Evaluation of Water Quality in Selected Communities in Obio/Akpor L.G.A, Rivers State

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ABSTRACT

The physico-chemical and microbial quality of ground water in Obio/Akpor, Rivers State were examined between September to October 2016. Five commercial borehole from 5 selected communities were analysed for various physico-chemical parameters using standard methods. The result values showed that the pH ranged from 5.6 – 6.97 with a mean value of 6.26, conductivity (30 – 91$\mu s/cm$), with mean value of 52$\mu s/cm$, TDS (11.00 – 20mg/L) with mean value of 144mg/L, TSS (7.00 – 11.00mg/L), with mean value of 8.8mg/L, COD (15.00 – 21.00mg/L), with mean value of 16.96mg/L, BOD (6.04 – 11.00mg/L), with mean value of 7.74mg/L, DO (4.50 – 5.00mg/L), with a mean value of 5.17mg/L, Turbidity (0.04 – 0.3NTU), with mean value of 0.4NTU, Alkalinity (3.20 – 4.80mg/L), with mean value of 4mg/L, Total hardness (0.30 – 4.00mg/L), with mean value of 2.08mg/L, Temperature (24 – 280C) with mean value of 260C. The bacteriological analysis results ranged from 1/100ml – 1,100/100ml for total coliform count and < 3/100ml – 91/100ml for faecal coliform count these values where within WHO/NDWQS/ FEPA permissible limits. The results of bacteriological analysis were not acceptable since they were all found to yield moderate to heavy growth of bacteria thereby making the water unfit for human consumption. It is recommended that strict laws should be enacted to ensure that water is treated regularly and checked by the regulatory authorities to forestall future occurrence.

Keywords: *Communities, microbal properties, borehole water, WHO and physico-chemical.*

INTRODUCTION

Water is a valuable natural resource that is essential to human survival and the several ecosystem healths. Two main sources of water are surface water (stream, lake, river, reservoir, ocean) and ground water (boreholes, wells). Ground water provides one of the important sources of water for human (Taiwo *et al*, 2015).

In Nigeria borehole water now serves as the easily accessed and sheep commercial source of drinking water for a greater number of about 140 million people. Therefore, the conformation of these sources of water to physico-chemical and microbiological properties of surface water and borehole water in Niger Delta areas (Ohagi and Akujieze, 1989; Ibe and Sowa, 2002; Nwidu *et al*, 2006; Ayotamuno, 1994). According to Ehirim and Ebeniro (2013) Port Harcourt and its environs has unconsolidated moderately porous and permeable sand with centicular clay and shales at depth up to 50m. Therefore, access to safe drinking water is essential to health, a basic human right and a component of effective policy for health protection (WHO, 2011).

Therefore, this brings the necessity of examining the water quality parameters of borehole water quality with special study interest on selected communities in Obio/Akpor Local Government Area in Rivers State, with a view to accessing their level of purity. Hence the study is aimed at the physico-chemical and microbiological properties of the borehole water from selected communities in Obio/Akpor Local Government Area of Rivers State.

MATERIALS AND METHODS

Study Area

Obio/Akpor is one of the Local Government Area Councils in Rivers State with an area of 260km^2 and a population of 878,890 from 2006 census. It is located between latitudes 4^{0}45'N and 4^{0}60'N and longitudes 6^{0}50'E and 8^{0}00'E. The geographical coordinates of communities: Alakahia, Rumuosi, Rumuekini, Choba and Rumualogu where the sampling was carried out

have the following coordinates: Alakahia $4^0$53'01,7"N, $6^0$55'19,6"E, Rumuosi $4^0$52'48,4"N, $6^0$56'27,9"E, Rumuekini $4^0$53'10,4"N, $6^0$56'27,2"E, Choba $4^0$53'22,0"N, $6^0$54'13,22"E and Rumualogu $4^0$52'35,6"N, $6^0$55'16,1"E (Fig. 1).

Field and Laboratory Procedures

Five borehole water samples were collected twice, randomly within some selected communities in Obio/Akpor Local Government Area. These communities were Choba, Alakahia, Rumuosi, Rumuekini and Rumualogu. One bottle of water sample measuring 2 litres was collected at each borehole site, labeled according to the stations and stored in an ice box for preservation at a relatively constant temperature.

