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Research Article

ASSESSMENT OF GROUNDWATER QUALITY IN PARTS OF AIR-PORT ROAD OMAGWA IN OBIO/AKPOR LOCAL GOVERNMENT AREA, RIVERS STATE

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ABSTRACT

Groundwater quality assessment was carried out in parts of Airport Road, Rivers State. The study area lies between between lies between latitudes 4°52´N and longitudes 6°57´E in the South-South Nigeria. This study was carried out to determine groundwater quality in the area with a view to assessing its suitability for various uses when compared to internationally acceptable standards. Twelve (12) spring water samples were collected at source. The samples were then stored in a cooler and transported to the laboratory for analysis using International regulatory methods. From the result, the study has revealed that groundwater from the area is generally characterized by low pH. The water is mildly acidic to alkaline due to dissociation of bicarbonate. Except for the low pH values and local occurrences of relatively high iron content, groundwater within the study area possesses chemical qualities compatible with the WHO standard (2006) for drinking water.

Keywords: Groundwater; Chemical Qualities; pH Values; World Health Organization (WHO)

INTRODUCTION

Water is vital for man's existence and without it there would be no life on earth. Water has numerous applications ranging from domestic applications like drinking, cooking, washing and bathing to agricultural and industrial applications like irrigation, power generation and industrial production. There is approximately 1.4 × 109 cubic kilometers of water on planet earth in the form of oceans, seas, rivers, lakes, ice etc but only 3% of the total quantity of available water resources is in the form of fresh water found in rivers, lakes and groundwater. Fresh water which is needed for clean water supply is limited but its demand far exceeds its supply due to increasing population and industrialization (American Water Works Association, 1981).

This research study is aimed at assessing the quality with a view to assessing its suitability for various uses when compared to internationally acceptable standards and investigating the interaction between the different chemical components of the groundwater and recommend appropriate treatment for parameters which exceed their highest desirable levels in the water. The study area is one of the coastal cities in the southern part of Nigeria is located within the oil rich Niger Delta Sedimentary Basin. Generally, the Delta is characterized by three formations, namely Akata (oldest), Agbada and Benin (youngest). These formations consist primarily of regressive Tertiary age sediments. The basal Akata Formation consists of low density, high pressure, shallow marine to deep water shales (Schield, 1978). The Agbada Formation consists of alternating deltaic (fluvial, coastal, fluviomarine) sands and shale.

