GSJ: Volume 8, Issue 9, September 2020, Online: ISSN 2320-9186
www.globalscientificjournal.com

COMPARISON OF GROUNDWATER ELEMENTS IN SELECTED TOWNS RIVERS STATE, NIGERIA.

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Abstract:

This study investigated the concentration of heavy metals in groundwater in Rivers State. Five Local Government Areas (Okrika, Eche, Gokana, Obio/Akpor and Port Harcourt) were selected for the study. Within these LGAs, four regions were selected for the analyses. Samples of water collected were analysed usind atomic absorption spectrophotometer (AAS) equipment for better accuracy. The samples were subjected to basic preservation methods by subjecting about 100ml of each water sample for filtration using Whattman filter paper No.1 to eliminate suspended solids and stored in plastic bottles. Subsequently, 1ml of concntrated nitric acid was added to the water samples and stored in 500ml double covered polyethylene bottle for preservation. The samples were subsequently stored at 400°C for a short time prior to analysis. The maximum values obtained are Zn (0.633mg/kg), Fe(0.36mg/Kg), Mn(0.18mg/Kg), Cu(0.018mg/Kg) and Pb(0.01mg/Kg), others like Ni amd Cr are found as trace elements far below 0.001. PH values obtained are 5.4, 5.8, 6.1, 6.3, and 6.6, which are below WHO (2015) recommende values of 6.5-8.5. Also, higher temperature values of 28.9 – 29.6 were recorded as against 27.5- 28.5 WHO values.

INTRODUCTIONS

Water and the existence of life has always shown to be essential in nature and requires to be the most important element on earth in its purest, odourless, colourless and tasteless form, yet as a result of human and animal activities, it is normally contaminated with solid and effluents from chemical industries and dissolved gases (Jimoh and Umah 2015)

As water is an essential element for the survival of all living organisms. Water make up about 70% of human body mass water. The human microbiological and physiochemical activities are hence dependent on water availability. Several infectious diseases and microorganism causing sicknesses in developing countries are associated with contaminated water. Therefore, good drinking water is not a luxury but one of the most essential demands of life and is the most abundant natural resources on the surface of the earth, while underground (bore hole water) is the largest reservoir of drinking water, aided by natural filtration, it is by some means less contaminated by microorganisms as compared to sundry surface water (Aiyesaami, 2004).

Groundwater (tap and well) is a vital and major source of drinking water in both urban and rural areas in Nigeria. (Muhammed et al, 2013). Determination of water quality is one of the most important aspects in studies (Valipour, 2012). Unfortunately, in developing countries (like Nigeria) the drinking water quality is continuously being contaminated and hazardous for human use due to high growth of population and expansion in industries, indiscriminate disposal of wastewater and chemical effluents in canals and other water sources (Muhammed et al, 2013).

The question set for solution of estimating groundwater in semi-arid areas like towns in Rivers State Nigeria is that recharge amounts are generally small in comparison with the resolution of the investigation methods (Allison et al, 1984). The greater the aridity of the climate, the smaller and potentially more variable in space and time is the recharge flux. Direct groundwater recharge from precipitation in semi-arid areas is normally small, usually less than 5% of the average annual precipitation, with a high temporal and spatial variability (Gieske, 1992).
Lerner et al (1990) concluded that determination of groundwater recharge in arid and semi-arid areas is neither straightforward nor easy. This is an effect of the temporal variability of precipitation and other hydrometeorological variables in such climates and the spatial variability in soil characteristics, geology, topography, land cover characteristics and land use.
Holman (2006) points out that climate change, also in arid and semi- arid areas, may affect recharge in the near future.

De Vries and Simmers (2002) rated natural groundwater recharge mechanisms according to the origin into three types: direct/diffuse recharge localized recharge, and indirect/non diffuse recharge. Direct recharge refers to water that is added to the groundwater reservoir from precipitation by direct percolation through the unsaturated zone in excess of soil moisture deficits, interception, surface runoff and evapotranspiration. Indirect recharge refers to water that percolates to the groundwater through the beds of surface watercourses. Localized recharge is an intermediate form of groundwater recharge resulting from horizontal (near) surface concentration of water (ponding) in the absence of well-defined channels.

