1000
pH	6.4	6.7	6.39	6.4	5.8	6.29	6.5-8.5	6-8

The TDS values for all the samples were found to exceed the WHO permissible limit of 500mg/L, with Gidan Liman well water having the highest average level of 1840 mg/L, while Gidan Maikoko well water samples have the least concentrations of 530mg/L. The high TDS value is an indication of contaminants present in the well waters due to natural and anthropogenic contributing factors.

The TSS values for all the evening samples were found to be higher than those of the corresponding morning samples. This is due to the fact that, the water has been disturbed and hence, rises up all its contents including those at the bottom. Gidan Sanini well water samples showed the highest level of 150.2mg/L, while Gidan Maikoko well samples indicated the least concentrations of 33.3mg/L. When compared with WHO limit of 40mg/L, it can be seen that, most of the water samples have high suspended solid values. Water is known to contain particulate matter ranging from colloidal organic or inorganic matter that settle to form suspended solids, and this could be the basis of high concentration of suspended solids in the samples analysed. Generally, solids whether suspended or dissolved can provide information on the level of water pollution (Bilotta and Brazier, 2008)

The level of total hardness for all the samples were above the permissible limit of WHO (150mg/L).Gidan Liman well water samples showed the highest concentrations of

390.0mg/L, while Gidan Maimarkade well samples had the least concentrations of 156.3mg/L. The high level of Total hardness in these locations may be attributed to nature of the mineral contents in the soil. All the Alkalinity values reported were below the WHO permissible limit. Gidan Maikoko samples had the highest level of 116.3mg/L while Gidan Sanini well samples had the least average concentration of 35.0mg/L. The high concentration of alkalinity at Gidan Maikoko well indicated possible presence of dissolved minerals in the soil. The results of Turbidity tests were mostly below the WHO permissible limit, except for Gidan Maikoko whose level exceeded WHO limit; however, most of the samples were aboveSON limit and this could be attributed to presence of high amount organic and inorganic matter resulting from natural and anthropogenic activities. The results of DO, BOD, conductivity and pH, for all the samples were below the WHO permissible limits. Water samples from GidanMaidinki well indicated a relatively high BOD of 0.2ppm, while samples from GidanMaikoko well showed the least concentration of 0.01ppm. A high BOD value means more oxygen is demanded by the microorganisms living in the water samples. This reflects the level of pollution in the water.

Conclusion and Recommendations

For most of the samples analysed, the values of pH, conductivity, BOD, DO and alkalinity were below the WHO recommended limits.

However, the levels for TDS and total hardness, in all the samples analysed have exceeded the limits, which makes the water unfit for drinking. Therefore, It can be concluded that, the water sources are not good for consumption as each sample contains certain parameter which exceeded

the WHO accepted ranges. However, such water can be used for domestic purposes. It is recommended that, the well water in the area should be purified before drinking. It is also advisable to the government to provide portable drinking water to the affected community for their health and safety.

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