International Journal of Research and Reviews in Pharmacy and Applied science

www.ijrrpas.com

ASSESSMENT OF HEAVY METALS IN BOREHOLE WATER IN UMUAGWO- OHAJI L.G.A, IMO SATE

[1]Adumanya, O. C. U., [1]Akunna, T.O, [2]Lele, KC, and [1]Ogu, U.J.F

[1]Department of Science Lab. Tech, Imo State Polytechnic, Umuagwo, Imo State, Nigeria.

[2]Department of Biochemistry. Imo State University Owerri, Imo State, Nigeria

E-mail, adumso2@yahoo.com ,

ABSTRACT

Water is one of the essentials that support all forms of life and heavy metals are among the water contaminants which find their way into water samples as a result of inadequate treatment, disposal of waste and industrial discharge. This work looked at the heavy metal contents (mg/l) manganese (Mn), lead (Pb) and cadmium (Cd) of borehole water samples in Umuagwo Ohaji, Imo State, Nigeria. Twenty different borehole water samples were assayed for Mn, Pb and Cd levels (mg/l). The result showed that Mn and Pb contents were within the limit allowed by WHO. But the Cd (from 0.003 – 0.02mg/l) levels were high compared to the WHO limit of 0.003mg/l. Therefore, treatment, and reduction of waste discharge around the borehole is advocated for, before it becomes too late

Keywords: Heavy metals, borehole water, samples

INTRODUCTION

Water is one of the essentials that supports all forms of plant and animal life (Vanloon and Duffy, 2005) and it is generally obtained from two principal natural sources; Surface water such as fresh water lakes, rivers, streams, etc. and Ground water such as borehole water and well water (McMurry and Fay, 2004, Mendie, 2005). Water has unique chemical properties due to its polarity and hydrogen bonds which means it is able to dissolve, absorb, adsorb or suspend many different compounds (WHO, 2007), thus, in nature, water is not pure as it acquires contaminants from its surrounding and those arising from humans and animals as well as other biological activities (Mendie, 2005). One of the most important environmental issues today is ground water contamination (Vodela et al., 1997) and between the wide diversity of contaminants affecting water resources, heavy metals receive particular concern considering their strong toxicity even at low concentrations (Marcovecchio et al., 2007).

Heavy metals are elements having atomic weights between 63.546 and 200.590 and a specific gravity greater than 4.0 i.e. at least 5 times that of water. They exist in water in colloidal, particulate and dissolved phases (Adepoju-Bello *et al*., 2009) with their occurrence in water bodies being either of natural origin (e.g. eroded minerals within sediments, leaching of ore deposits and volcanism extruded products) or of anthropogenic origin (i.e. solid waste disposal, industrial or domestic effluents, harbour channel dredging) (Marcovecchio *et al*., 2007).

Some metals are essential to sustain life-calcium, magnesium, potassium and sodium must be present for normal body functions. Also, cobalt, copper, iron, manganese, molybdenum and zinc are needed at low levels as catalyst for enzyme activities (Adepoju-Bello *et al*., 2009), however, excess exposure to heavy metals can result in toxicity. Therefore this work is aimed at assessing the heavy metal (Mn, Pb and Cd) contents of borehole water in Umuagwo Ohaji Egbema, L.G.A, Imo State, Nigeria.

MATERIALS AND METHODS

The sample borehole water samples for the study were collected from different localities in Umuagwo village. About 20 samples of borehole water were used for the study. Four(4) samples from each kindred and the containers were coded as follows: Umudukwu as village A, has sub-samples (A_1, A_2, A_3 and A_4), Umuguma as B with sub-samples (B_1, B_2, B_3 and B_4), Umuogbuanu C with(C_1, C_2, C_3 and C_4), then Umuturu as D with the sub-samples (D_1, D_2, D_3 and D_4). Finally Umuezewere as E with sub-samples (E_1, E_2, E_3 and E_4). During this collection, the tap was opened and allowed to runoff for few minutes before collection so as to obtain a uniform flow rate (Ambrose, *et al*, 1989).

