Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

Pelagia Research Library

Advances in Applied Science Research, 2013, 4(1):82-85

Pelagia Research Library

ISSN: 0976-8610
CODEN (USA): AASRFC

Analysis of lead in sachet water production from three senatorial zones of Anambra State, Nigeria

Ilodigwe EE, Ojukwu CE, Agbata CA, Mbagwu I S and Ajaghaku DL

Department of Pharmacology and Toxicology, Faculty of Pharmaceutical Sciences, Nnamdi Azikiwe University, Agulu Campus, Anambra state, Nigeria

---

ABSTRACT

Lead contamination in sachet water production was evaluated in three senatorial zones of Anambra State, Nigeria. Three companies from each senatorial zone were sampled. 10 samples each were collected from different points of production: the point of water source (Point 0), the point after passing through the sand and charcoal filters (Point 1) and the point after passing through series of other filtration processes to the point of packaging (Point 2). Lead concentration in samples collected were determined using Atomic Absorption spectrophotometer (AAS).Samples collected from Anambra central (Table 1) have mean Lead concentration (ppm) ranging from 0.0018 to 0.0094. The lowest and the highest levels were found in samples (CT) at point 1 and (SRD) at point 2 respectively. For Anambra North, the mean lead concentration (ppm) ranges from 0.0012 to 0.004 (Table 2) with the lowest and highest levels occurring in samples (ZAN) at point 0 and (PE) at point 0 respectively while that of Anambra South ranges from 0.0012 to 0.0048 (Table 3) with the lowest and highest levels found in sample (DYCA) at points 0 and 2 respectively.High Lead concentration was recorded from point 0 of two companies from Anambra central (0.004 and 0.005 ppm) and one company from Anambra North (0.004 ppm). High Lead concentration was also recorded from point 1 and point 2 of same companies in Anambra central (0.008 to 0.009 ppm) close to the WHO guideline for lead in drinking water (0.01 ppm). Alternative source of water supply for companies with high lead concentration at point 0 is recommended. Also, evaluation of the plumbing system and management of exposure to generator fumes for companies with high concentration at points 1 and 2 is recommended.

Key word: Lead, Anambra senatorial zones, Nigeria, Atomic Absorption Spectrophotometer.

INTRODUCTION

Sachet water (popularly called pure water in Nigeria) is consumed on daily basis by all irrespective of age, social class or religion. About 70% of Nigerian adults drink at least one sachet of pure water per day [1]. In many areas of Anambra State, Nigeria, accessto good pipe born water has become a critical and urgent problem. Most indigenes therefore depend on sachet water as major source of drinking water.

Water in sachets is readily available and affordable, but there are concerns about its purity. The integrity of the hygienic environment and conditions where the majority of the water in sachets are produced has been questioned by the Consumer Affairs Movement in Nigeria [2]. The sources of water, conveying system from the source to the production factory, the treatment processes, storage, distribution and handling of the finished product affect the quality of sachet water.

Among the heavy metal contamination of water is lead. It is a natural occurring metal found throughout the environment through human activities like mining, industrial processes and burning fuels. It is also a content of many products like gasoline (as additive), batteries, paints, ceramic glazes etc. Lead contamination of sachet water may be contributed by the nature of water source, the plumbing system, storage site and environmental exposure. Excess Lead in drinking water is a threat for population health not only in developing countries but also in the developed world. However, it is considered an overlooked source of lead toxicity [3]. Lead contamination of drinking water can have deleterious effect on multiple organ systems including the nervous, heamatopoietic, renal, endocrine and reproductive system, especially in children [4-6].

Few studies conducted in recent years on the quality of sachet water in Nigeria focused primarily on the end-product, without trace of possible point of contamination in the production process [7]. This study therefore evaluates possible point(s) of Lead contamination in sachet water production from three senatorial zones of Anambra state Nigeria.

