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Physicochemical Analyses of Hand-Dug Well Water In Egunughan Community, South-western Nigeria.

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***Abstract**: Ground water (Hand dug well water) in the Egunughan community of Emughan, Abua in Abua/Odual Local Government Area of Rivers State was assessed for potability purpose by analyzing the water for physico-chemical parameters. The results obtained were compared with the permissible limits for drinking water provided by World Health Organization (WHO), Standard Organization of Nigeria(SON) and National Agency for food and drugs Administration and control(NAFDAC). The results from Hand dug well water for the six samples range for pH, 4.8-6.8, Electrical conductivity (EC) 76-407µs/cm, Total dissolved solids(TDS), 50-274 mg/L, salinity(sal.).0.03-0.20‰,Temperature(T) 27.7-28.4^{O}C, Dissolved Oxygen (DO) 5.7mg/L, Biochemical Oxygen demand(BOD) 0.8mg/L, Total Hardness (TH) 7.7-88.1mg/L, Total alkalinity (TA) 8-44mg/L, and chloride (Cl^-) 5.9-84.4mg/L. The pH, the hydrogen ion concentration was high for the first well (W1) and W2, while slightly acidic for W4 and W6 hand-dug well. This means that the water samples are not suitable for drinking. Meanwhile, W3 and W5 are within permissible limits for drinking water. However, all the other parameters are within the guidelines. Nevertheless, these hand dug well water (W1–W6) should be monitored regularly to avoid pollution problems that would bring about water borne diseases in the community.*

***Keywords**: Ground water, physico-chemical parameters, Egunughan*

I. Introduction

Water is essential to all forms of life. Ground water forms a major source of drinking water; it is needed for domestic, industrial and irrigation all over the world [1].

In the last few decades, there has been a tremendous increase in the demand for freshwater, due to the rapid growth of population and the accelerated pace of industrialization. Human health is threatened by the unsanitary conditions through open drains carrying and dispensing waste water into natural water bodies. The availability and quality of ground water is affected, due to the oil pollution and improper waste disposal system, especially in the rural and oil producing areas [2]. According to world health organization (WHO), about 80% of all the diseases in human beings are caused by water (water borne disease). Once the ground water is contaminated, its quality cannot be restored back easily as well as to protect it. To communicate information on the quality of water to concerned citizens and policy makers, analysis of water is of utmost importance. The problems of groundwater quality are more acute in areas which are densely populated, with localization of industries [3]. Water for human consumption must be free from organisms and chemical substances in of concentrations large enough to affect health [4,5].

The addition of various kinds pollutants through sewage, industrial effluents, and agricultural run–off, oil explorations, oil spillages etc. into the water main stream brings about a series of changes in the physicochemical characteristics of the water, which have been the subject of several investigations [6,7,8].

Groundwater is obtained through hand dug wells, hand pump operated shallow wells and submersible pump operated deep well or boreholes. Hand-dug wells are divided into two kinds namely: shallow and deep wells.

The term physicochemical quality is used in reference to the characteristics of water, which may affect its acceptability due to aesthetic consideration as color and taste produced toxicity reactions.

Some physicochemical parameters of interest are temperature (pH), total dissolved solids (TDS), chloride(Cl^-), salinity(S), totahardness(TH), totalalkanity(TA), dissolved oxygen(DO), electrical Conductivity (EC), biochemical oxygen demand (BOD), and chemical oxygen demand.

In the Northwest of Nigeria, the pollution of ground water was traced to shallow water table that intercepts pit latrines and suck away pits [9].

In 2009, at Kaithal city in India, water samples were analyzed from twenty sampling points for physiochemical characteristics like pH, color, odour, hardness, chloride, alkalinity, TDS etc. On comparing the results against drinking water quality standard laid by the Indian council of medical

research (ICMR) and World Health Organization (WHO), it was found that some of the water samples were non-potable for human being, due to high concentration of one or the other parameter [10].

The world is on track to achieve the millennium development goal target, on free access to potable water. Water generally, is an indispensable substance for survival and growth of any living organism [11].

According to WHO, 2009, over 385,000 children die annually of various diseases due to drinking contaminated water. In Nigeria, the death toll from water borne diseases is not restricted to children alone, we have had of the epidemic cases of cholera killing both young and old due to drinking unhygienic water in the past. Isolated cases of cholera out break are reported periodically in the national dailies in Nigeria. Polluted water is potentially dangerous to health because of possible outbreaks of dysentery or cholera [2].

There was need to monitor water quality on regular basis. This is because cases of diarrhea affecting both children and adults are commonly reported in our hospitals especially in the rural areas where potable water is not available and untreated ground well water serve as one of the major sources of domestic water supply.

The addition of various kinds of pollutants and nutrients through uncensored human activities within and around the Egunughan community, into the water stream could have caused series of changes in the physico-chemical characteristics of the water. Therefore, there is need for assessment.

II. Materials And Methods

Study Area

Egunughan is in Emughan district of Abua in Abua/odual Local Government Area of Rivers State, the Orachi region of Niger Delta, South-South of Nigeria.

Abua lies between latitude 4.5^0 and 6.5^0N of the equator and between longitude 6^0E and 7^0E of the Greenwich Meridian.

Major occupation is farming. Farming of cassava for the production of garri and also produce cocoyam, plantain, banana, pineapple and fruits like ogbono and also, snail, fish production and timber.