EQUIPMENTS AND INSTRUMENTS USED

The under listed instrument and equipments were used in this work.

Sartomins Digital Weighing Balance, Crucibles, Carbolite drying Oven

General Laboratory Glassware, Perkin Elmer Atomic Absorption Spectrophotometre (AAS) PE 6000 i, Volumetric flask, and Whatman No42 filter paper.

METHODOLOGY

The Atomic Absorption Spectrophotometric method (James, 1995) was employed. A measured volume of each sample (50mls) was digested and dried in a crucible till it became ash. The resultant ash was dissolved in 10mls of 2M HCl solution and diluted to 100mls with distilled water in a volumetric flask. It was filtered through Whatman No42 filter paper. The filtrate (extract) was used for the analysis.

The instrument, Perkin Elmer AAS PE 6000i, was operated according to the manufacturer's Instructions. It was switched on and allowed to equilibrate for 15minutes. It was then flushed by aspirating distilled deionised water into the system.

Meanwhile, Standard solution of each test element were prepared and diluted in series as desired to determine the concentration of each element in the extract, the appropriate hollow cathode tube was put in place and the monochromator was set at the wavelength of the particular element being analysed for. The Standard solutions were aspirated in turns into the instrument and their respective absorbancies were recorded and plotted into a curve (which was later used to extrapolate the concentration of the test element in the sample). After that, the extracts from the samples were separately aspirated into the instrument and their respective absorbance was also recorded. The concentration of each test element was calculated with reference to the standard curve. The general formula below was used

$$E\ (mg/l) = 1000 \times \frac{X}{V} \times \frac{D}{1000}$$

V =volume of sample digested
X=concentration (in ppm) derived from standard curve.
D= Dilution factor as applicable.
E=sample from borehole (test sample).

RESULTS

WHO 2006/2007 standard: [Mn]=0.4mg/l, [Pb]=0.01mg/l, [Cd]=0.003mg/l

s/no	BOREHOLE WATER SAMPLES				Mn (mg/l)	Pb (mg/l)	Cd (mg/l)
	location	Activity around the borehole	Dept(ft)	Year of construction			
1	A_1 (Umudukwo village)	Home	125	2009	0.015 ± 0.0006	0.027 ± 0.0005	Not detected
2	A_2	Home	130	2012	0.008 ± 0.0006	0.031 ± 0.0006	Not detected
3	A_3	Home	125	none	0.008 ± 0.0006	0.024 ± 0.0005	0.003 ± 0.0006
4	A_4	Home	130	2009	0.003 ± 0.0006	0.055 ± 0.0006	Not detected
5	B_1 (Umuguma village)	Home	130	none	0.011 ± 0.0005	0.047 ± 0.0006	0.003 ± 0.0006
6	B_2	Beer pallor	130	2008	0.004 ± 0.0006	0.052 ± 0.0006	0.004 ± 0.0006
7	B_3	Home	130	none	0.004 ± 0.0006	0.036 ± 0.0006	Not detected
8	B_4	Home	130	2009	0.007 ±0.0006	0.027 ± 0.0005	Not detected
9	C_1 (Umuogbuanu village)	Home	130	2012	0.016 ± 0.0005	0.06 ± 0.00	Not detected
10	C_2	Palm Milling	130	2012	0.02 ± 0.005	0.048 ± 0.0006	0.008 ± 0.0006
11	C_3	Home	130	2003	0.02 ± 0.005	0.06 ± 0.0006	0.003 ±