MATERIALS AND METHODS

Study area and sampling

Most populated and industrial cities were selected from three senatorial zones (Anambra Central, North and South) in Anambra State, Nigeria. Three companies from each zone were sampled. In each company, samples were collected from three different points of production. Point 0 (the raw source of water), point 1 (after passing through the sand and charcoal filters) and point 2 (after passing through series of other filtration processes ready for packaging). Ten samples (1 litre) were collected at each point for each company.

Reagents and glass wares

The reagents used were of Analar grade. Fresh distilled water was prepared and used throughout the study. The glass wares and sampling bottles were thoroughly washed and oven dried.

Analysis of water samples

The samples were pre-concentrated and made acidic with 0.1M HNO_3 solution. 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 ± SD. Means were analyzed using a one-way analysis of variance (ANOVA). All the statistical analyses were done using SPSS, Version 16.0.

RESULT AND DISCUSSION

From the result, samples CT (Anambra Central) and DAM (Anambra South), PE and UNE (Anambra North) has lead levels higher at points 0 compared to points 1 and 2 (Tables 1, 2 and 3). Ideally, this is expected as water collected at point 0 is raw, unfiltered and yet to be processed.

Table 1: Lead concentration (ppm) of water collected at three points from companies in Anambra Central senatorial zones.

Samples name	Mean ± SEM of lead concentration (ppm)		
	Point 0	Point 1	Point 2
SRD	0.004± 0.026	0.008± 0.009	0.009± 0.005
TO	0.005± 0.011	0.008± 0.006	0.009± 0.008
CT	0.003± 0.001	0.002± 0.006	0.002± 0.005

Table 2: Lead concentration (ppm) of water collected at three points from companies in Anambra North senatorial zones.

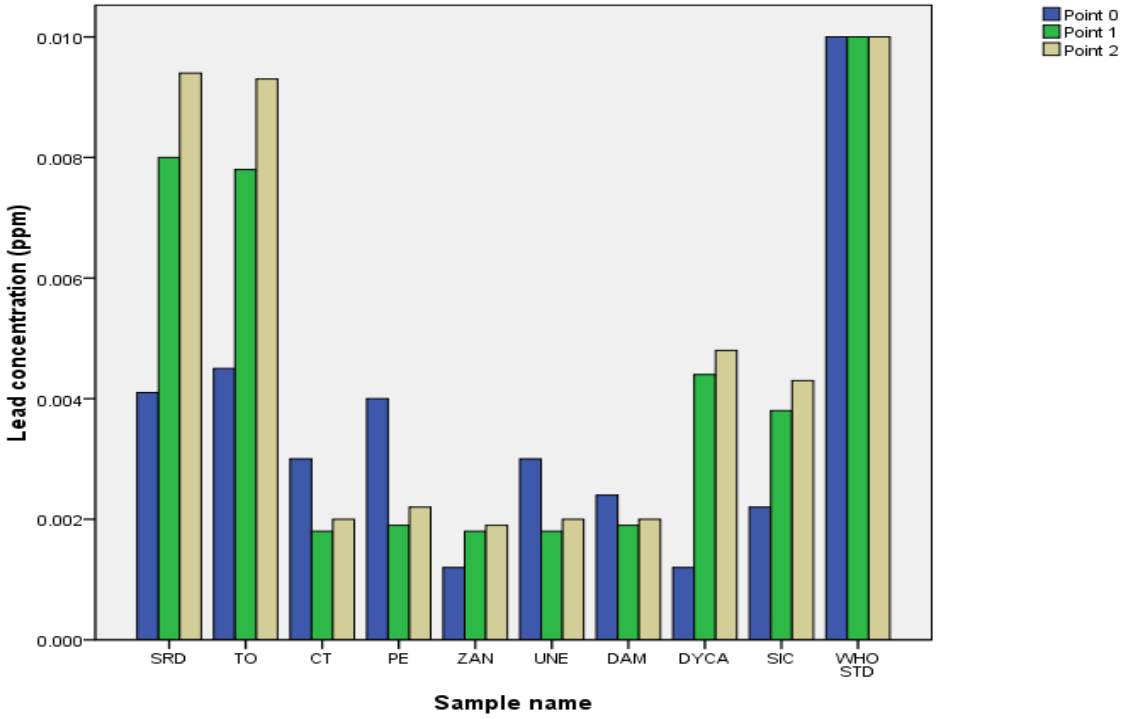
Samples name	Mean ± SEM of lead concentration (ppm)		
	Point 0	Point 1	Point 2
PE	0.004± 0.007	0.002± 0.007	0.002± 0.004
ZAN	0.001± 0.008	0.002± 0.006	0.002± 0.008
UNE	0.003± 0.007	0.002± 0.006	0.002± 0.004

