Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

Der Pharmacia Sinica, 2013, 4(3):44-46

Der Pharmacia Sinica
ISSN: 0976-8688
CODEN (USA): PSHIBD

Determination of heavy metals in tap water samples in Ekpan district of Warri, Delta State, Nigeria

Ilodigwe EE[1], Ogbogbo JFO[1], *Ajaghaku L Daniel[1], Utoh-Nedosa UA[1] and Umeokoli BO[2]

[1]Dept. of Pharmacology/Toxicology, Faculty of Pharmaceutical Sciences, Nnamdi Azikiwe University Awka, Anambra State, Nigeria
[2]Dept. of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

---

ABSTRACT

The concentrations of Lead, Iron, zinc, Copper, Manganese and Tin was determined in Tap water samples in Ekpan district of Warri, Delta State, Nigeria. Samples were collected from six different sites each of industrial and residential areas of the district and were analyzed using Atomic Absorption Spectrophotometer (AAS). From the industrial location, Lead and Iron in samples S_3 and S_4 respectively were significantly ($p<0.05$) above the WHO limit for Lead and Iron in drinking water while only Manganese from sample S_5 in residential areas was significantly ($p<0.05$) above the WHO limit for Manganese in drinking water. Tin was not dictated in all the samples collected from the industrial area while both Lead and Tin were absent in samples collected from the residential areas. The levels of Lead and Iron from the industrial areas of Ekpan district are above the WHO limits, indicating higher risk of Lead and Iron toxicities in this district.

Key words: Heavy metals, Atomic Absorption Spectrophotometer, Ekpan district Warri, Delta State, Nigeria.

INTRODUCTION

Water is one of the essentials that support all forms of life [1]. Contamination of water have been a major source of health problems particularly in the developing countries [2]. Heavy metals are one of the most persistent pollutants in water. Unlike other pollutants, they are difficult to degrade and can accumulate producing potential human risks and ecological disturbances [3]. Heavy metals occurrence and accumulation in the environment is as a result of direct or indirect human activities such as rapid industrialization, urbanization and anthropogenic sources [4-6].

Heavy metals can affect our bodies in a multitude of negative ways [7,8]: they can disrupt our energy producing pathways in the body; they have an affinity for the central nervous system and nerve cells; they bind to blood cells impairing them; they are deposited in bones, kidney, liver and most organs of the body, causing organ damage; they compete with nutritional metals for binding hormones that control our endocrine and reproductive functions. The results of these actions includes fatigue, memory loss, attention loss, weight loss, irreversible neurological damage, tremor, insomnia, depression, anaemia, low blood pressure and a host of other symptoms. Some elements like Fe, Zn, Cu, Cr, Mn, Ni are needed in small quantities for human metabolism but may be toxic at higher levels. Others like Hg, Cd, AS etc have no beneficial role in human system [3]. Nigerian Gas and Petroleum Refineries are located in Ekpan district of Warri and the area is characterised by high gas fumes, oil and smelting activities. There has been unofficial complaints of heavy metal related poisoning. Therefore, this study evaluated the heavy metals contamination in tap waters from the residential and industrial areas in Ekpan district of Warri, Delta State, Nigeria.

MATERIALS AND METHOD

Study Area and Sampling

The study was carried out in Ekpan district in Warri, Delta State, Nigeria. Tap boreholes water samples were collected from six different sites each of industrial and residential areas of the district at two weeks interval for six months.

Analysis of water samples

The samples were pre-concentrated and made acidic with 0.1M HNO_3 solution. Hundred millilitres (100 ml) of each sample was transferred into a 250 ml beaker to which 5 ml of concentrated nitric acid was added. The samples were aspired into the oxidizing air-acetylene flame of Atomic Absorption Spectrophotometer (AAS). Sensitivity for 1% absorption was observed. The metal concentration was read off a standard curve.

Statistical Analysis

Data were expressed as the mean of five replicates ± SEM. Means were analyzed using a one-way analysis of variance (ANOVA). All the statistical analyses were done using SPSS, Version 16.0.

RESULTS AND DISCUSSION

The water samples from the industrial and residential areas showed variable concentrations of heavy metals. Lead was not detected from water samples collected from the residential areas (Table 1), an indication of unlikelihood of Lead toxicity arising from drinking water in this area. However, significant ($p < 0.05$) concentrations were observed in samples S_1 and S_3 (Table 2) collected from the industrial location compared to WHO guideline (0.01 ppm) for Lead in drinking water [9]. The elevated Lead concentration in these samples could have been contributed by the fumes from the combustion of gasoline contained Lead from the refineries (Nigeria Gas station refinery and Warri Refinery petroleum company) located in that area.

