Physicochemical Analysis of Bore-Hole Water in D/Line Area of Port Harcourt. Nigeria.

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Abstract- Domestic water in the D/line area of Port Harcourt was assessed for portability by analysing water samples from four selected bore holes chosen at random to see how safe they are drinking. Results obtained from this study compared well with permissible limits for safe drinking water as provided by NAFDAC, SON, and WHO. Results also showed pH values ranging from 3.5 – 5.7, for total alkalinity range within 16mg/l – 20mg/l. Total dissolves solids from 0.08mg/l – 1.20mg/l. Total hardness range between 9mg/l and 17mg/l while calcium hardness range between 6mg/l and 11mg/l. All the samples from B_1 – B_4 were slightly acidic. The study showed that water from these bore holes did not meet the standard parameters for safe drinking water. It is therefore recommended that in future studies boles in the area should be monitored and further treated to avoid break out of disease epidemic within the study area.

Index Terms- Bore-hole water, physico-chemical parameters, NAFDAC, Analysis, domestic water.

I. INTRODUCTION

Water is a universal solvent that dissolves all solutes. Bore-hole water forms a major source of domestic, industrial and agricultural water sources globally [1]. As a result of rapid population growth in the world, and accelerated industrialisation, there is an increase in demand and use of fresh water. The purity and quality of ground and surface water is constantly affected due to pollution caused by improper waste disposal methods both in urban and rural areas. [1, 2]. The D/line dwellers are affected by a lot of urban pollutants ranging from chemical wastes from industries to human wastes. The study area lies between latitude 4.5^o and 5.0^o N of the equator and on longitude 7.0^o E of the Greenwich meridian. Literature has shown that drinking water is easily exposed to water-borne diseases [2, 4, 5]. The complaints and health conditions of the inhabitants of this area necessitated this study. The study therefore, provides baseline information for the physicochemical analysis of the main sources (bole holes) of drinking water supply in the D/line area of Port Harcourt, Nigeria.

II. MATERIALS AND METHODS.

Water samples were selectively collected from four different bore-hole locations (B1 – B_4) in the D/line area of Port Harcourt, Rivers state Nigeria. Each water sample was collected in a clean 1 litre plastic container. Parameters selected for estimation of water quality were pH, temperature (T), electrical conductivity (EC), salinity (S), total dissolved solids (TDS) chlorides $(CI)^-$, total alkalinity (TA), total dissolved oxygen (DO), and biochemical oxygen demand (BOD), the containers were stored in a refrigerator for physicochemical analysis in the laboratory.

III. RESULTS.

The results of the variables measured in the bore-hole water samples from the study area.

Table 1: Variables measured from water samples. Parameters detected.

	B_1	B_2	B_3	B_4	Mean	SD
Temperature (^{o}c)	26	27	27	28	27	13.5
TDS (mg/l)	1.2	0.08	0.08	0.08	0.57	0.28
Conductivity Ec (µs/cm)	3.5	0.13	0.13	0.13	0.96	0.48
Chlorides (mg/l)	85	50	37	55	56.7	28.35
Total hardness (mg/l)	13	14	9	17	13.3	6.65
pH	3.9	3.6	3.8	5.7	4.3	2.15
Total alkalinity (mg/l)	20	16	16	18	17.5	8.75

Table 2: Standard for portable water [3, 6].

Parameter	NAFDAC	SON	WHO
TEMP ^{O}C	–	Ambient	28
pH	6.5 – 8.5	6.5 – 8.5	7.0 – 8.5
Electrical cond. (µs/cm)	1000	1000	1,200
Total dissolve solids (mg/l)	100	500	1000
Total hardness (mg/l)	100	100	100
Chlorides (mg/l)	100	100	250
Total solids (mg)	500	-	-
Total alkalinity (mg/l)	100	-	-

IV. DISCUSSION

The pH of the water samples from the area surveyed ranged from 3.6 to 5.7. The mean value is at 4.3, which shows that drinking water in D/line area is slightly acidic and therefore not conducive for drinking as well as for other domestic purposes. The water may thus be considered to be acidic for human consumption which could result to an ill health especially acidosis [7, 8]. Drinking water should have a temperature of $27^{o}c$ which is ideal and falls within acceptable standards. [9, 10, 11] TDS values were uniform at 0.08mg/l in B_2, B_3 and B_4 with mean value 0.57mg/l. the amount of total dissolved solids in water is generally determined by many factors which include temperature, atmospheric pressure, salinity, hardness etc. [12]

Their concentrations showed no adverse physiological effect on humans as total alkalinity obtained in this study was 17.5mg/l. Conversely, water saturated with dissolved oxygen is best for humans, fish and other aquatic organisms. However drinking water has no specific guidelines for dissolved oxygen [5, 14, and 15]. High pH values could cause corrosion to metals while lower values tend towards acidity.

Hardness of water above the standard limits of 100 – 500mg/l is not acceptable for drinking [13, 14] therefore hardness of water in this area is moderate. The table below explains all hardness of water which is in conformity to safe drinking water guidelines [1, 9]

Table 3 shows safe drinking water guidelines

Hardness (mg/l CaCO$_3$)	Classification
0 – 75	Soft
75 – 150	Moderately hard
150 – 300	Hard
Over 300	Very hard

V. CONCLUSION

The results from the analysis of D/line bore-hole water shows that the water can be reduced by adding lime to increase in the pH of the water. The water is not completely safe and can cause water-borne disease in both long and short term consumption.

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