Sampling Collection And Analysis

Water samples were collected from six locations (namely W1–W6) within the Egunughan Village of Emughan in Abua, Abua/odual Local Government Area of Rivers State, the Niger Delta region of Nigeria.

The selected parameters for estimation of water quality were pH, temperature(T), electrical conductivity(EC), salinity(S), total dissolved solids(TDS), chloride(Cl^-), total hardness(TH), total alkalinity(TA), dissolved oxygen(DO), and biochemical oxygen demand(BOD).

III. Results And Discussions

The results of the levels of the variables measured in the ground water (hand-dug wells) in the community are presented in the Table 1.

Table 1:Results of hand-dug well water parameters

	pH	EC	TDS	S	T	DO	BOD	TH	TA	Cl^-
W1	4.80	76	50	0.03	28.1	5.70	0.80	7.70	8	5.90
W2	5.80	140	92	0.07	27.8	5.70	0.80	34.50	24	11.90
W3	6.70	257	172	0.12	27.1	5.70	0.80	61.30	44	17.80
W4	6.00	176	115	0.08	28.1	5.70	0.80	30.70	8	12.80
W5	6.80	407	274	0.20	27.9	5.70	0.80	88.10	28	48.40
W6	6.00	122	81	0.08	28.4	5.70	0.80	19.20	24	8.90

Table 2: Standard for potable water

Parameter	NAFDAC	SON	WHO
Temperature ^oC		Ambient	28
pH	6.5 – 8.5	6.5 - 8.5	7.0-8.5
Electrical conductivity (µS/cm)	1,000	1,000	1,200
Total dissolve solids (mg/L)	100	500	1,000
Total Hardness (mg/L)	100	100	100
Chloride (mg/L)	100	100	250

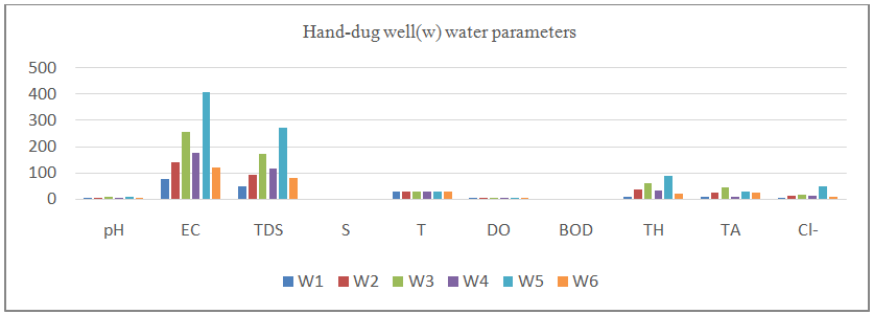

Figure 1: Water variables

The pH of hand-dug well water from the study community ranges from 4.8 to 6.8 This with mean value of 6.0. This shows that the surface water of the study area is slightly acidic in nature and two of the samples, W1 and W2 have high acidic values of 4.8 and 5.8 respectively compared to W6 and W4 which are slightly at 6.0 respectively, whereas the W3 and W5 at 6.7 and 6.8 respectively were within the guide line range, recommended by WHO, (2006), SON (2007), and NAFDAC (2001) guidelines.

Therefore, pH of the first and second samples, W1 and W2 are acidic and not good for drinking and domestic purposes. And also the samples of W4 and W6 are slightly acidic, therefore, not good enough for drinking and domestic purposes.

In the study area, the temperature of hand-dug well water ranges between 27.7^0C and 28.4^0C with a mean valve of 28^0C. Public Drinking waters should be of a temperature that is refreshing to the consumer.

Electrical conductivity gives the total concentration of the electrolytes. It depends upon the presence of various ionic species. It ranges from 76µS/cm in W1 to 407µS/cm in W5 with a mean valve of 196.3µS/cm. This increases with increase in chloride, hardness, and total dissolved solids.

The DO levels in this study are uniform at 5.7mg/L as well as the mean valve. The amount of dissolved oxygen in natural water is due to the factors upon which it is depended - temperature, atmosphere pressure, salinity etc. Their concentrations produce no adverse physiological effect on human. However, water saturated with dissolved oxygen must be available for fish and other aquatic organism which cannot survive under dissolved oxygen depleted conditions. However, it is safe and preferable to drink water saturated with dissolved oxygen. However, drinking water criteria do not specify guidelines for dissolved oxygen.

The BOD values in hand-dug well water samples were all uniform at 0.8mg/L However, values in literature show that water with BOD levels less than 4-mg/L are deemed reasonable clean. Water samples with BOD levels greater than 10mg/L are considered polluted since, they contain large amounts of degradable organic materials. Therefore, the values obtained here were within acceptable limit. Low total alkalinity can cause corrosion in pipes and plumbing as a result of High acidity.

IV. Conclusion

The findings in this study showed that the groundwater (hand-dug well water) in this community area is slightly acidic except for W3 and W5 wells which are within the acceptable limits. The acidic nature of W1 well water could cause serious water- borne disease in the long run.

Subsequently, the local government council should create public awareness in the communities affected of the quality of the water in the short and long run term of the implication of such water. Also, the pH of the hand–dug wells should be raised by adding lime.

Table 3:Classification of variation of water hardness

Hardness (mg/L $CaCO_3$)	Classification
0-75	Soft
75-150	Moderately hard
150-300	Hard
Over 300	Very Hard

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