Generally, ground water quality differs from place to place and this will account very much to its suitability for consumption. There are specific threats to groundwater quality which include domestic, commercial and industrial wastes and increased agricultural uses of fertilizers and pesticides. These pollutants contain heavy metals (Zn, Ni, Cu, Pb, etc) which are elements that infiltrate into the through seepage and so affecting the groundwater. This study therefore, seeks to compare groundwater elements in selected towns in Rivers State, Nigeria in order to rate its suitability for consumption.

2.0: Materials and Methods

In all the locations sampled four water samples were randomly collected from four different boreholes at Baptist Water Front Borokiri, Port Harcourt, in Abio/Akpor LGA Rumukwurushi, Ozuzu, Orwu, Ogida, and Egbu in Eche LGA, Ogoloma, Ogan Ama, Okerekana and Ibuluya/Dikibo Ama and Bodo in Ogokana LGA all of Rivers State. Besides some well water were taken from Tegu, Obara and Baamu streets in Gokana LGA The water samples were collected into four different clean plastic bottles, corked and later transported to Anal Concept Laboratory for Analysis immediately for analysis. Thereafter, about 100ml of each water sample was filtered using Whattman filter paper No.1 to eliminate suspended solids and stored in plastic bottles.

Subsequently, 1ml of concntrated nitric acid was added to the water samples and stored in 500ml double covered polyethylene bottle for preservation. The samples were subsequently stored at 400°C for a short time prior to analysis by atomic absorption spectrophotometer (AAS).

TABLE 1: Comparison of heavy metals cocwntration for tap water and local well water samples in Obio/Akpor with WHO (2011) Standards.

HEAVY METALS	SAMPLES		WHO (2011) Maximum Permissible (Mg/Kg)
	Tap Water Well (Mg/Kg)	Local (Mg/Kg)	
Zn	0.13	0.03	0.40
Mn	0.18	0.04	0.40
Pd	ND	ND	0.01
Cd	ND	ND	0.03

WHO : World Health Organisation
ND : Not Detected

TABLE2: Result showing the conventration of heavy metals in Bore Hole water samples. In Baptist water front, Borokiri, Port Harcourt, River State.

Samples	Fe (mg/l)	Cu (mg/l)	Zn (mg/l)	Pb (jmg/l)
STA A	0.088	ND	0.078	ND
STA B	0.081	ND	0.420	ND
STA C	0.079	ND	0.015	ND
STA D	0.191	0.002	0.633	ND
WHO	0.300	2.000	3.000	0.010

TABLE 3: Mean Concentration of heavy metals (mg/l) and Ph in drinking water in OKrika local government area.

Location	Zinc (Zn)	Lead (Pb)	Iron (Fe)	pH
Okrika Island	0.50	0.012	0.360	6.60
Okrika Mainland	0.60	0.014	0.0410	6.30
WHO (2015)	3.00	10.00	30.00	6.5-8.5

Sampled Location: Ogan Ama, Ogoloma, Okerekana, Ibuluya/Dikibo Ama

TABLE 4.1: Mean Concentration of Heavy Metals (mg/l) and PH in drinking water in Gokana local government area.

S/N	Zn	Ni	Cr	Cu	Pb
1.	0.035	<0.001	<0.001	0.017	<0.001
2.	0.031	<0.001	<0.001	0.018	<0.001
3.	0.038	<0.001	<0.001	0.016	<0.001
4.	0.049	<0.001	<0.001	0.010	<0.001
WHO (µ/kg)	10	8-9	10	7-9	9-10

Table 4.2: TEGU STREET WELL LOCATION (RESULT)

S/N	Zn	Ni	Cr	Cu	Pb
1.	0.054	<0.001	<0.001	0.017	<0.001
2.	0.064	<0.001	<0.001	0.018	<0.001
3.	0.052	<0.001	<0.001	0.016	<0.001
4.	0.072	<0.001	<0.001	0.010	<0.001
WHO (µ/kg)	10	8-9	10	7-9	9-10

