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Physico-chemical and heavy metals assessment of bore hole water in oghara community, Nigeria

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ABSTRACT

Three water sample in Oghara Community, Ethiope -West, Nigeria were assessed for Physico-Chemical and heavy metals. The pH of the water ranges from 6.10-8.60, conductivity of water lies between 7.50-77.90µ/cm. Total solids, Total alkalinity, hardness, sulphate, ranges from 40.00-50.00mg/1, 28.00-29.70mg/l, 37.00-4.00mg/1, 55.20-5.30mg/I respectively, copper, iron, zinc lies between 0.02 – 0.03mg/I, 0.07-0.08mg/I, 021-0.31mg/I respectively. The results obtained from this study fall within the recommended values specified by NAFDAC and SON except the pH from site C that was above the maximum permissible limits specified by National Agency for Food Drug Administration and Control. (NAFDAC) and Standard Organization of Nigeria (SON).

Introduction

Groundwater is an important source of water supply through out the world (Egereonu, 2005). It is often used in irrigation, industries, urban and rural homes.

Groundwater exists beneath the earth surface and become borehole water when pumped or conveyed to the surface through submersible or surface pump. Ugbune, 2011; Egereonu, 2005). Ground water contamination may be defined as induced degration of natural ground water quality. Surface and atmospheric water is also a surface water; some are consumed untreated while some are treated. Ground water is a complex chemical composition of which is in dynamic state, the composition of which to a large extent attributes to the solution of material in soil and rocks by per collating water. The contamination of ground water is difficult to detect and difficult to control and persists for decades. The presence of these contamination above the World Health Organization (WHO), Standard Organization of Nigeria (SON) and Nation Agency for Food Drug Administration and Control (NAFDAC) standard can cause different kind of disease, such as cholera, typhoid fever, dysenteries, tuberculosis etc, water quality is very important in determining it suitability for the purpose of drinking, agricultural, industrial and domestic uses. It also provide information about the nature of the aquifer through which water passes.

Problem involving ground water can only be understood by the general knowledge of their elemental composition, the general chemical element found in action in the rock through which the water passes. Ideally water for domestic purpose should be clear colorless tasteless and odourless.

Water is one of the most valuable natural resources and it is essential for the maintenance of all forms of life (FAO, 1997). Surface (river, streams, lake and ocean) and ground (wells and borehole) are the principle sources of water. In recent years, because of rapid urbanization, industrialization and growing population, the rate of discharge of pollutant into the environment which ultimately finds their way into these water bodies is higher than the rate of its purification. It is believed that surface water are generally more polluted than ground water.

Hence, the use of ground water (borehole) as the major source of drinking water in may urban and rural areas (Shyamala, 2008)

Unfortunately, ground water can also be contaminated through various ways such as seepage from effluent waters, fertilizer from agricultural activities, mainly activities, mining activities vehicle maintenance and savage disposal water. Ground water has been reported to account for about 88% of safe drinking water where pollution is widely dispersed and the infrastructure needed for treatment and transport of surface water does not exist. (Kumar, 2004).

Safe potable water is essential for healthy living and for water to be regarded safe for drinking, it must meet certain physical, chemical and microbiological criteria set regulatory agency.

Water is an essential resource required for human survival and the presence of its reliable of its reliable source is a factor in the establishment of a community. In its absence, people must adopt a nomadic life style moving from one area to another. Water has the potential for spreading ill health and death.

Traditionally, water is needed for drinking, cooking, bathing watching of domestic and human wastes (Marry and Crasser,1983). Water, plays a vital role in the photosynthetic production of dry matter by plant species. Water is requested by all industries in the world for different purpose. Some of which include, fermentation, pharmaceuticals, soft drink preparations, ice making e.t.c. It is essential to all forms of life and living organism can survive only for a short period without water. This fact has resulted in the relationship between water population density and quality of life (Laccecy, 1981).

There are many metals that are toxic, which pollute water: The include aluminum, arsenic, beryllium, bismuth, cadmium,

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chromium lead, mercury, nickel, selenium, strontium and thallium e.t.c.

