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PHYSICO-CHEMICAL AND MINERAL COMPOSITION OF ARUN STREAM IN IDANRE COMMUNITY, ONDO STATE, NIGERIA

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ABSTRACT: *Arun stream was evaluated for its physico-chemical properties and mineral composition to know its suitability for human comsumption. The results obtained from the physical characteristics like colour, odour, taste, turbidity, temperature, conductivity and total Dissolve solids were within the permissible limits of World Health Organization (WHO) for drinkable water.The results for the chemical analysis were total hardness (22.00±0.20mg/l), calcium hardness (16.00±0.10mg/l) magnesium hardness (22.00±0.10mg/l), Nitrate (0.32±0.10mg/l), Sulphate was absent, chloride (8.99±0.20mg/l), total Alkalinity (6.00±0.10) and P^H (7.80±0.20) respectively.The mineral composition Analyzed were Iron (0.02mg/l), Manganese (0.015±0.01mg/l), Copper(0.01±0.01mg/l), calcium (6.4mg/l±0.10),Magnesium (1.46±0.10mg/l) and sodium (5.84±0.10mg/l) for Arun stream respectively. These values were below WHO specification for drinkable water.*

KEYWORDS: Arun Stream, physico-chemical, mineral, assessment, samples.

INTRODUCTION

Water is produced by condensation in the forms of cloud which falls to the ground as rain, snow or hail, it then becomes either surface water in the form of a river, stream or lakes or underground water in the form of springs, well or borehole(Lehloesa, and Muyima, 2002).

A study of the history of civilization has revealed that the provision of fresh clean safe drinking water is the bedrock of any developed well society. The growth of urbanized civilization has been sustained since ancient times by water supply systems (Gill, 2008). Sufficient provisions of clean, safe drinking water are a necessity for buildings and their occupants, including both commercial and residential structures and facilities. Even though the necessity of water is acknowledged by everyone only those who do not have it in acceptable quantity and quality will appreciate it the more (Treado *et al.*, 2008). A great majority of the people living in African Continent and some in Asia fall into this category.

The basis for drinking water assessment and improvement is the concern over public health to which little attention has been given by the way of effort in the provision of safe drinking water. However, some encouragement could be derived by stakeholders in public health when efforts are made to ascertain the public health benefits expected from involvement in the provision of clean safe drinking water (Herman and Zaslow, 1996):.

Even where there is enough water to meet current needs, many rivers, lakes and groundwater resources are becoming increasingly polluted (Christopher and Modh, 2011). The most frequent sources of pollution are human waste (with 2millions tons a day disposed of in water sources), industrial wastes and chemicals and agricultural pesticides and fertilizers (Abdulrafiu, 2011):. It has been estimated that half of the population of the developing world is exposed to polluted sources of water that increase disease incidence (International Organization for Standardization,1984-1986). Key forms of pollution include faecal coli forms, industrial

organic substances, acidifying substance from mining aquifers and atmospheric emissions, heavy metals from industry, ammonia, nitrate and phosphate pollution from agriculture, pesticide residues, sediments from human – induced erosion to rivers, lakes and reservoirs and Stalinization.

We are in the midst of a water crisis that has many Desirable that drinking water be free of suspended solids and turbidity, that it be tasteless and odorless, that dissolved inorganic solids be in moderate quantities, and that organics toxic substance, and pathogens be absent(Aremu *et al*.,(2011):. As more is learned about the constituent of water, additional requirement will be possibly added to the existing drinking water quality guidelines making drinking water requirement even more stringent (Guidolti *et al.,* 2001):. It is important to state that this research work does not pretend to test for every known drinking water quality parameters. Instead, effort has been made to address major stream which are peculiar to this locality as the source of their drinking water. The research aims at investigating Arun stream at Idanre as a source of suitable portable water supply for the population in Idanre households. And the objectives are as follows: to collect sample of suitable portable water using grab method of water sampling at diferent point source, to examine the physical and chemical through laboratory tests, to analyze the mineral composition of the water, to compare outcome of laboratory tests of sample with standard drinking water quality guidelines and to be able to make recommendation on drinking water quality protection.

