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# Physicochemical Analysis of Some Sachet Water Samples Available in Maiduguri, Borno State

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***Abstract:*** *The physicochemical analysis of some sachet water samples available from four different manufacturing companies available in Maiduguri, Borno State. The sachet waters are Rampoly water, Kuru water, Rahama water and Fell Free water labeled as sample 1, 2, 3, and 4 respectively. The physicochemical parameters of the samples were determined using assorted standard methods in which turbidity was reported to be 0.00, 0.00, and 0.00NTU for samples 1, 2, and 3 respectively which are absent or not detected. Similarly, sample 4 had a low value of 0.26 NTU. Some heavy metals were also estimated and the mean values of the metals Fe and Zn for the study samples were obtained to be 1.02mg/l and 0.59mg/l respectively. Pb has not been detected in all the samples. Other parameters were relatively within the condonable ranges of the WHO and NAFDAC standards for permissibility of drinking water and domestic uses.*

***Keywords****: Physicochemical, concentration, impurities, metals, mean value, heavy metals.*

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## INTRODUCTION

Water is the basic needs for living organisms in the world. People consume water daily for domestic, industrial, and agricultural activities. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life (Oluduro and Adenye, 2007). Natural water contains some types of impurities whose nature and amount vary with source of water. Metals for example, are introduced into aquatic system through several ways, which include, weathering of rocks and leaching of soils, dissolution of aerosol particles from the atmosphere and from several human activities, including mining, processing and the use of metal-based materials (Ipinmoroti and Oshodi, 1993; Asaolu et al. 1997). Metals after

entering the water, many can be taken up by fauna and flora and eventually, accumulate in marine organism that are consumed by human being (Asoalu et al, 1997).

The increased use of metal-based fertilizer in agriculture revolution could result in continued rise in concentration of metal pollutions in fresh water reservoir due to the water run-off. Also fecal pollution of drinking water causes water-borne disease which has led to the death of millions of people both in cities and villages (Asoalu, 2008). The discharge of these wastes may affect the aquatic of such river adversely and alter the chemical composition of the river (Adewoye, 1998). Water quality characteristic of aquatic environment arise from a multitude of physical, chemical and biological interaction (Deuzane, 2007). The water bodies, rivers, lakes, dams and estuaries are continuously subject to dynamic state of change with respect to the geological age and geochemical characteristics. This is demonstrated by continuous circulation, transformation and accumulation of energy and matter through the medium of living organisms and their activities. The dynamic balance is the aquatic ecosystem is upset by human activities resulting in pollution, which is manifested dramatically as fish kill, offensive taste, odour , colour and unchecked aquatic weeds (Asoalu, 2008).

**SOURCE OF WATER**

Basically, there are three main sources of water, these are:

- Rain-water
- Surface water
- Underground water

**Rain water**: Is regarded as the pure form of natural water, however, it can be contaminated by dissolved gases such as carbon dioxide ($CO_2$) and sulphur dioxide ($SO_2$) which combine with hydrogen ion ($H^+$) to form acid rain (Holderness, 2012).

**Surface water:** Surface water is mainly water from rivers, lakes, streams; oceans etc. surface water is the water, which falls to penetrate into the soil, but stays stagnant or flows along surface of the ground for some time (Howard, 2015).

**Underground water:** Underground water is found naturally as springs and artificially as well or borehole water. Underground water acts as a reservoir since its availability is not seasonal as rain or surface water (Howard, 2015).

**MATERIALS AND METHODS**

**SAMPLE COLLECTION**

This piece of work deals with analysis of some sachet waters available in Maiduguri town of Borno state. In view of this, four samples were bought from different places and of different sources. These are Rampoly water, Kuru water, Rahama water and Feel Free water. These samples were obtained in Maiduguri town. In other to avoid contamination a sterilized and

labeled containers 1, 2, 3 and 4 were used for identification and were transported to NAFDAC Maiduguri north east zonal office, Geology Department in the University of Maiduguri and Maiduguri Water Treatment Plant for further analysis and processing.

**SAMPLE ANALYSIS**

A total of seven physical parameters were determined in water samples using HANNA products, for temperature, pH, Dissolved Oxygen (DO), Total Dissolved Solid (TDS), conductivity and turbidity. Three heavy metals were determined in the same samples (Zn, Fe and Pb), using LaMotte smart spectrophotometer.

**PROCEDURES**

The following procedures were applied in the determinations of the heavy metals in water samples.

**DETERMINATION OF LEAD**

A universal sample tube was rinsed with 10ml of sample water and scan blanked then it was removed 5ml of sample was removed using a syringe and was discarded, 5ml of the sample in the tube was transferred into the tube. A 5ml buffered ammonium chloride was added to fill the 10ml line of the tube; the sample was swirl to mix. 3 drops of 10% sodium cyanide was added. Sample was swirled to mix again. A 0.5ml pipette was used to add 0.5ml PAR indicator then swirled again. Another 0.5ml pipette was used to add 0.5ml stabilizing agent. The sample was capped and mixed then inserted into the sample chamber and scanned and the result was recorded as reading A. sample was removed from the sample chamber, three drops of DDC reagent was added. The sample was capped and swirled then subjected for analysis. The result was recorded as reading B.

mg/l lead = reading A – reading B.