The physico-chemical parameters that were analysed are temperature in in-situ, biological oxygen demand, dissolved oxygen, pH, conductivity, total hardness, alkalinity, turbidity, chemical oxygen demand, total suspended solids and total dissolved oxygen.

All the parameters were measured in mg/L except temperature which was measured in in-situ.

The physico-chemical parameters were determined according to the procedure outlined in the standard methods for the examination of water and waste water (APHA, 1998).

Microbial Analysis for Total and Faecal Coliform

Two microbial analysis of the sample were used, such as faecial coliform count both were incubated for 24 and 48 hours at 37^0C, using confirmed test plates of erosin methyl one blue agar for faecal coliform count while completed test of nutrient agar slant culture was used for total coliform count (Nwala *et al*, 2007).

RESULTS/DISCUSSION

The results of physico-chemical parameters and microbial analysis of borehole water samples from Obio/Akpor community are presented in Table 1, 2 and mean values in Fig. 2 respectively.

Table1. *Results of the physico-chemical analysis of borehole water in Obio/Akpor*

Samples/ Station	Alakahia	Rumuekini	Rumualogu	Rumuosi	Choba	Mean Density	WHO/ NSDWQ
pH	5.91	6.97	6.94	5.94	5.54	6.26	6.5-8.5
Conductivity μs/cm	30	50	10	90	80	52	250
TDS mg/L	12.00	10.00	10.00	20.00	20.00	14.4	500-1000
TSS mg/L	10.00	8.00	8.00	10.00	8.00	8.8	5
COD mg/L	16.00	16.00	20.80	16.00	16.00	16.96	10
BOD mg/L	7.04	10.24	8.32	6.40	6.72	7.74	> 6
DO mg/L	5.20	5.20	5.44	4.96	5.04	5.17	-
Turbidity (NTU)	0.04	0.04	0.04	0.04	0.04	0.4	5
Alkalinity mg/L	4.80	4.00	4.00	3.20	4.00	4	200
Total hardness mg/L	4.00	2.40	0.40	0.40	3.20	2.08	100-300
Temperature ^{0}C	26	24	26	28	26	26	-

Table2. *Microbal results from five boreholes in Obio/Akpor LGA*

Samples/ Station	Alakahia	Rumuekini	Rumualogu	Rumuosi	Choba	WHO Standard
Total coliform	1/100mL	1,100/100mL	43/100mL	4/100mL	<3/100mL	0
Faecal coliform	<3/100mL	91/100mL	20/100mL	<3/100mL	<3/100mL	0

The physico-chemical parameters determined during the two (2) months, September – October, 2016 sampling periods of five boreholes water samples from five communities in Obio/Akpor Local Government Area showed pH ranged from 5.54 – 6.97 with mean value of 5.93, conductivity (11.00 – 91.00 μs/cm), with a mean value of 52.8 μs/cm, TDS (11.00 – 14.00)mg/L with mean value of 12.6mg/L, TSS (7.00 – 11.00)mg/L, with a mean value of 8.8mg/L, COD (15.00 – 21.00)mg/L,

with mean value of 17mg/L, BOD (6.04 – 11.00)mg/L, with mean value of 7.64mg/L, DO (4.50 – 5.30)mg/L, with mean value of 5.1mg/L, turbidity (0.3 NTU), with mean value of 0.3 NTU, alkalinity (3.80 – 4.60)mg/L, with mean value of 4.18mg/L, total hardness (0.30 – 4.00)mg/L, with mean value of 2.14mg/L and temperature (24 – 28)^{0}C, with a mean value of 25.4^{0}C (Table 1 and Fig. 2) Values of microbial analysis ranged from 1/100mL – 1,100/100mL

