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# Physicochemical Analysis of Drinking Water from Selected Boreholes in Maiduguri Metropolis, Nigeria

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**ABSTRACT**

*Potable drinking water is one of the major natural resources and it is foundation for the prevention and control of water borne diseases. Thus the objective of this study was to determine the physicochemical parameters of drinking water from selected boreholes in Maiduguri Metropolis, Nigeria. Water samples were collected from seven boreholes within Maiduguri Metropolis for physicochemical analysis. These include State Low Cost (S1), Damboa Road (S2), London Ciki (S3), Shehuri (S4), LawanBukar (S5), Pompomari Low-Cost (S6) and Abbaganaram (S7). The results obtained were compared with the standard set by World Health Organization (WHO) and Nigerian Standard of Drinking Water Quality (NSDWQ).However, with the exception of S4, none of the sample meets the standard requirement set by both WHO and NSDWQ. Therefore, it is recommended in this study, to create awareness among the residents of the studied area about the need to purify water from boreholes before utilize for drinking and domestic purposes.*

**Key Words:** Drinking Water, Borehole, Maiduguri, Physicochemical, WHO and NSDWQ

## INTRODUCTION

The deterioration of standard of drinking water as a result of pollution produces devastating effects to most of the developing countries around the globe. The major causes of water pollution in an environment are as a result addition of biological or chemical substances, such as land surface washing (Akan *et al.,* 2012). Water covers about two third of the total land of the earth and it plays a vital role in the development of communities; hence a consistently good source of water is essential for the existence of the both human and animals. Water is mostly found through precipitation, underground and is said to be polluted if it is not suitable for intended use. Polluted water is world public health problems that make people to have contact with several water borne diseases such as metal pollution and chemical intoxication (Okonko*et al.*,2009; Bukar*et al.,* 2015).One of the majorproblems that

cause threat to human health is faecal and metal contamination of water supplies. Devastating problem of health can cause by polluted water that is being passed or washed into pond, lake ,river,pool, stream or being allowed to seep into well or borehole (Cheesbrough, 2006). There has been much report that shows problem of borehole water is contaminatedthrough lotsof domestic waste water and livestock manure especially if there is cracks in a layer of soil (obi and Okacha, 2007).These sewage and waste when it deposited near the wells and boreholes may run with percolating rain water directly into the boreholes or may travel along the well or surrounding material of the drill-holes (obi and Okacha 2007). Management of qualitative drinking water has become a key controller of polluted water for more than one and half decades and it continue to maintain and prevent the contamination of water from foreign material (WHO 2010; Isa *et al.*,2013; Bukar*et al.,* 2015). In addition pollution water could be of point source or non point source. Point source of pollution can happen if pollutant release in the water bodies from the industries or drainage pipes, while non point source can release pollutant indirectly to the water bodies through environmental changes such as pollution from town run-off (Akan *et al.,* 2012).Therefore, it is essential to determine the physical and chemical parameter of drinking water quality to ensure and maintain the safety of life of the people especially in developing countries. Thus the objective of this study was to determine the physicochemical parameters of drinking water from selected boreholes in Maiduguri Metropolis, Nigeria.

## MATERIAL AND METHOD

### Study Area

Maiduguri is the capital of Borno State, located in Northeastern part regionof Nigeria. It possess the land mass of 3000 $km^2$ of different land units. Maiduguri and its surrounding environment is known for its dryness, with semi-arid climate, savannah or tropical grasslands vegetation, light annual rainfall of about 300 to 500 mm and the average daily temperature ranging from 22 to 35°C, with mean of the daily maximum temperature exceeding 40°C between March and June before the onset of the rains in July to September. It has mainly sandy loamy soil (Bello *et al.,* 2013;Arku*et al.,* 2011). Geographically, Maiduguri is divided into twenty-one different zones (Isa *et al.*,Rudiger, 2002). In this study,seven geographical zones were randomly used; these include State Low Cost (S1), Damboa Road (S2), London Ciki (S3), Shehuri (S4), LawanBukar (S5), Pompomari Low-Cost (S6) and Abbaganaram (S7).

### Collection of Samples

In the study water samples were collected from seven differentboreholes within different geographical zones in Maiduguri Metropolis using three sterile 500ml air-tightcontainer for each sample. To avoid contamination of the samples, the borehole taps was decontaminated by using heat (lighter), after which the taps were opened to flow up to 10 to 20 min. Then, the containers were filled with water up to 300 ml leaving some space to allow shaking before analysis as described by Isa *et al.* (2013) and Bello*et al.* (2013)

### Physicochemical analysis

The collected water samples were used todetermine the temperature, colour, turbidity, pH, total dissolve solid, conductivity, total alkalinity, manganese, copper and fluoride as describe by Isa *et al.*(2013)

### Results

The important of potable drinking water to sustenance and improvement of human life

cannot be overemphasizes. There are lots of reports indicating drinking water was contaminated by different chemical substances especially in developing countries. Thus,in this study water samples were collected from seven different boreholeswithin the Maiduguri Metropolis and used for the analysis of physicochemical parameters. The result is presented inTable 1 and indicated that the temperature of the water samples at the time of the analysis ranged from 22.1 to 30.6°C, with water samples from S7 found to havehigh temperature of 36°C, conversely S3had the lowest temperature of 22.1°C, although, none of the samples had objectionable colour.The turbidity of water samples collected from all the studied area range from 013 to 0.75NTU, with water samples fromS1had the highest turbidity of 0.75 NTU, while S6 had 0.13NTU. The pH of all the water samples ranged from 6.0 to 8.5, while the total dissolvesolid ranged from 152 to 564mg/L and conductivity measured at µs/cm alsoranged from 78 to 1070. Total alkalinity ranged from 65 to 100, while the copper content ranged from 0.21 to 0.90mg/L, with the water sample fromS7 having the highest copper content of 0.90mg/L whileS6 having the lowest copper content of 0.21mg/L. Fluoride also ranged from 0.12 to 0.90 mg/L (Table 1).