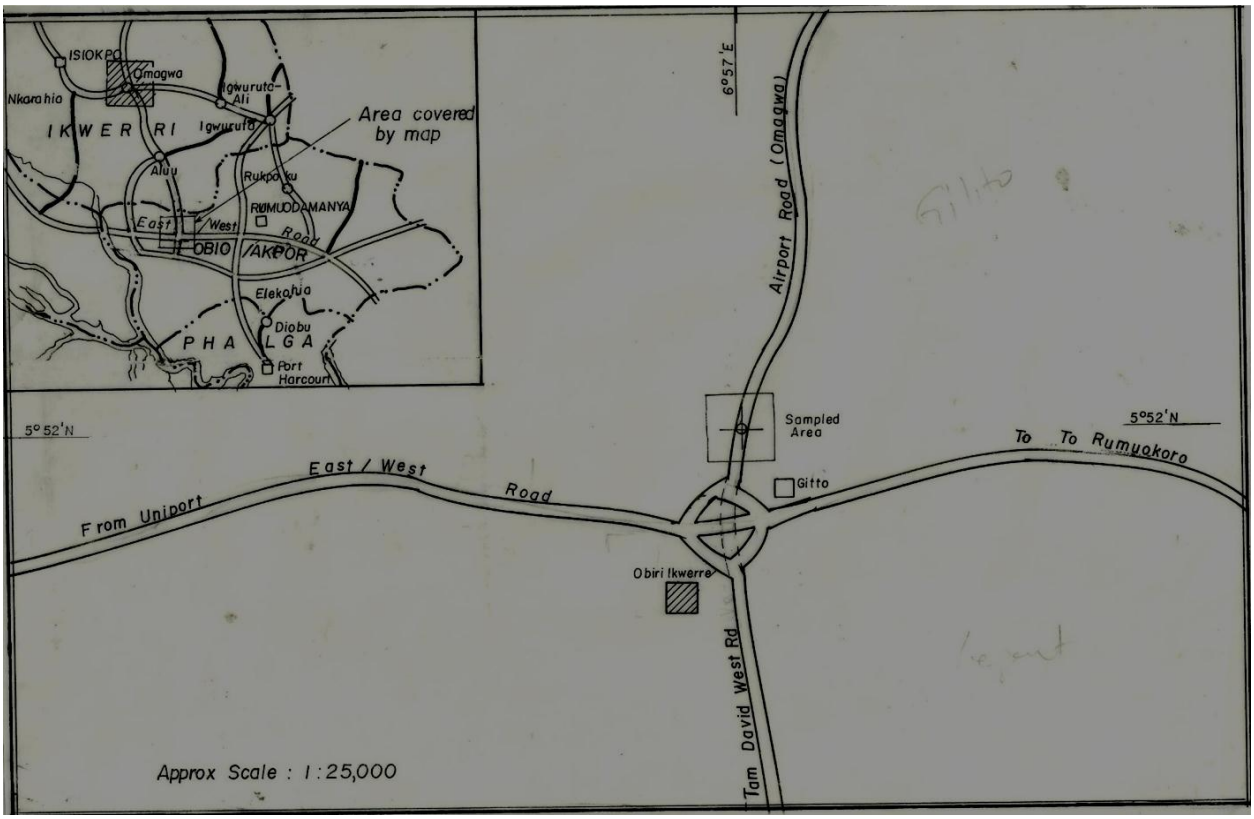

Figure 1: Location map of the study area

METHODOLOGY

This study was carried out in stages that included;

- desk study,
- field sampling,
- laboratory analysis and
- data interpretation using standard methods.

- Twelve (12) borehole water samples were collected at source. The water samples were collected in thoroughly cleaned plastic containers of 0.5 liter capacity provided with double cap devices.
- The samples were collected up to top without leaving any space so as to prevent premature release of dissolved gases during the transit period.
- The samples were preserved with few drops of Nitric acid (HNO_3). After sampling, the lids of the

containers were immediately replaced to minimize contamination and escape of gases.

- The samples were then stored in a cooler and transported to the laboratory for analysis. The evaluation of water quality was in accordance with regulatory standard.

Parameter	Measurement/Analytical Method	Standard used
pH	Digital pH meter	APHA 4500H
Temperature	Mercury-in-glass thermometer	-
Conductivity	Digital conductivity meter	APHA 2510B
Ca^{2+}, Mg^{2+}	Flame photometer	ASTM D511-93
As^{2+}	Colorimetric method	-
Cu^{2+}, Ni^{2+}, Fe^{2+}, Pb^{2+}, Zn^{2+}, Cr^{2+}, Cd^{2+}, Mn^{2+}	Atomic absorption spectrophotometer	ASTM D858, ASTM D1068, ASTM D4192-97
Total Dissolved Solids (TDS)	Filtration and evaporation method	APHA 2130B
Total Hardness	Titration method	APHA 2340B
SO_4^{2-}	Turbidimetric method	ASTM S-516
Cl^-	Silver nitrate titration	ASTM 512 B
NO_3^-	UV-Spectrophotometric method	APHA 4500- NO_3B
PO_4^{3-}	Ascorbic acid method	APHA 4500 PE