These metals or their compound may be discharged from industries, farmland and municipal urban runoffs e.t.c; into surface water to cause pollution. Some also may indirectly toxic found out that drinking water contaminated by wastes from mines producing cadmium, lead and zinc resulted in racket-like diseases. The metals laddered effluent may flow into a receiving water body or emptied on land. Some heavy metals are naturally present in some natural water sources and some are essential for healthy living of organisms.

However, when the concentration of the metal are very high beyond certain tolerable limit, they become toxic.

Materials and Methods

Three samples of water from bore holes in Oghara Community specifically Otefe, Oghara Junction and Ogharefe were collected as shown in table 1. Qualitative analysis was carried out on the three samples. The water samples were introduced into plastic bottles cleaned with 2M HNO_3 and rinsed with deionized water, this minimizes the possibility of contamination of the sample bottles. Samples of elemental analysis such as alkaline earth and trace metals, concentrated HNO_3 of high purity was added to the sample making the pH less than 2. This is to stabilize the samples, maintain the oxidation state of the elements, discouraging precipitation and prevent metals from adhering to the walls of the containers.

pH

A Phillip analog pH meter was used to monitor the pH of all water samples. pH was determine at the site of collection of water samples.

Conductivity

This was determined at the site of collection of water samples using Wissen Schaftirch-techische conductivity meter

Temperature

This was determined at the site of collection of water samples using mercury in glass thermometer.

Total Suspended Solids

Total suspended solids were determined by the filtration method. Water samples were filtered by the use of the filter paper. The filter paper and residue were dried in an oven for 30-40 minutes. At a temperature of about 105^{o}C the difference in weight of filter paper before and after drying gives the total suspended solid.

Alkalinity

50cm^3 of water were pipette into a 250cm^3 Erlenmeyer flask and three drops of phenolphthalein indicator was added and swirled. The solution was titrated with standard H_2SO_4 solution to a colourless end point. The titre values were then recorded as the total alkalinity of the water samples .

$$\text{Alkalinity (mg/L)} = \frac{\text{Titre Value x Molarities x 100}}{\text{Vol. of sample}}$$

Hardness Determination

50cm^3 of the water sample was introduced into a beaker and 1cm^3 buffer solution of NH_3 added. Three drops of solochrome Black indicator was also added and the solution was stirred properly.

The mixture was titrated with the colour changed from wine red to pure blue with no bluish tinge remaining. The total hardness of the water sample was calculated.

$$\text{Total hardness (mg)}(CaCo_3/MgCo_3) = \frac{\text{Volume of titrant x 100}}{\text{Volume of sample (cm}^2\text{)}}$$

Chloride Content

100cm ^{2} of the water sample was measured into Erlenmeyer flask.. This were determined by the flame emmission spectrophotometric technique standard graphs for the detected elements, were prepared following procedures in technical bulletin 27 (Her Mabesty's, 1973) and standard methods for the examination of water and waste water.

Sulphate and Nitrates

Sulphate was determined by the Hach Corporation Sulfaver. This method adapted from standard method for the examination of water and waste water. Also the Hach Corporation method was also used for Nitrate, nitraver 5 nitrate was used which was adapted from the cadmium reductions methods using power pillows.

Metallic ion

The metallic ions were determine usinmg the atomic absorption spectrophotometer of (AAS) of Unicam model 911).

Result and Discussion

Discussion of Results

The physico-chemical properties and heavy metals were analyzed from sample from Otefe (A), Oghara-Junction (B) and Ogharefe (c) as shown in table 2 and table 3. For drinking water to be safe the concentration of desirable substances should not exceed the level recommended by NAFDAC and SON.

pH

The pH of water samples ranges from 6.1 – 6.7 for Otefe and Oghara-junction. These values were within the range specified by NAFDAC and SON for portable water.

These values were also within the range reported by Ugbune , 2011, for borehole water in Mosogar community. The pH value from Ogharefe exceed the specified standard recommended by NAFDAC and SON.

Temperature

The temperature of water samples of 25^{o}C were within the range reported Ugbune, 2011. These values were also within the range reported by Egereonu, 2005, for ground water in Aba and its environs.