Table 3: Lead concentration (ppm) of water collected at three points from companies in Anambra Central senatorial zones.

Samples name	Mean ± SEM of lead concentration (ppm)		
	Point 0	Point 1	Point 2
DAM	0.002± 0.011	0.002± 0.006	0.002± 0.005
DYCA	0.001± 0.014	0.004± 0.013	0.005± 0.004
SIC	0.002± 0.018	0.004± 0.016	0.004± 0.002

For samples SRD, TO (Anambra Central) and PE (Anambra North), high concentration of Lead observed at point 0 (0.004 to 0.005 ppm) compared to samples from other senatorial zones is an indication of high natural Lead content of their water sources. Human activities like mining and industrial processes might have led to the high Lead accumulation in these areas. The elevated Lead concentration at points 1 and 2 observed at samples SRD and TO (Anambra Central) (Fig 1) close to WHO permissible limit (0.01 ppm) for Lead concentration in drinking water [8] is an indication of possible contamination from the plumbing system coupled with high Lead levels observed from their water sources (point 0).

Fig 1: Lead concentration at various points of sampling compared with WHO permissible limit.



Samples DYCA and SIC (Anambra South) have lead concentration higher at points 1 and 2 compared to point 0 but not as observed from samples SRD and TO. Location of the processing units near factory's generator houses as observed from some of the companies in these areas may also be a possible source of contamination.

Though the observed values in all the senatorial zones were within the WHO permissible limit for drinking water quality (WHO, 2011); owing to the bio-cumulative property of Lead, chronic consumption of sachet water from these companies may predispose to lead toxicity especially in children.

CONCLUSION

Samples SRD, TO and PE sources of water (point 0) is high in lead therefore an alternative source of water supply for sachet water production is necessary. There is also elevated Lead concentration in samples SRD, TO, DYCA and

SIC after processing. Evaluation of the plumbing system and controlled exposure to fumes from factory's generator is recommended.

REFERENCES

[1] Edoga MO, Onyeji LI, Oguntosin OO. *Journal of Engineering and Applied Sciences* **2008**, 3 (8): 642-646.
[2] Consumer Affairs Movement of Nigeria (CAMON). NAFDAC to ban 97% contaminated. Consumer link **2007**; 1:1.
[3] Ranner R. *Environmental Health Perspectives*, **2010**, 118: 68-72.
[4] Landrigan PJ; Schechter, CB; Lipton JM, Fahs MC, Schwartz J. Environmental pollutants and disease in American children. Environmental health perspectives, **2002**, 110 (7): 721-8.
[5] Bryant SD. *Journal of Toxicology. Clinical Toxicology*, **2004**, 42: 287-294.
[6] Morales LS, Gutierrez P, Escarce JJ. Demographic and socioeconomic factors associated with blood Lead levels among Mexican-American children and adolescents in the United States. Public Health Reports, **2005**, 120: 448-454.
[7] Omalu ICJ, Eze GC, Olayemi IK, Gbasi S, Adeniran LA, Ayanwale AV, Mohammed AZ, Chukwuemeka V. *Online J health Allied Scs*, **2010**, 9 (4):15.
[8] WHO . Lead in drinking water. Geneva WHO, **2011**.