**Table 1: Physicochemical Parameters of Drinking Water from Boreholes in Maiduguri Metropolis**

| SN | parameter | S1 | S2 | S3 | S4 | S5 | S6 | S7 | NSDWQ | WHO |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Temperature at the time of analysis (°C) | 23.2 | 26.5 | **22.1** | 27.8 | **30.6** | 24.0 | 36 | Ambient | 40 |
| 2 | Colour (TCU) | Colourless | Colourless | Colourless | Colourless | Colourless | Colourless | Colourless | 15 | 6 |
| 3 | Turbidity (NTU) | 0.75 | 0.56 | 0.41 | 0.56 | 0.35 | 0.13 | 0.5 | 5 | 5 |
| 4 | PH | 7.04 | 6.50 | 8.5 | 7.5 | 6.42 | 6.5 | 6.0 | 6.5-8.5 | 7.0-8.5 |
| 5 | Total dissolve solid (mg/L) (TDS) | 332 | 564 | 543 | 152 | 249 | 500 | 453 | 500 | 500 |
| 6 | Conductivity (µs/cm | 647 | 1070 | 596 | 178 | 78 | 192 | 500 | 1000 | - |
| 7 | Total Alkalinity (mg/L) | 100 | 70 | 100 | 80 | 83 | 100 | 65 | - | 80 |
| 8 | Copper (mg/L) | 0.8 | 0.45 | 0.32 | 0.41 | 0.76 | 0.21 | 0.9 | 1.0 | - |
| 9 | Fluoride (mg/L) | 0.33 | 0.46 | 0.64 | 0.8 | 0.9 | 0.12 | 0.5 | 1.5 | - |

**WHO (2001), NSDWQ (2007)**

## Discussion

In this study, water samples from different boreholes were obtained and analysed for physicochemical parameters. The results obtained shows that the PH of the water sample from S7, does not meets the standard requirement. It values is less than the lower limits of the pH (6.5) as recommended by WHO and NSDWQ. The PH of drinking water has a great impact on human health; water with PH above 11 can cause irritation of skin, eye and mucous membrane. On the other side, pH values below 4 can also cause irritation due to the corrosive effects of low pH levels (NSDWQ, 2007). Similarly, total dissolve

solid (TSD) of the water sample from S2 and S3 exceeded the standard recommended by WHO, and NSDWQ (500 mg/l). However, TDS in water supplies originate from natural sources, sewage, cites and farming activities rain, and industrial wastedisposal. Salts used for road de-icing can also contribute to the TDS loading of water supplies, although, the presence of TDS in water may affect its taste (Bello*et al.,* 2013).The turbidity of all water samples used in this study is in agreement with both WHO and NWDSQ standard. The turbidity is very crucial in drinking water because the water that has high turbidity is often linked with high level of diseases cause microorganism, such as cholera and other parasites (Isa*et al.,* 2013;Shittu*et al.,* 2008). The total alkalinity of all water samples is in agreement with WHO (80 - 120 mg/l) standard except S1, S3 and S6 who shows high level of alkalinity. Alkaline water is known as safe, but it has the state of quality to produce side effects. It can reduce stomach acid, however, for most healthy people; low levels of stomach acid are likely to cause problems. It may also end up with health problems if drink high amount of alkaline water.Also, fluoride content of all water samples fell within the standard limit of NSDWQ (1.5 mg/l). The presence of fluoride above standard may bring skeletal fluorosis, in which fluoride builds up in the bones. The coppercontent of all the water samplesused in this study agrees with NSDWQ standard of 1 mg/l. Copper is an important element for living organisms, including both humans and animal, and need in small quantity to supplement our diet to ensure good health. However, high amount of copper can cause unfavourable effects of health, including malaria, headache, stomach problem, and nausea. It has also been associated with hepatitis and kidney disease. The water samplesthat were used in this study have undetected colour which is in agreement with the standard colour of 6 TCU by WHO and 5 TCU by NSDWQ (Isa. *et al*,2013)

## Conclusion

The major aim of physicochemical analysis is to prevent physical changes as well as chemical contamination of drinking water, so as to protect the life of people in a society. In this study, seven samples were collected from different areas within Maiduguri Metropolis and analysed for physicochemical parameters. However, with the exception of S4, none of the sample meets the standard requirement set by both WHO and NSDWQ. Therefore, it is recommended in this study, to create awareness among the residents of the studied area about the need to purify water from boreholes before utilized for drinking and domestic purposes.

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