Conductivity

The conductivity of water samples ranges from 7.50-77.90µ/cm for Ogharefe, Otefe and Oghara junction. These values were within the range specified by NAFDAC and SON for portable water.

Total Solid

The total solid of water samples ranges from 40.00-50.00mg/I for Otefe, Oghara-Junction and Ogharaefe. These values were within the range specified by NAFDAC and SON for portable water.

Total Alkalinity

The total alkanity of water sample ranges from 28.00-29. 70mg/I for Oghara Junction, Otefe and Ogharaefe, these values were within the range reported by Egereonu, for ground water in Aba and its environs.

Hardness

The hardness of water sample ranges from 37,.00-4.00mg/I for Otefe, Oghara Junction and Ogharaefe. These values were within the range reported by Lacey. For ground water inAba and its environs, they are also fall with the value specified by NAFDAC and SON.

Sulphate

The sulphate of water samples ranges from 5.20-5.30mg/I for Otefe, Oghara Junction and Ogharaefe, these value were below the NAFDAC and SON maximum permissible limit of 100mg/I.

Table 1: Physico-chemical Properties

S/N	PARAMETER	OTEFE (A)	OGHARA JUNCTION (B)	OGHAREFE (C)	NAFDAC STANDARD	SON STANDARD
1.	Temperature (^oC)	25	25	25	25	Ambient
2	Ph	64	6.7	8.60	65.85	6.5-8.5
3.	Conductivity μs/cm	77.90	77.70	7.50	50	1000
4.	Total solids (mg/l)	40.00	50.00	40.00	100	500
5.	Total alkalinity (mg/I)	29.70	28.00	29.00	100	100
6.	Hardness ($Caco_3/mgco_{3)}$	39.00	40.00	37.00	500	100
7.	Free residual (Mg/I)	ND	ND	ND	ND	8.
8.	Sulphate (mg/I)	5.20	5.30	5.25	250	100
9.	Hydrogen Sulphide (mg/I)	ND	ND	ND	-	0.01
10.	Nitrate (mg/I)	0.34	0.30	0.31	45	10

Table 2: Heavy Metal Concentration

S/N	PARAMETER	OTEFE (A)	OGHARA JUNCTION (B)	OGHAREFE (C)	NAFDAC STANDARD	SON
1.	Maganese (mg/I)	ND	ND	ND	0.05	0.05
2.	Copper (mg/I)	0.02	0.03	0.02	1.0	0.1
3.	Iron (mg/I)	0.09	0.08	0.07	0.3	0.3
4.	Arsenic (mg/I)	ND	ND	ND		0.0
5.	Zinc (mg/I)	0.31	0.21	0.22	5.0	5.0

Nitrate

The nitrate content of water samples from the areas of study lie between 0.30-0.34mg/I. These value were within the range reported by Nogel (1984), for ground water in Aba and its environs.

Calcium

The calcium of water samples ranges from 11.0-12.00mg/I for Oghara Junction Otefe and Ogharefe, these values were below the NAFDAC and SON. Maximum permissible limit of 75mg/I.

Magnesium

The magnesium of water samples ranges from 10-1.77mg/I for Oghara Junction, Ogharefe and Otefe respectively, these value were within the ranges specified by NAFDAC and SON for portable water.

These values were also within the range reported by Lazarus for river water and its environs.

Copper

The Copper of water samples ranges from 0.02-0.03mg/I for Ogharefe and Oghara respectively, these values were within the range specified by NAFDAC and SON for portable water. These values were also within the range reported by Egereonu. for ground water in uratta and its environs.

Iron

The iron of water samples ranges from 0.02-0.09mg/I for Oghara junction, Otefe and Ogharaefe.

Zinc

The zinc of water samples were within the range from 0.21-0.31mg/I for Oghara-Junction, Otefe and Ogharefe. These values were within the range specified by NAFDAC and SON for portable water.

Conclusion

The study revealed that water from Oghara Community fall within the range stipulated by NAFDAC and SON. The only exception is the pH site C that was above the maximum permissible level stipulated by the regulatory body (NAFDAC and SON).

Therefore, there is need for borehole water in site C to be subjected to pH treatment.

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