**DETERMINATION OF ZINC**

A universal sample tube was rinsed with sample water and filled with it to the 10ml line. It was inserted into the sample chamber and scan blanked at the zinc test menu. The sample was removed from the chamber and a 0.5g sodium ascorbate powder was added to the sample using a 0.5g spoon. The sample was capped and shook vigorously then 3 drops of 10% sodium cyanide was added. The sample tube was capped and swirled. 1ml of dilute zinc indicator solution was also added using a 1ml pipette the sample tube was capped and mixed again. A plain pipette was used to add four drops of 37% formaldehyde solution, the sample was capped and inverted 15 times then it was inserted into the sample chamber and scanned, the result was recorded in mg/l.

**DETERMINATION OF IRON**

A sample tube was rinsed using the sample water then it was scanned blank at the iron test menu. Sample was removed and 0.5 ml of iron reagent was added to the sample using a 0.5ml pipette. The sample was capped and mixed; a 0.1g iron 2 powder was added. Sample was

capped and swirled then shook vigorously for three minutes for maximum colour development sample was immediately inserted into the sample chamber and scanned. The result was recorded in mg/l.

**DETERMINATION OF ELECTRICAL CONDUCTIVITY pH, TDS AND TEMPERATURE**

The sample cell was filled to 25ml mark, the switch of the combo pH and EC was turned on. The sensitive probe was inserted into the sample water, using the set/hold bottom scroll and gets the parameters, the instrument then displays the values of the parameters.

**DETERMINATION OF TURBIDITY (USING TURBIDITY METER)**

A sample cell was rinsed with sample water and 10ml of the sample water was put and covered. It was then slot into the chamber and the power was turned ON, it displays SIP (sampling in progress) for some minutes and later the reading was displayed.

**DETERMINATION OF DISSOLVED OXYGEN (DO)**

Using an instrument Mettler Toledo, a beaker was filled with sample water and the instrument was inserted into the water and was turned ON. The reading is then displayed on the meter.

**DETERMINATION OF BIOLOGICAL OXYGEN DEMAND (BOD)**

The Biological Oxygen Demand was determined by measuring the Dissolved Oxygen (DO) level in the sample collected using an instrument mettler Toledo and comparing it to the dissolve oxygen level in a sample that was collected at the same time but incubating under specific condition (wrapped with black polyethene bag to prevent penetration of light for 5 days.

## RESULTS AND DISCUSSION

**TABLE 1 SHOWS THE PHYSIO-CHEMICAL PARAMETERS OF THE SAMPLES**

| Parameters | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Standard value |
|---|---|---|---|---|---|
| Temperature ($^{o}$C) | 28.9 | 30.3 | 29.9 | 28.1 | Ambient |
| pH | 7.01 | 7.21 | 7.81 | 7.43 | 7.0 – 8.5 |
| TDS mg/l | 7 | 81 | 37 | 85 | 100 |
| Conductivity (NS/cm) | 15 | 162 | 75 | 174 | 100 – 500 |
| Turbidity (NTU) | 0 | 0 | 0 | 0.26 | 5 |
| DO (mg/l) | 2.0 | 2.1 | 1.8 | 1.7 | 0.5 – 2 |
| BOD (mg/l) | 0.7 | 1.0 | 0.9 | 0.4 | 0.5 - 2 |

Table 2 shows the concentration of the heavy metals Fe, Pb and Zn in the four samples.

| Metals | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Standard Values |
|---|---|---|---|---|---|
| Fe (mg/l) | 0.19 | 0.16 | 0.74 | 0.03 | 0.30 |
| Pb (mg/l) | ND | ND | ND | ND | 0.01 |
| Zn (mg/l) | 0.22 | 0.07 | 0.23 | 0.07 | 5.00 |

ND = Not Detected

**DISCUSSION**

The results as observed in table 1 presented fair criteria especially with respect to temperature, pH, conductivity and BOD which had all the value within the acceptable ranges for drinking water and aquatic lives. Sample 4 has the highest value for Total Dissolved Solid (TDS) and conductivity, although all fall below the WHO acceptable values of 100mg/l and 100-500mg/l for TDS and conductivity parameters respectively. Sample 2 gives the highest value of 2.1NTU for DO followed by sample 1 with 2.0NTU and least value was observed from sample 4 with 1.7NTU as in line with the standard value. As recommended by both WHO and NAFDAC (Federal Ministry of Environment, 1992).

Similarly, table 2 shows the metal concentrations of the studied samples with respect to Fe, Pb and Zn. Iron (Fe) was found to be lower of all the samples estimated with the value of 0.19mg/l, 0.16mg/l and 0.03mg/l with exception of sample 3 which is far above with the value 0.74mg/l.

Lead (Pb):- the concentration of Pb in all the samples were not detected, while the permissible value of WHO standard is 0.01mg/l, which is very negligible. This shows clear indication that all the samples are good for health, because lead (Pb) is very toxic and dangerous. Zinc (Zn): - The concentration of zinc in all the samples considered, though all the values fall below the admissible limit of 5.0mg/l, the highest value of 0.23mg/l was recorded in sample 3 and the least 0.01mg/l was seen in sample 2.

In conclusion, the concentration of the determined heavy metals Fe, Pb and Zn for the four samples under study with least concentration not health threatens except Fe in sample 3 which presented value above WHO standard.

**CONCLUSION**

From all the water samples analyzed, it shows that only Fe in sample 3 exceeds the WHO standard values, but for the rest of the samples they all falls within the acceptable ranges. This show a clear indication that the water samples are free from contamination and are healthy and safe for drinking.

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