Table 4.3: BAAMU STREET BOREHOLE (RESULT)

S/N	Zn	Ni	Cr	Cu	Pb
1.	0.081	<0.001	<0.001	0.017	<0.001
2.	0.072	<0.001	<0.001	0.018	<0.001
3.	0.053	<0.001	<0.001	0.016	<0.001
4.	0.042	<0.001	<0.001	0.010	<0.001
WHO (µg/kg)	10	8-9	10	7-9	9-10

Table 4.4: OBARA STREET WELL WATER LOCATION (RESULT)

S/N	Zn	Ni	Cr	Cu	Pb
1.	0.068	<0.001	<0.001	0.017	<0.001
2.	0.061	<0.001	<0.001	0.018	<0.001
3.	0.031	<0.001	<0.001	0.016	<0.001
4.	0.021	<0.001	<0.001	0.010	<0.001
WHO (µg/kg)	10	8-9	10	7-9	9-10

4.0: RESULTS AND DISCUSSIONS

The results presented in Tables 1-4 above show, that the concentration of heavy metals in all locations sampled in the five Local Government Areas give lower levels of concentration as compared to WHO threshold limits for drinking water, see figures 1-5 for details. From the results presented, it is observed that in Station A, the concentration of Fe, Cu and Zn were higher but the values were within WHO permissible limit except Pb that was not detected. Station A, B and C showed a lower concentration of Fe and Zn compared to the level of concentrations observed in Station D and they were all below the WHO permissible limit. The findings from the result above showed that, the water samples contains some amount of heavy metals such as Fe and Zn except Cu and Pb that were not detected in the samples.

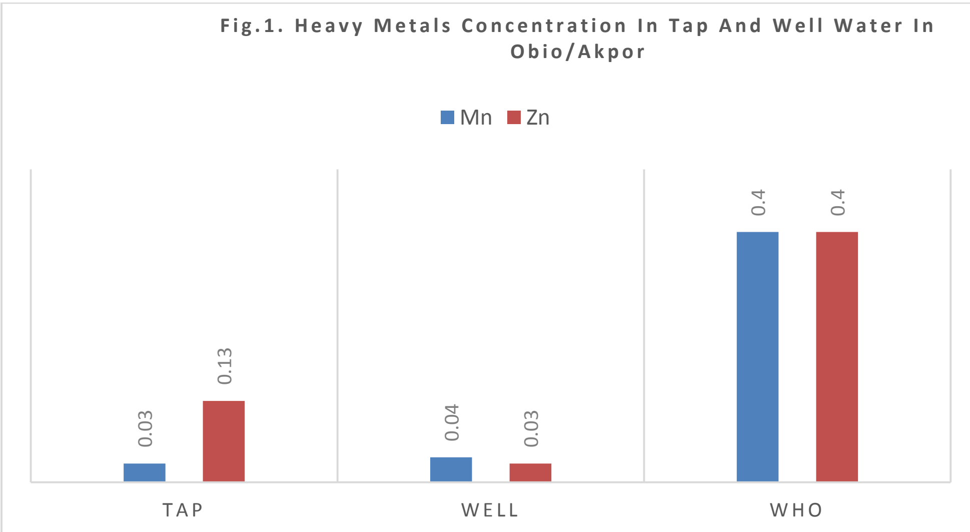

Figure 1: Heavy Metals Concentration in Tap and Well Water in Obio/Akpor

From the results in Figure 1, manganese was detected which is not found in samples in other locations. This may be attributed to soil nature, human wastes concentration and industrial activities. Metals like Nickel and Chromium are never found in most water samples tested from the different locations and local Government areas. In fact the very few areas they are found as trace element in the samples, which indicates that drinking water in Rivers State scarcely have Ni and Cr as shown in Figure 2-5.

The results also show that the ph values obtained from virtually in all the locations are below 6.5, only Okrika Island water has a ph value of 6.6, 0thers are below this value indicating acidic water concentration in our localities, see Figure 3and 4. The values values from Eche LGA are far below 6.0,they are between 5.4 - 6.1. This may be attributed to industrial activities, such values are far below WHO recommendations as such, they are not recommended for drinking.