Table 1: Analytical methods used for the analyses of groundwater samples

RESULT

S/N	Sample ID	Temp (^0C)	pH	Conduct µs/cm	Suspended Solids	Total Hardness	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	Cl^{-}	PO_3^{-}	SO_4^{2-}	NO_3^{-}	HCO_3^{-}
1	WS 1	23.5	6.6	42.0	96.0	12.0	11.2	5.52	6.56	1.84	6.0	6.64	7.21	**0.12**	35.0
2	WS 2	24.2	6.8	43.0	98.0	44.0	7.8	4.87	7.02	3.91	13.0	18.09	4.15	6.21	40.0
3	WS 3	25.7	7.2	42.0	112.0	17.0	3.5	6.26	9.73	2.96	15.0	14.23	11.25	0.87	25.0
4	WS 4	25.7	7.5	23.0	116.0	34.0	2.8	4.89	7.89	5.65	12.0	4.48	13.71	1.78	15.0
5	WS 5	24.8	6.3	36.0	90.0	56.0	9.2	6.67	8.1	3.98	19.0	3.97	8.21	3.98	20.0
6	WS 6	24.4	7.6	67.0	96.0	23.0	12.9	7.53	9.78	7.43	10.0	5.15	7.65	2.26	20.0
7	WS 7	25.2	7.8	50.0	96.0	32.0	13.9	1.24	5.67	1.18	14.0	12.54	6.47	1.19	10.0
8	WS 8	23.9	6.7	26.0	113.0	30.0	6.7	0.98	5.09	2.36	17.0	9.4	9.98	2.09	30.0
9	WS 9	24.8	7.7	20.0	101.0	18.0	10.5	3.78	8.85	2.76	3.0	3.9	4.00	3.65	35.0
10	WS 10	25.5	6.9	119.0	117.0	44.0	8.5	6.31	7.85	0.45	18.0	8.78	8.46	2.34	40.0
11	WS 11	23.6	7.0	87.0	99.0	22.0	7.5	5.57	5.98	0.78	22.0	13.35	8.87	3.46	25.0
12	WS 12	24.8	7.4	55.0	93.0	31.0	8.5	4.84	6.80	2.63	16.0	12.98	6.56	1.16	20.0
	WHO Standard (2006)		**6.68**	**1400**	**-**	**-**	**-**	**-**	**200**	**-**	**250**	**-**	**500**	**50**	**-**
	Average	22.6	7.05	50.83	102.25	30.25	7.75	4,87	7.44	2.41	12.92	9.46	8.04	2.43	26.25
	Minimum	23.5	6.3	36.0	93.0	12.0	2.8	0.98	5.98	0.45	3.0	3.9	4.00	0.12	15.0
	Maximum	25.7	7.8	119.0	117.0	56.0	13.9	7.53	9.78	5.65	22.0	18.09	13.71	6.21	40.0

Table 2: Result of Water Quality Analysis in parts of Airport Road, Omagwa, Rivers State

SAMPLE ID	Cd	Cu	Pb	Zn	Fe
WS 1	Bdl	Bdl	0.07	0.04	0.21
WS 2	Bdl	Bdl	0.03	0.03	0.74
WS 3	Bdl	0.01	Bdl	0.01	0.25
WS 4	0.08	0.01	0.08	0.03	0.73
WS 5	Bdl	0.01	0.08	0.02	0.68
WS 6	0.04	Bdl	Bdl	0.04	0.08
WS 7	0.05	0.01	0.05	Bdl	0.05
WS 8	0.03	0.01	0.02	Bdl	1.32
WS 9	0.03	0.02	Bdl	0.04	1.11
WS 10	Bdl	Bdl	0.04	Bdl	0.59
WS 11	0.12	0.02	Bdl	Bdl	0.17
WS 12	0.06	0.03	0.04	0.02	0.05
15	0.02	0.03	0.01	Bdl	Bdl
WHO Standard (2006)	**0.005**	**1.0**	**0.01**	**5.0**	**0.3**
NIS Standard (2004)	**0.01**	**1.0**	**0.05**	**5.0**	**1.0**
Mean	0.05	0.02	0.05	0.027	0.61
Minimum	0.01	0.01	0.01	0.01	0.03
Maximum	0.12	0.03	0.08	0.04	23

Table 3: Result of Statistical Summary of Trace Metal Concentrations

This study has revealed that groundwater from the area is generally characterized by low pH. Except for the low pH values and local occurrences of relatively high iron content, groundwater within the study area possesses chemical qualities compatible with the WHO standard for drinking water. This implies that although groundwater may be suitable for use in irrigation, it would require various forms of treatment as may be applicable in the locality to adjustment of pH qualities to specifications needed for certain domestic and industrial purposes. Also, slightly high EC and chloride concentrations imply possible encroachment of saltwater into the groundwater.

CONCLUSION

Most of the hydrochemical parameters satisfy the WHO (2006) standards for drinking water, the concentration levels of Pb and Cd is slightly elevated in relation to WHO standard. Except for pH values that is mildly acidic in some locations, all the cations, anions and electrical conductivity are below the WHO (2006) recommended standards for drinking water. The water is mildly acidic to alkaline due to dissociation of bicarbonate and the following water facies: Na-SO_4-Cl, Na-HCO_3, Ca-Na-SO_4 and Ca-Mg-HCO_3-SO_4. The water is slightly acidic to slightly alkaline and could be classified as fresh water (Ezeigbo, 1989; Todd, 1980).These characteristics make the water suitable for both domestic and industrial usage. Among the trace elements only Cd, and Pb have concentration above WHO (2006) recommended limits.

RECOMMENDATION

Regular flushing of boreholes is advocated in order to aid in the removal of mineralized deposits accumulated over time in the groundwater. There is need for regular hydrogeochemical studies within the study area in order to detect any future deterioration of groundwater quality.

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