							0.0006
12	C_4	Market	130	2012	0.011 ± 0.0005	0.031 ± 0.0006	Not detected
13	D_1 (Umuturu village)	Market	130	2007	0.008 ± 0.0006	0.044 ± 0.0006	Not detected
14	D_2	Home	130	none	0.016 ± 0.0005	0.032 ± 0.0006	Not detected
15	D_3	Fuel station	130	none	0.012 ± 0.0005	0.052 ± 0.0006	0.004 ± 0.0006
16	D_4	Market	130	2011	0.011 ± 0.0005	0.04 ± 0.006	0.004 ± 0.0006
17	E_1 (Umuezewere village)	Hostel, milling	130	2009	0.023 ± 0.0005	0.03 ± 0.006	Not detected
18	E_2	Hostel	130	2011	0.004 ± 0.0006	0.047 ± 0.0006	Not detected
19	E_3	Hospital	125	1989	0.008 ± 0.0006	0.052 ± 0.0006	0.012 ± 0.0005
20	E_4	Beer pallor	130	2008	0.007 ± 0.0006	0.072 ± 0.0006	0.02 ± 0.005

Table 1.1 The results of the borehole water samples analyzed

DISCUSSION

The results as shown in table 1.1 showed that manganese (Mn) (mg/l) was found in all the borehole water samples assayed. The range of Mn is from 0.003mg/l - 0.023mg/l, which falls within the limit of WHO standard of Mn (0.4mg/l) for drinkable water (WHO, 2007). The lead (Pb) content (mg/l) of the borehole water samples ranges from 0.024 - 0.072mg/l, which is also within the limit of WHO (0.01mg/l) (WHO, 2007). The cadmium levels (mg/l) of the borehole water samples assayed as shown in table 1.1 ranges from 0.003 - 0.02mg/l in 8 borehole water samples, while it was not detected in the remaining 12 borehole water samples. This shows that the Cd levels are very high compared to the limit of 0.003mg/l prescribed by WHO. This high Cd levels could be as a result of the activities going on around the boreholes. Some of the boreholes were surrounded by beer palour where there is high level of cigarette smoking. Cigarette has been attributed to high level of Cd which could pollute the environment (WHO, 2007).

CONCLUSION

The lead and manganese levels were not high compared to the WHO standards, but most of these boreholes are gradually experiencing cadmium elevation, which inturn leads to its toxicity when consumed if not checked and purified. Hence, the reduction in the activities especially cigarette smoking should be avoided. Also appropriate legislation to regulate the siting and sinking of borehole should be adopted and enforced in Umuagwo in Ohaji-Egbema.

REFRENCE

1. Adepoju-Bello, A.A., Ojomolade, O.O. Ayoola, G.A. and Coker, H.A.B. (2009). Quantitative analysis of some toxic metals in domestic water obtained from Lagos metropolis. The Nig. J. Pharm. 42(1): 57-60.
2. Ambrose, A.M., Larson, D.S. Borzelleca J.R. and Hennigar, G.R. (1976): Long-term
3. James, S. (1995): Trace metals levels in Drinking water on viti Lerv. Fiji Islands. Pac.J.Nat.Sci.21:31-34.
4. Marcovecchio, J.E., Botte, S.E. and Freije, R.H. (2007). Heavy Metals, Major Metals, Trace Elements. In: Handbook of Water Analysis. L.M. Nollet, (Ed.). 2nd
5. Mcmurry, J. and Fay, R.C., (2004). Hydrogen, Oxygen and Water. In: McMurry Fay Chemistry. K.P. Hamann, (Ed.). 4th Edn. New Jersey: Pearson Education,
6. Mendie, U., (2005). The Nature of Water. In: The Theory and Practice of Clean Water Production for Domestic and Industrial Use. Lagos: Lacto-Medals Publishers, pp: 1-21.
7. Vanloon, G.W. and Duffy, S.J. (2005). The Hydrosphere. In: Environmental Chemistry: A Global Perspective. 2nd Edn. New York: Oxford University Press, pp: 197-211.
8. Vodela, J.K., Renden, J.A. Lenz, S.D. Henney W.H. and Kemppainen, B.W. (1997). Drinking water contaminants. Poult. Sci., 76: 1474-1492.
9. WHO, (2007). Water for Pharmaceutical Use. In: Quality Assurance of Pharmaceuticals: A Compendium of Guidelines and Related Materials. 2nd Updated Edn. World Health Organisation, Geneva, 2: 170-187.