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Physicochemical Parameters of Borehole Water, Tap Water and Well Water from Dawakin Kudu Local Government Area of Kano State, Nigeria

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Abstract

Quality water is very important for maintenance of healthy environment, to determine the safety of the water consumed in the environment, pH, Turbidity, electrical conductivity, Alkalinity and hardness of water samples borehole, tap and well were analyzed. The result of the study showed that the pH of the water samples were found to be 6.3borehole, 6.7 tap and 6.8 well water, Turbidity were found to be 0 borehole, 1 tap and 0(NTU) well water, while conductivity were found to be 401 borehole, 635 tap and 556(µS/cm), well water and Hardness were found to be 172borehole, 68 tap and 88 mg/ml well water . The physicochemical analysis carried out the pH of the water were found to be from 6.3 to 6.8 only two of the samples are below the ranges laid down by W.H.O which are sample A and D and in conductivity also two of the samples are above the limit which are sample B and C and for the total hardness all are below the permissible limit by the standard (W.H.O).

Keywords: pH, Turbidity, Conductivity, Alkalinity, Hardness, Physicochemical parameters

INTRODUCTION

Physical parameters include temperature and color of water while chemical parameters include pH, dissolved oxygen contents, alkalinity, hardness and electrical conductivity. In this experiment only chemical parameters such as electrical conductivity, pH and hardness were measured. Table 8 shows the results for pH, electrical conductivity and hardness of collected water samples. WHO normal ranges for pH are 6.5-8.5. pH of all the collected water samples was recorded within the normal range. WHO normal range for electrical conductivity of water is 400-600 μS/cm. In all the collected water samples values of electrical conductivity were recorded above the normal range. WHO normal range for hardness of water is 50-250mg/ml. (Zigham Hassan *et al.,* 2012)

pH is a measure of the free hydrogen ion and hydroxyl ions in the water. A pH of 7 is neutral. pH under 7 indicates acidity; higher than 7 indicates alkalinity. Because pH can be affected by chemicals in the water, pH is an important indicator of water that is changing chemically. Drinking water with a pH between 6.5 and 8.5. generally, is considered satisfactory. Acidic waters are corrosive to plumbing and faucets, particularly if the pH is below 6. Waters with a pH above 8.5 may have a bitter or soda like taste. The pH of water can affect the treatment of water and should be considered if the water is used for field application of pesticides. Water with a pH of 7 to 8.5 requires more chlorine for the destruction of pathogens (disease organisms) than water that is slightly acidic (Majumber A.K 2009).

Turbidity is a measure of suspended minerals, bacteria, plankton, and dissolved organic and inorganic substances. Turbidity often is associated with surface water sources. Treatment includes mixing with a substance such as alum that causes coagulation of the suspended materials, which then can be removed by sand filter filtration (Adefemi *et* al 2007).

Borehole and tap waters are obtained from underneath the earth crust, and the quality are usually affected by some chemicals such as heavy metals, mineral salts and slightly by a change in the pH. They are African's most valuable resources, which provides reliable water supplies for more than a 100 million people. However, most of the contaminated

water affected by some chemicals such as heavy metals, mineral salts are mostly found in the rural areas, this is due to fact that rural areas have the abundance of miner Water quality is based upon the soluble species due to weathering from source rocks and anthropogenic activities (Abubakar M.Y *et al.*, 2024(a). The polluted water absorbed by various vegetables during the agricultural process results in the vegetables becoming contaminated, which are then consumed by humans and other animals. Once these contaminated vegetables are ingested, the heavy metal contents exhibit poisonous effects on the body (Abubakar M.Y *et al.*, 2024(b).

Hardness is the property that makes water form an insoluble curd with soap and primarily is due to the presence of calcium and magnesium. Very hard waters have no known adverse health effects and may be more palatable than soft waters. Hard water is primarily of concern because it requires more soap for effective cleaning; forms summon curd; causes yellowing of fabrics; toughens vegetables cooked in the water; and forms scale in boilers, water heaters, pipes and cooking utensils. The hardness of high-quality water should not exceed 270 mg/l (15.5 grains per gallon) measured as calcium carbonate. Water softer than 30 to 50 mg/l may be corrosive to piping, depending on pH, alkalinity and dissolved oxygen. Water softeners will correct hard water of more than 270 mg/l (Sa'id, M. D.,2008).

Alkalinity is a measure of the capacity of water to neutralize acids. The predominant chemicals present in natural waters are carbonates, bicarbonates and hydroxides. The bicarbonate ion is usually prevalent. However, the ratio of these ions is a function of pH mineral composition, temperature and ionic strength. Water may have a low alkalinity rating but a relatively high pH or vice versa, so alkalinity alone is not of major importance as a measure of water quality. Alkalinity is not considered detrimental to humans but generally is associated with high pH values, hardness and excessive dissolved solids. High-alkalinity waters also may have a distinctly flat, unpleasant taste. Treatment is an ion exchange via the addition of a tank media or reverse osmosis (Adefemi *et al.,* 2007).

Conductivity is a measure of the conductance of an electric current in water. This is an easy measurement to make and relates closely to the total dissolved solids (mineral) content of water. The maximum contaminant level (MCL) is 0.4 to 0.85 micro Siemens per centimeter. Treatment with reverse osmosis is effective for 1.4.5drinking water purposes (Ekhwan *et al.,* 2007).