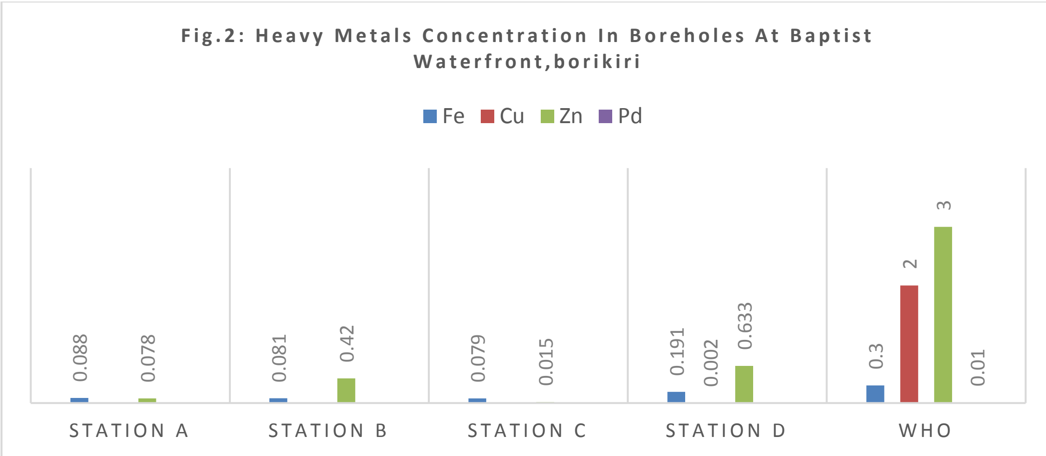

Figure 2: Heavy Metals Concentration in Boreholes at Baptist Waterfront, Borikiri

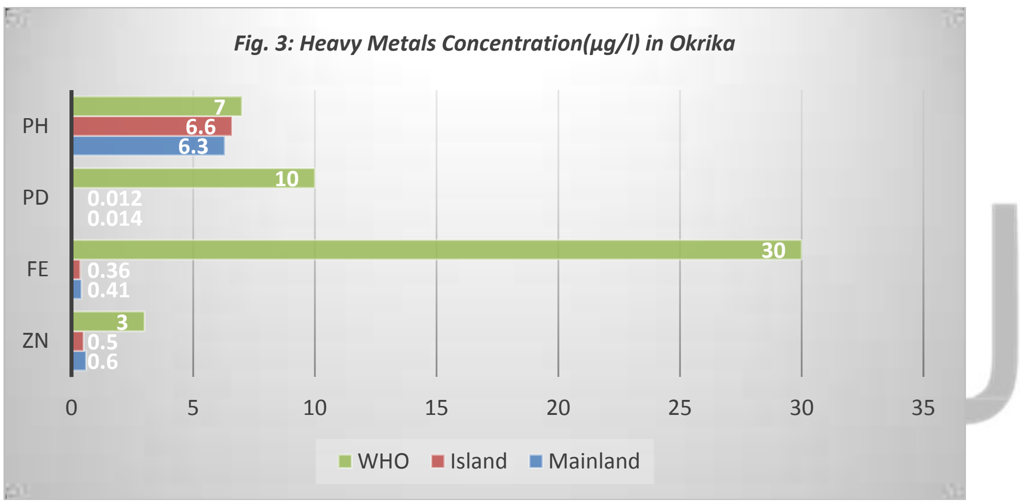

Figure 3: Heavy Metals Concentration in Okrika

Finally, from results on Table 1 -4 and figure 4, it is obvious that the temperature values obtained are above WHO (2015) recommendations. However, now that hot water is being recommended by some agencies based on health grounds, but these values are above WHO (2015) recommendations and there is need to check the rising temperature of groundwater in our Local Government Areas.