MATERIAL AND METHODS

Collection of Sample: Water sample was collected during wet/rain season by grab method at different point at the stream water called Arun located in Oke-Idanre in Idanre Township in Idanre Local Government Area, Ondo state. The reason for collection at this period is due to seasonal attribute of this sample, because it may be undesirable during the dry season. The width of the source of this sample was found to be 3.75ft and the depth of 3.40ft.

This sample was also collected in the distinctive period of day in morning and evening time (10:00am and 5.00pm) from the same point and form homogenous sample for the investigation. It was collected by means of plastic container.

Description of the Area

Fig 1: Idanre Township

Idanre is a locality in the city of Ondo state, Nigeria where hills were mostly located in Ondo state of Southwestern Nigeria. Idanre hill consists of high plain with spectacular valleys

interspersed with Inselbergs of about 3000ft above sea level. Its physical attributes include Arun water and old king's palace. The city of Idanre is located in Ondo state South Western, Nigeria between latitudes 10.0 and 7^0 6^1 0" N and longitude is between 8.0 and 5^0 6^1 0" E. it is the one of the 18 local government in Ondo state. In 2006, Idanre had a population of 129,795. Idanre is continually growing in human population and this has resulted in continuous increase in water consumption demand. Idanre has a reviewing the forecasts for Idanre in the week ahead shows the average daytime maximum temperature will be around 31^0C, with a high for the week of 33^0C expected on the afternoon of Wednesday 17th. The average minimum temperature will be 22^0C, dipping to its lowest on the morning of Wednesday 17th at 22^0C. The week ahead will have most days seeing a little rain. Current predictions suggest Wednesday 17th will have the most precipitation with an accumulation of around 7.0mm. On the whole winds are likely to be light. In recent times the highest recorded temperature in June has been 39^0C that's 102^0f, with the lowest recorded temperature 13^0C, about 55^0f and the average daily relative humidity for June is around 80%.

Sample Analysis: All of the physical parameters and some of the chemical parameters were carried out at the Federal Ministry of Water Resources Regional Water laboratory, Bode George Road, Alagbaka in Akure, Ondo state, Nigeria using method adopted by Ademoroti,1996. Heavy metals and metallic ions in sample were determined at the multi-disciplinary research laboratory of the Federal Ministry of Water Resources using AOAC,2000.

Physical Analysis

Colour: The determination of colour of sample was done by physical appearance both the water are pure or not pure and the use of photometer apparatus is an instrument that measures high intensity or optical properties of a solutions or surfaces.

Turbidity: Turbidity was measured by the use of turbidity meter. Turbidity meter is an electronic device which has a small compartment for holding water and a read-out system.

Odour and Taste: These were done through the subjective use of the researcher's sense of taste and smell.

Chemical Analysis

Chloride: Titrimetric method was employed to determine the presence of chloride. A clean burette was mounted on the burette stand. A solution of potassium nitrate (KNO_3) and Silver Nitrate ($AgNO_3$) in the burette was titrated against 100ml of water sample in a conical flask with diphynyl / carbazone power. Titration was done until there was a colour change from yellow to pink.

PH: The P^H was determined by the use of the indicator. The range goes from 0-14 with 7 being neutral. P^H of less than 7 indicate acidity, where as a P^H of greater than 7 indicates a base. P^H is real a measure of the relative amount of free hydrogen and hydroxyl ions in the water.

Total solid:

A weighed small quantity of water in a test tube over a controlled flame of the Bunsen burner was evaporated to dryness. The evaporated sample was dried in the oven for one hour at a temperature range of 100^0C – 105^0C after which it was cooled and reweighed on a very sensitive electronic weighing balance. The determination of total solid concentration is shown below:

$$\text{Total solid} = \frac{\text{Weighed (mg) of dried residue}}{\text{Weight (mg) of sample}}$$

Total Hardness: The determination of total hardness was done by titration procedure. 2 milliliters of ammonium buffer aid and Ferrochrome Black T were added to 50ml of water

sample in a conical flask. A 0.01M concentration of EDTA reagent was then titrated against the sample solutions mentioned above. Titration against the sample solution turned brick red. Total hardness was determined from burette readings.

Total Alkalinity: Titration procedure was used to determine the total alkalinity of samples. Two drops of methyl orange were added to 100ml of water sample in a conical flask against which 0.1M H_2SO_4 was titrated to a pink end point.