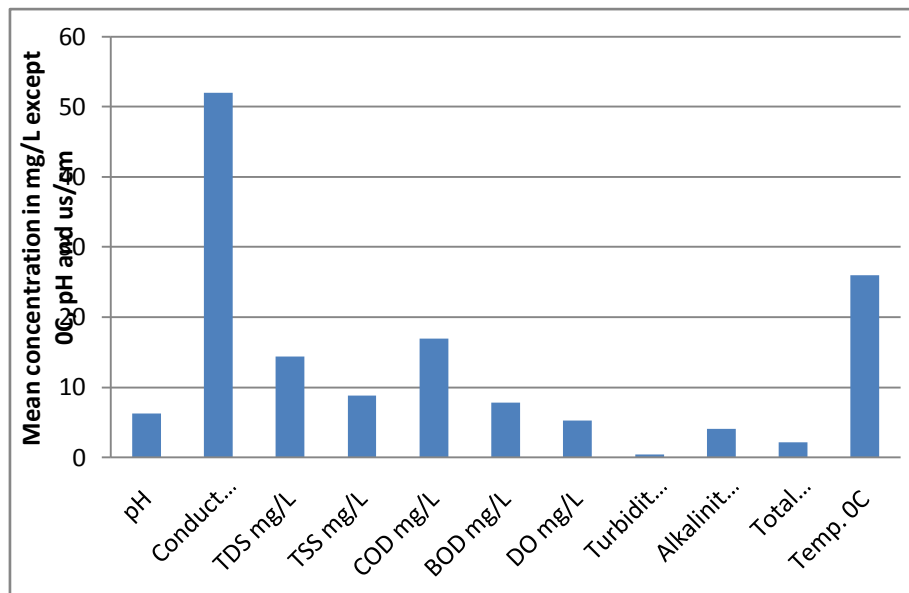for total coliform count while faecal coliform count ranged from <3/100 – 91/100mL (Table 2).

Figure2. *Mean values of physico-chemical parameters of five borehole water samples in selected communities in Obio/Akpor L.G.A.*

DISCUSSION

Conductivity recorded the highest values in most parameters in Rumuosi although most of them were still within permissible limits, the pH value in the study area conforms WHO and NSDWQ standard for drinking water. Although pH usually has no direct impact on consumers, it is one of the most important operational water quality parameter (WHO, 2003). BOD recorded its highest value of 11.00mg/L in Rumuekini borehole, which is less than six (6) WHO/NSDWQ. All other parameters were within stipulated safe limits for drinking water in Nigeria by (NIS, 2007 and FEPA, 1991). Most of the values obtained in the present study were not far from similar studies in the Niger Delta area (Ohagi and Akujieze, 1989, Onyeike *et al*, 2002). However the study of groundwater in Port Harcourt by Woke & Babatude (2015) and in Yenegoa by Agbalagba *et al* (2011) showed more acidic groundwater water samples. Turbidity and TDS values were within the range of values obtained from the studies (Balogun *et al*, 2014) on drinking water in Abeokuta.

Therefore turbidity of >0.05 NTU is considered unhealthy, while TDS values were very far below the WHO recommended guideline value of 1000mg/L low TDS is said to be a characteristic of hills and upload areas that represent areas of recharge (Olobaniyi *et al*, 2007). The levels of dissolved oxygen recorded agreed with the report of Akhionbare, (1998) and was higher than the minimum 5mg/L acceptable for safe drinking water by NIS and FEPA. Ohwo and Abel (2014) opined that dissolved oxygen is necessary for good water quality and lack of oxygen in body tissues creates a defect of real blood cells. Therefore oxygen availability in an aquatic ecosystem is an indication of the systems health and general well-being. This is further supported by the Prati *et al*, (1971) scale of classifying safe water.

The values obtained for both total and faecal coliform counts for all sample stations were far above acceptable limits as specified by WHO (2006) and FEPA, (1991) for drinking water, the presence of E. coli implies faecal contamination of the water samples analyzed in the present study and strongly suggests the possible presence of enteric pathogenic bacteria as well as other parasites.

The evaluation of the physico-chemical and microbial parameters of borehole water sampled in five communities in Obio/Akpor LGA showed that most of the physico-chemical parameters of the borehole water samples were within the federal/international standards limits for drinking water and compared closely to other reported values for the same parameters in the Niger Delta region where the study area is located. However, results of the total and faecal coliform failed expected maximum limit for safe drinking water by federal/international standards. Therefore, the bacteriological analysis results of

the selected borehole water samples were not acceptable since they were all found to yield moderate to heavy growth of bacteria thereby making them unfit for human consumption. We therefore advocate for safe water policy redress and enforcement of standards on commercial water sold to the public and strict laws should be enacted to ensure that water should be treated regularly and that it should be done as at when due.

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