

LEVEL OF SOME HEAVY METALS IN RIVER OGUN, NIGERIA

O. P. Sanyaolu*¹, A. Williams² and A. A. Inegbenebor²

¹Faith Academy Canaanland,

Km 10, Idiroko Road, P.M.B. 1026, Ota, Ogun State, Nigeria.

²Department of Chemistry, Covenant University,

Km 10, Idiroko Road, Canaan land, P.M.B. 1021, Ota, Ogun State, Nigeria.

Correspondence authors' e-mail: sunyakay2014@gmail.com; Tel.: +2347013912774

Abstract

The levels of some heavy metals in River Ogun were investigated using Atomic Absorption Spectrophotometer (AAS). Metals analyzed were Cd, Co, Cu, Cr, Fe, Mn, Pb and Zn; in order to know how healthy the medium for human consumption is. The results showed that the mean concentration of these heavy metals were 1.14 mg l⁻¹ cadmium, 1.11 mg l⁻¹ cobalt, 0.32 mg l⁻¹ for copper, 0.77 mg l⁻¹ chromium, 20.54 mg l⁻¹ iron, 2.45 mg l⁻¹ manganese, 3.53 mg l⁻¹ lead and 1.61 mg l⁻¹ zinc. These results were compared with the WHO standard guidelines; and discharge of untreated industrial wastes and occupational wastes from dyeing activities, into the river responsible the level of pollution of River Ogun.

Keywords: Heavy metals, River Ogun, untreated wastes and pollution

Introduction

Water is a universal solvent upon which plants and animals depend for their survival. River Ogun is one of the major sources of water supply in the South-Western part of Nigeria. Corporations like Ogun-Osun River Basin Authority manage the handling and distribution of treated water to the Nigerian citizens [1]. Procedures to produce safe and potable water for drinking and washing were developed in the '19th century, when it became clear that many water-borne diseases were due to pollution of the main water source [2]. Industrial and occupational effluents like toxic chemicals and heavy metals pollute rivers. The heavy metals include cadmium, cobalt, copper, chromium, iron, manganese, lead and zinc. A feature that heavy metals have in common is that they accumulate in the bodies of their recipients. Therefore, its concentration increases along the food chain. Some marine organisms such as algae contain heavy metals up to one hundred times that of the water in which they are living [3 - 4]. A World Health Organisation (WHO) survey has highlighted the fact that each day some 30,000 people die from water related diseases and contaminations. In developing countries, including Nigeria, sixty percent (60%) of all illnesses is water related. Also, a quarter of children born die before the age of five (5) from water related illnesses [5]. At high levels, some of these metals could cause injure, such as hypertension, tumors, hepatic dysfunction, vomiting, difficulties with respiration, decalcification, proteinuria and glycosuria as long term effects, hyperzincuria, stomach, sickle cell anemia, skin leisure, diarrhea,

mental lethargy, depression, eye-leisure, rough skin, anorexia, ucher, gastro-enteritis, vomiting, and gastro-intestinal breeding. The main goal of this study is to determine the levels of some heavy metals in River Ogun.

Materials and Methods

Description of the Study Areas

River Ogun is located between latitude 7° N and longitude 3°15'E and 3°30'E. It drains through Alabata, Lafenwa, Sokori, Olomore, Ita-oshin and Isheri in Lagos state where it find its way into the Lagos Lagoon.

Sample Treatment

The water samples were collected in September, 2013 at ten (10) different locations along the River Ogun by random sampling to provide representative coverage of the South-East and North-East section of River Ogun. They were collected in inert polyvinylchloride (PVC) plastic bottle which were pre-washed and soaked with 0.1 M HNO₃ solution for more than eight (8) hours. They were filtered and preserved by adding 10ml. of the 0.1 M HNO₃ solution to the sample in the bottle. Water samples obtained from different sites were -pretreated by repeated evaporation with analytical grade trioxonitrate (V) acid (HNO₃) as outlined ill standard methods for water and effluents analysis [6 - 7]. The heavy metal concentration in the water samples were determined using Perkin-Elmer flameless Atomic Absorption Spectrometry-model 306, equipped with hollow cathode lamp graphite furnace [8- 9].

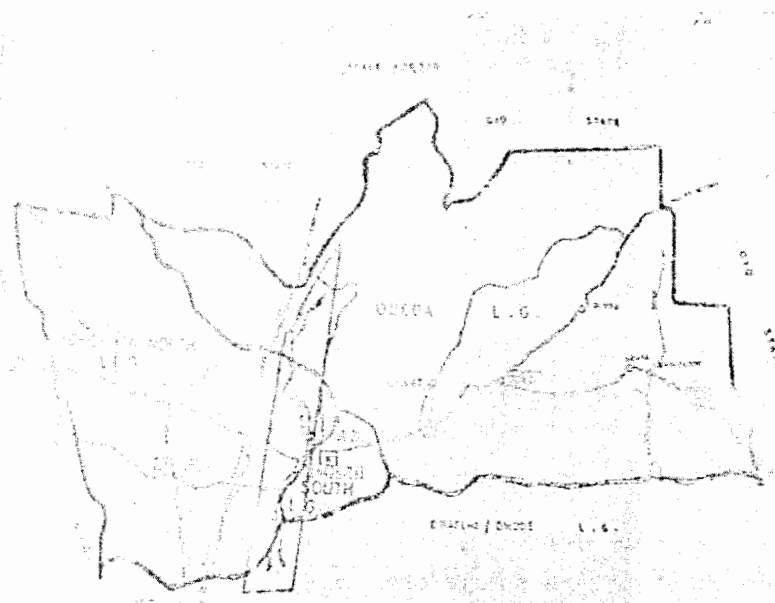


Fig. 1: The Map of Abeokuta North, Abeokuta South and Odeda Local Government Areas