MATERIALS AND METHODS

Measuring cylinder (10, 100cm^3), Pyrex Beaker, Conical flask, Funnel, Sample bottles, Pots, Stove/Hotplate, Sand bath, Stirrer, buffer solution pH meter, turbidity meter, conductivity meter.

Study area description

Galadanchi is an area located in Dawakin Kudu Local Government Area Kano State, Kano is 481 meters (or about 1580 feet) above sea level. The city lies to the north of the Jos Plateau, in the sudanian savanna region that stretches across the south of the Sahel. The city lies near where the Kano and Challawa Rivers flowing from the southwest converge to form the Hadejia River, which eventually flows in to Lake Chad to the east. According to the 2006 census, Kano is the most populous state in Nigeria, with about 9,383,682 million people (Illife, 2007).

The region features savanna vegetation and a hot, semi-arid climate. Kano sees on average about 690mm (27.2 in) of precipitation per year, the bulk of which falls from June through September. Kano is typically very hot throughout the year; through from December through February, the city is noticeably cooler. Night time temperature is cool during the months of December, January and February, with average low temperatures of 11^{0}C-14^{0}C. Kano metropolis encountered problems of environmental sanitation due to improper refuse disposal and sitting industries in residential area. So, the level of heavy and trace metals was considerably expected to be high (observatory, 2012).

Sampling

The samples were collected randomly in various sites in Galadanchi area of Dawakin kudu LGA. The water samples were collected in clean polythene plastic containers, the sample containers were rinsed with respective water sample before filling each with the sample, and were labeled A, B, C and D. For borehole and Sachet water, samples were collected from different direction, at an interval the tap was allowed to run for some minutes before filling the sample containers as to obtain a composite sample.

Methods for physiochemical analysis

Turbidity

The turbidity of water is determined by pouring the water in the sample bottle to the mark on the bottle, the blank was placed in the sample in the cell holders on the meters; the

blank sample I is the distilled water in the blank sample bottle. The meter is on followed by pressing PRG 95 followed by Enter then zero, the meter will show zero NTU.The water sample in the sample bottle is placed in the cell holder after removing the blank sample and press read, the meter will display the turbidity of the water in NTU.

pH Test

The pH is measured using a pH meter, the water sample is collected in a 100mL measuring cylinder, the electrode of the pH meter is inserted in the measuring cylinder containing the water. The meter is on, the pH meter will start reading, when the pH reading is attained, the meter will beep, then pH is recorded.

Alkalinity Test

100mls of final water is measured into the conical flask where phenolphthalein indicator is added. The colour remains unchanged. A methyl orange indicator is added which changes the colour to yellow. 0.1N HCl is titrated against the mixture in the conical flask up to the attainment of reddish coloration which marks the end-point of the first titration, where the reading is taken. The mixture in conical flask is boiled and allowed to cool where the same 0.1N HCl is again titrated against the mixture i.e. the second titration up to the formation of paint yellow coloration, the second reading is taken. The first reading and the second is summed and multiplied by (50) which is the approved standard conversion factor to obtain the total alkalinity of the final water expressed in mg/l.

Conductivity Test

The conductivity test is carried out using conductivity meter. The conductivity of both raw and treated water are carried out. The water(s) are obtained in a beaker where the electrode of the conductivity meter is rinsed in distilled water and placed in the water sample. The read button on the meter is pressed which displays the conductivity of the water sample, either raw or treated. It is expressed in Noc/cm.

Hardness Test

50ml of raw and final water was measured into separate conical flask. 2ml of buffer solution are added to each sample, the colour remains unchanged. A small amount of eriochrome black T is added to each sample, a pink coloration is observed. The samples are titrated with ethylenediamminetetraaceticacid (EDTA) up to the observance of blue coloration. The titre values of both raw and final water samples are multiplied with (44.892)

as the approved conversion factor where the hardness of both raw and final water is expressed in mg/L.

RESULTS AND DISCUSSION

Table for Physicochemical Analysis carried out

	Conductivity (µS)	Turbidity (NTU)	Hardness mg/L	Alkalinity	pH
Borehole water	401	0	172	4.9	6.3
Tap water	635	1.0	68	8.0	6.7
Well water	556	0	88	6.6	6.4

From the result above the pH of the five samples of water analyzed the pH were ranges from 6.3 to 6.8 which only two of the samples are below the permissible limit laid down by W.H.O which is from 6.5 to 8.5, Turbidity ranges from 0 to 1.0 (NTU) in all the samples while conductivity ranges from 401 to 635(µS/cm),WHO normal range for electrical conductivity of water is 400-600 µS/cm sample B and C are above the permissible level for drinking water, and for the Alkalinity it ranges from 2.4 to 8.0 and also for the Hardness it ranges from 68 to 172 mg/L.WHO normal range for hardness of water is 50-250mg/ml which implies all the samples are below the limit laid down by W.H.O. all are below the limit.

CONCLUSION

For the physicochemical analysis carried out the pH of the water were found to be from 6.3 to 6.8 only two of the samples are below the ranges laid down by W.H.O which are sample A and D and in conductivity also two of the samples are above the limit which are sample B and C and for the total hardness all are below the permissible limit by W.H.O.

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