Table 1: Heavy metal concentration in tap water samples from residential location in Ekpan district of warri

Heavy metals	Mean metal concentration (ppm) ± SEM					
	S_1	S_2	S_3	S_4	S_5	S_6
Lead	0.00	0.00	0.00	0.00	0.00	0.00
Iron	0.00	0.00	0.01±0.00	0.03±0.02	0.01±0.00	0.00
Zinc	0.10±0.03	0.12±0.04	0.06±0.02	0.06±0.01	0.21±0.03	0.07±0.02
Copper	0.00	0.00	0.00	0.40± 0.06	0.13± 0.02	0.17±0.05
Manganese	0.00	0.00	0.00	0.00	*0.11± 0.05	0.00
Tin	0.00	0.00	0.00	0.00	0.00	0.00

*n = 5 * p<0.05 compared with WHO standard limit*

Table 2: Heavy metal concentration in tap water samples from industrial location in Ekpan district of warri

Heavy metals	Mean metal concentration (ppm) ± SEM					
	S_1	S_2	S_3	S_4	S_5	S_6
Lead	*0.02± 0.01	0.00	*0.02±0.01	0.00	0.00	0.00
Iron	0.04±0.02	0.01±0.00	0.03±0.02	*0.78±0.02	0.02±0.00	0.01±0.00
Zinc	0.5±0.02	0.05±0.01	0.35±0.04	0.32±0.03	0.19±0.03	0.03±0.01
Copper	0.00	0.00	0.05±0.01	0.00	0.00	0.00
Manganese	0.00	0.00	0.00	0.00	0.01± 0.00	0.00
Tin	0.00	0.00	0.00	0.00	0.00	0.00

*n = 5 * p<0.05 compared with WHO standard limit*

There was a significant ($p < 0.05$) elevation of Fe concentration in S_4 collected from industrial location compared with WHO guideline (0.3 PPM) for Fe in drinking water [9]. The high concentration of Fe in S_4 could as well be attributed to the location of Warri refinery petroleum company in that area. The second desalter step of Crude refinery is the removal of iron which could cause accumulation of Fe in that area. Corrosion of borehole tanks and pipes made of iron could have as well contributed to the observed high Fe concentration S_4. Iron concentration levels had continue to maintain its top position in relation to the concentration levels of other heavy metals in the surface water of warri river in all investigations carried out from 1981-2008 [10,11]. The high value of iron observed at the effluent zones in industrial locations in Warri suggests that industrial activities are responsible for iron contamination of waters in warri [12].

Significant ($p < 0.05$) concentration of Manganese was observed in S_5 from residential area. High Manganese concentration in this area could be due to the presence of automobile mechanics and electricians who frequently use batteries and steels made of manganese. Careless disposal of the battery contents and burning of steels could be a potential source of manganese contamination of drinking water in this area. Manganese generated as combustion

product from vehicles could have as well contributed as samples (S_5) were collected from residential areas Close to the roads. Although manganese is an essential nutrient, the observed concentration is above the WHO guideline (0.4 ppm) for manganese in drinking water [9] and as such could predispose to adverse health effect.

Copper and Zinc levels were below the WHO Guideline (2 and 3 ppm) for these metals in drinking water respectively [9] while Tin was not dictated in water samples both from the residential and industrial areas.

CONCLUSION

The industrial locations of Ekpan district of Warri State, Nigeria have a higher risk of heavy metal toxicity as indicated by significant levels of Lead and Iron from three sampling sites compared to residential areas that have Manganese elevated only at one sampling site.

REFERENCES

[1]Vanloon GW and Duffy SJ. The Hydrosphere. In: Environmental Chemistry: A Global Perspective, 2nd Edn. New York: Oxford University Press **2005**, 197-211.
[2]UL-Haq N, Arain MA, Badar N, Rasheed M and Haque Z. *Eastern Mediterranean Health Journal* **2011**, 17(11).
[3] Shri SK Sahni. Hazardous Metals and Minerals Pollution in India: Sources, Toxicity and Management. India Natural Science Academy, Angkor Pulishers Ltd **2011**, 1-29.
[4]Hussein H, Farag S, Kandil K, Moawad H (**2005**) *Process Biochem* **2005**, 40: 955-961.
[5]Gardea-Torresdey Jl, Peralta-Videa JR, Rosa GD, Parsons JG. *Coord. Chem. Rev* **2005**, 249(17-18): 1797-1810
[6]Martin-Gonzalez A, Díaz S, Borniquel S, Gallego A, Gutierrez JC. *Res. Microbiol* **2006**, 157: 108-118.
[7]Adepoju-Bellow AA and Alabi OM. *The Nig J Pharm* **2005**, 37: 41 – 45.
[8]Gaur S, Agrawal S, Saxena SK, Goyal R and Kumar D. *J of Applied Pharm Sc* **2012**, 2(7) 177 – 181.
[9]WHO . Lead in drinking water. Geneva WHO, **2011**.
[10] Egborge A.B.M. Handbook on water pollution in Nigeria biodiversity and Chemistry in Warri River **1994**.
[11] Wogu MD and Okaka CE. *J of Biodiversity and Environmental Sciences* **2011**, 1(3): 7-12.
[12] Ayenimo JG, Adeyinwo CE and Amoo IA. *Kragujevac j. Sci* **2004**, 27:43-50.