Results

Table 1: Concentration of Heavy Metals at the Sites in River Ogun

Sample No	Metal concentrations (ppm)							
	Cd	Co	Cu	Cr	Fe	Mn	Pb	Zn
1	6.60	2.38	0.03	1.25	40.00	2.33	1.45	2.43
2	0.35	0.90	0.18	0.45	9.45	1.18	1.75	2.00
3	2.20	1.05	0.03	1.03	9.85	1.90	0.10	2.70
4	0.18	0.40	0.10	0.25	5.40	1.43	5.02	2.10
5	0.58	0.15	0.98	0.58	7.98	5.68	2.20	0.83
6	0.80	1.05	0.70	0.58	8.05	4.18	0.40	0.78
7	0.70	1.55	0.30	1.00	27.40	2.18	4.40	0.30
8	1.30	0.10	0.40	1.05	25.20	1.30	4.60	2.50
9	0.70	1.08	0.25	1.00	26.80	1.33	8.45	0.23
10	1.03	1.95	0.25	1.25	35.25	2.83	6.97	2.25
Range	0.18-6.60	0.10-2.38	0.03-0.98	0.25-1.25	5.40-27.40	1.18-5.68	4.60-8.45	0.23-2.70
Mean±SD	1.44±1.80	0.77±1.39	0.32±0.29	0.77±0.44	20.54±11.67	2.45±1.39	3.53±2.73	1.61±0.92
WHO	0.10	1.00	1.50	1.00	20.0	0.50	0.10	0.50

Table 3: Simple correlation analysis of heavy metals in River Ogun

Metals	Correlation values (r)							
	Cd	Cu	Fe	Mn	Pb	Zn	Cr	Co
Cd	1.000							
Cu	0.630	1.000						
Fe	-0.395	0.330	1.000					
Mn	-0.149	0.710	0.585	1.000				
Pb	-0.325	-0.135	-0.111	-0.468	1.000			
Zn	0.414	-0.530	-0.682	-0.757	-0.262	1.000		
Cr	0.378	-0.120	-0.205	-0.102	-0.209	0.357	1.000	
Co	0.476	0.003	-0.192	0.334	0.128	-0.237	0.283	1.000

Discussion

The results showed that the mean concentration of these heavy metals were 1.14 mg l⁻¹ cadmium, 1.11 mg l⁻¹ cobalt, 0.32 mg l⁻¹ for copper, 0.77 mg l⁻¹ chromium, 20.54 mg l⁻¹ iron, 2.45 mg l⁻¹ manganese, 3.53 mg l⁻¹ lead and 1.61 mg l⁻¹ zinc. These concentrations were compared with the WHO standard guidelines and they indicated high levels for Cd, Pb and Mn. The high levels were attributed to the discharge of untreated industrial wastes into the river, indicating the level of pollution of River Ogun. Also, the results obtained from this investigation, indicates that there is positive correlation between copper and cadmium, iron and copper, manganese and copper, manganese and iron, zinc and cadmium, chromium and cadmium, chromium and zinc, cobalt and cadmium, cobalt and copper, cobalt and manganese, cobalt and lead, and cobalt and chromium. This implies that the presence of one of the coupled heavy metals influences the mechanism of accumulation of the other in River Ogun. Lead showed negative correlation relationship with all the heavy metals investigated, indicating that the assumption at the beginning of this study that River Ogun was unpolluted cannot hold. Manganese, Lead and Zinc are extremely above the recommended of World Health Organization (WHO). This implies that River Ogun is polluted with these toxic heavy metals. This will have a long-term effects on the health state of the people that use River Ogun for drinking and other purposes without proper treatment before such usage.

Conclusion

Eight heavy metals were identified in River Ogun. The results showed that the mean Concentration of these heavy metals were these heavy metals were 1.14 mg l⁻¹ cadmium, 1.11 mg l⁻¹ cobalt, 0.32 mg l⁻¹ for

copper, 0.77 mg l⁻¹ chromium, 20.54 mg l⁻¹ iron, 2.45 mg l⁻¹ manganese, 3.53 mg l⁻¹ lead and 1.61 mg l⁻¹ zinc. These concentrations were compared with the WHO standard guidelines and they indicated high levels for Cd, Pb and Mn. Inter-elemental correlation and bar chart analysis were used to establish that

River Ogun is highly polluted by toxic heavy metals like cadmium, manganese, lead and zinc. Prominent among the sources of this pollution is the discharge of effluent wastes from local dyeing occupation peculiar to people of this area and industrial wastes from industrial rapid growth from these locations. There is need for the government to legislate appropriate laws, to regulate the treatment of river water before usage and environment, assessment appraisal and monitoring by industries. The effective way to control, reduce and eliminate the impact of these toxic heavy metals is to develop proper environmental policies and implementation of both wastes management plan and environmental assessment appraisal along with setting up Task. Force to ensure compliance to such laws and policies.

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