Equipment for Analysis of Metals: Atomic absorption Spectroscopy (AAS) is the modern technique of detecting and measuring the amount of metals and organic substances such as lead, cadmium, Arsenic, barium etc. in any solutions without chemical titration. Atomic absorption spectrophotometer is the equipment devised to carry out this job. The sample is fragmented into very small drops (atomized). It is then fed into a flame. Isolated metal atoms interact with radiation wavelengths absorbed by different atoms. This interaction is measured and interpreted. Atomic absorption exploits different radiation wavelengths absorbed by different atoms. The instrument is most reliable when a simple line relates absorption concentration.

Calculation: Concentration of metal in mg/l is read from the calibration or directly from the readout system of the instrument.

RESULT AND DISCUSSION

Results

Table 1: The results of the Physical parameters analyzed on Arun stream.

Parameters	**Results**
Appearance/Colour	Clear
Odour	Unobjectionable
Taste	Unobjectionable
R\Turbidity (NTU)	0.21
Temperature (^{0}C)	28.20
Conductivity us/Cm	25.00
Total Dissolve Solid (Mg/l)	16.80

Table 2: The results of the chemical parameters analyzed on Arun stream.

Parameters	**Results**
Total hardness**(Mg/l)**	22.00±0.20
Calcium hardness**(Mg/l)**	16.00±0.10
Magnesium Hardness**(Mg/l)**	8.00±0.10
Nitrate**(Mg/l)**	0.32±0.10
Sulphate	Nil
Chloride**(Mg/l)**	8.99±0.20
Total Alkalinity**(Mg/l)**	6.00±0.10
pH	7.80±0.20

±Mean values of duplicate analysis

Table 3: The results of the Mineral components analyzed from Arun stream

Parameters (Mg/l)	**Results**
Iron (Fe)	0.020±0.01

Manganese (Mn)	0.015±0.01
Copper (Cu)	0.010±0.01
Calcium (Ca)	6.41±0.10
Magnesium (Mg)	1.46±0.10
Sodium (Na)	5.84±0.10

±Mean values of duplicate analysis

DISCUSSION

The results from the physico-chemical analysisof Arun stream were presented in table 1 and table 2 respectively. The results obtained from the physical characteristics like colour, odour, taste, turbidity, temperature, conductivity and total Dissolve solids were within the permissible limits of World Health Organization (WHO) for drinkable water.

The results for the chemical analysis in table2 indicated that total hardness (22.00±0.20mg/l), calcium hardness (16.00±0.10mg/l) magnesium hardness (22.00±0.10mg/l), Nitrate (0.32±0.10mg/l), Sulphate was absent, chloride (8.99±0.20mg/l), total Alkalinity (6.00±0.10) and P^H (7.80±0.20). These values were below the WHO specification which were 100 – 500 for total hardness, not specified for calcium hardness, magnesium hardness not indicated, Nitrate (10-50mg/l), sulphate (250-500), Chloride (200-250mg/l) and Total Alkalinity (100mg/l) for World Health Organization (WHO) respectively.

The mineral composition Analyzed were shown in table3.The values obtained indicated that the metal ions present were below World Health Organization (WHO) specification. Iron concentration (0.02mg/l) against 1-3mg/l indicated by WHO. Manganese ion (0.015±0.01mg/l) against 0.1 – 0.4 indicated by WHO. Copper ion (0.01±0.01mg/l) against 0.2, calcium (6.4mg/l±0.10) against 75mg/l, Magnesium (1.46±0.10mg/l) against 20mg/l, sodium (5.84±0.10mg/l) against 200mg/l for Arun stream and WHO specification respectively.

CONCLUSION

The results obtained from the physico-chemical and mineral analysis of water sample from Arun stream in Idanre hill township from table 1 to 3 indicated appreciable results for drinkable water according to WHO specification. The comparative results between the Arun stream and the standard set by World Health Organization (WHO) provides a baseline at which Arun stream can be employed for industrial utilization and human consumption.

RECOMMENDATION

The water samples from Arun stream are recommended for simple ultra-violet ray treatment from the storage tank which can easily take care of any microbiological activities.

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