GSJ: Volume 8, Issue 9, September 2020
ISSN 2320-9186

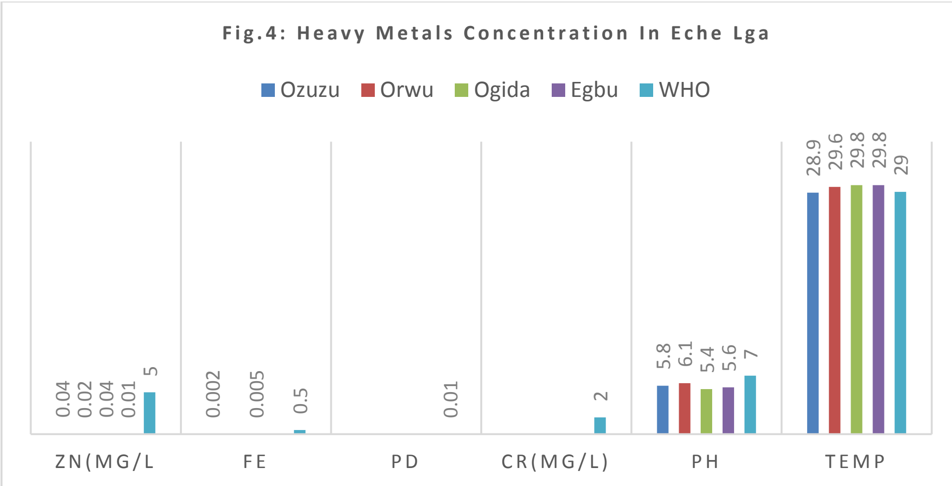

Figure 4: Heavy Metals Concentration in Eche LGA

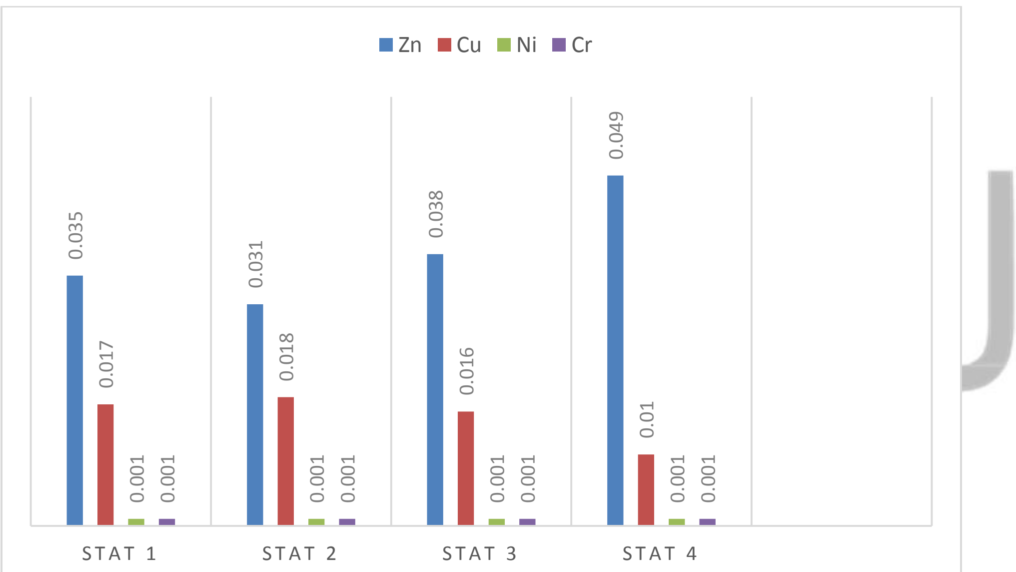

Figure 5: Heavy Metals Concentration in Borehole Water in Gokana LGA

5.0: Conclusion

A study of heavy metals concentration was undertaking in five LGAs in Rivers State at random, the results above show that in most part of Rivers State, borehole and water for drinking have less than the threshold limits, but they mostly acidic in nature. Secondly, some basic elements that enriches groundwater are completely absents. All regions tested, Zinc(Zn) metal has the highest value followed by Iron (Fe) and then Lead (Pb). Chromium and Nickel found in few areas as trace elements. Based on acidity content of our groundwater discovered in this study, some actions are imperative to reduce side effects on humans.

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