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Research Article

DETERMINATION OF SOME HEAVY METALS IN BOREHOLE WATER SAMPLES OF SELECTED MOTOR PARKS IN MAIDUGURI, NIGERIA

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ABSTRACT
This study is aimed at ascertaining the levels of pollution of some borehole waters of selected motor parks in Maiduguri, Nigeria. Borehole water samples from Kano, Bama, Baga and Borno Express motor parks were collected and analysed for Pb, Cr, Cd, As, Pt and Hg using Atomic Absorption Spectrophotomeric techniques. Results showed varying concentrations based on location. High concentration of Pb was observed at Bama Park (0.14mg/l) and other metals showed lower values while Hg was not detected in all the boreholes. High levels of Pb might be associated to the mechanical activities, high vehicle exhaust, municipal waste and other anthropogenic activities within the busy motor parks. The results indicate that most of the boreholes are contaminated with abnormal levels of Pb, Cr and Cd capable of causing health hazards to the consumers of the borehole waters. This suggests that the borehole waters require further treatment before consumption.

Keywords: *Borehole Water, Maiduguri, Heavy metals, Motor Park, Pollution.*

INTRODUCTION

Water plays a vital role in the development of communities; hence a reliable source of water is essential for the existence of both human and animals. Water supply is essentially derived from precipitation and is said to be polluted if it is not suitable for the intended purpose (WHO, 2006; Wells, 1977; Waziri *et al.*, 2009; Kolo and Baba 2004).

There is global concern on water pollution as it affects human health and one of the major causes of groundwater pollution is the disposal of waste materials directly into the land surface. The waste may occur as individual mounds or it may spread out over the land. If the waste materials contain soluble materials, they will infiltrate and may lead to ground water pollution (Waziri *et al.*, 2009; Kolo *et al*., 2009).

Maiduguri town is located at Longitude 13^0 10´ E and Latitude 11^0 50´ N (Google Earth, 2011). The town has a number of motor parks for transportation of people and goods within Nigeria as well as to the neighboring Chad and Cameroun. Human activities within such busy environment could influence the quality of borehole waters used as the source of drinking water by the inhabitants.

This study is aimed at determining the levels of the toxic metals in borehole waters at the selected motor parks within the city in order to ascertain the portability of the water for human use.

MATERIALS AND METHODS

Sample Collection

Borehole water samples were collected weekly for a period of three weeks in four major motor parks within Maiduguri town. The samples were collected in pre cleaned plastic containers, labeled appropriately and taken to the laboratory for analysis.

Sample Preparation

Sample preparation was carried out as described by Ademoroti (1996). Water sample (100ml) was digested with HNO_3 over a hot plate until clear solution was obtained.

Analysis of Samples

Atomic absorption spectrophotometer (Shimadzu AA 6880 model) was used for the analysis of the metals. The procedures employed in these determinations were as contained in the manufacturer's manual for the equipment.

RESULTS

The results of the elemental analysis are presented in Table 1. Significant variation in concentration of metals recorded depicts the activity of the different sampling locations in the city. All the boreholes were contaminated with high levels of Pb and Cr when compared to the acceptable values as stipulated by WHO (1996) and NAFDAC (2001). The highest mean concentration of Pb (0.14±0.03mg/l) was observed at Bama motor park borehole. A high level of Cd was found in the borehole waters at three locations while Pt and as were detected at two out of the four sampled boreholes. However, Hg was not detected in any of the samples analyzed.

DISCUSSION

Toxic metals are mostly carcinogenic in nature as they tend to accumulate in visual and sensory organs of human beings leading to cancer. Thus, water meant for consumption must be free from chemical and microbial contaminants for it to be safe for drinking. This is supported by similar work conducted by other researchers (Dada, 2009 and Ashbolt *et al.,* 1993).

Borehole which serves as the major source of drinking water for the people in most sub-Saharan Africa could be infected by toxic metals by natural or anthropogenic sources. Exhaust from vehicles, use of fertilizers, refuse dumps, use of non-biodegradable materials could be the possible sources of the toxic metals. The ingestion of these metals could be detrimental to human health especially when they occur in very concentrations as observed in this study.

Table 1: Mean concentrations of Heavy toxic metals (mg/l) in the selected boreholes in motor Parks at Maiduguri

Sample Location	Mean Concentration (mg/l) of Heavy Metals					
	Pb	**Cr**	**Cd**	**Pt**	**As**	**Hg**
A	0.08±0.02	0.08±0.01	ND	ND	0.04±0.01	ND
B	0.04±0.01	0.03±0.10	0.04±0.001	ND	0.02±0.01	ND
C	0.14±0.15	0.21±0.05	0.07±0.02	0.05±0.15	0.025±0.01	ND
D	0.07±0.03	0.05±0.01	0.06±0.01	0.04±0.01	ND	ND
WHO Limits (mg/l)	0.01	0.05	0.003	0.01	0.01	0.0001
NAFDAC Limits (mg/l)	0.015	0.1	0.005	0.01	0.05	0.05

A= Kano motor park, B=Express motor park, C= Bama motor park and D= Baga motor park, ND= Not detected

The results of this study generally show the influence of human activities on the boreholes. The high concentrations of Pb, Cr and Cd as obtained might be due to the mobility of metals in soil, rate of infiltration and nature of soil as well as retention ability of the matrix composition of the terrain. The complex interaction between water and life processes is therefore fundamental when considering the supply of potable water (Comerton *et al.,* 2006 and Diamant 1980).

Conclusion

The result of the toxic metal determination in borehole waters of motor parks located at Maiduguri shows that most of the boreholes are contaminated with abnormal levels of Pb, Cr and Cd capable of causing health hazards to the consumers of the borehole waters. Therefore, the boreholes require further treatment to meet the standards for potable drinking water. However, further monitoring should be conducted to determine the extent of pollution by other physico-chemical and bacteriological pollution indicators.

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