

## CONCENTRATIONS OF HEAVY METALS IN SOME IMPORTANT RIVERS OF OWERRI ZONE, IMO STATE, NIGERIA

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**ABSTRACT:** *Analyses of heavy metals in water samples from different rivers of the Owerri zone in Imo State, Nigeria were carried out using Atomic Absorption Spectrophotometer (AAS). Water samples from Rivers Azaraegbelu, Ogochie, Okatankwu and Otamiri were analyzed for lead (Pb), arsenic (As), cadmium (Cd) and zinc (Zn). The concentration of lead was highest in water samples from Azaraegbelu River (0.054 ppm). Arsenic was present in lower concentration in Azaraegbelu, Ogochie and Okatankwu Rivers. Cadmium concentration was 0.511 ppm in Azaraegbelu River, 0.034 ppm in Ogochie River, 0.091 ppm in Okatankwu River and 0.166 ppm in Otamiri River. Concentration of Zinc was higher in Azaraegbelu River (0.288 ppm), while Ogochie River recorded the lowest concentration of 0.098 ppm. Comparatively, Azaraegbelu River recorded the highest concentration values of the heavy metals analyzed.*

**Keywords:** *Heavy metals, concentration, river, pollution, bioavailability, toxicity*

### INTRODUCTION

Many developing countries of the world still depend on surface water resources for their water supply. Industrial effluents and other toxic waste substances pollute some of these water sources (Aririatu, 2003). In the Owerri zone of Imo State, Southeastern Nigeria, Owerri urban is the only major urbanized area. Other areas are rural, without pipe-borne water. However, there are few private and public boreholes. These actually do not meet the water needs of the people. As a result, the available surface water sources serve as sources of supply even in the urban areas where people may resort to Otamiri River and rainwater, when there is short supply from the waterworks. Major available rivers in this zone are Azaraegbelu, Okatankwu, Otamiri and Ogochie Rivers.

Researchers in many parts of the world ((Gibbs, 1973, Henriksen and Wright, 1978, Egboka *et al.*, 1983, Johnson, 1997, Kanu *et al.*, 2006, Obiekezie, 2006) have studied the pollution of water by waste substances containing heavy metals. Though heavy metals differ widely in their chemical properties, their relative concentrations, discharges, and their bioavailability are very important to terrestrial, aquatic and marine organisms in terms of toxicity. Inasmuch as small amount of these elements are common in the environment and diet, and are necessary for good health, large amounts of them may cause acute or chronic toxicity (ASTDRS, 2001).

Heavy metal toxicity can result in damaged or reduced mental and central nervous function, lower energy level and damage to the blood composition. High concentrations of lead for example, can cause birth defects, muscular weakness and paralysis (UNESCO, 1984). Acute cadmium exposure on the other hand can lead to vomiting, abdominal pains, kidney damage etc. Any water resource, which has higher concentration of heavy metals above the stipulated standards, therefore remains unsuitable for consumption (Akintola and Aresla, 1979). Much work has however not been done on the concentrations of heavy metals in available water resources in Imo State.

This study therefore investigated the concentrations of lead, zinc, cadmium and arsenic in natural surface water sources in Owerri zone of Imo state, Nigeria.

### MATERIALS AND METHODS

Water samples were collected from four major rivers in Owerri Zone of Imo State, namely Azaraegbelu, Okatankwu, Otamiri and Ogochie Rivers and labeled. Samples were collected from different locations where people make use of the rivers (both up and down streams), using one-liter clean rubber bottles. The samples were collected in duplicate from the banks of the Rivers as well as from 2 cm below the water surfaces and transported in a cooler to the laboratory for analyses.

The atomic absorption spectrophotometer (AAS) (UNICAM 919) was used to analyze for the heavy metals in the water samples. In each case, the standard solution of each element (heavy metal)

under investigation was aspirated into the nebuliser-burner assembly and the corresponding absorbance reading obtained at the wavelength of the element under investigation. The water sample to be analyzed was then aspirated and absorbance reading obtained. This was repeated for all the heavy metals of interest using their respective hollow cathode lamps and wavelengths. Concentration of elements in water samples were obtained by extrapolation from their respective standard curves.

Data generated were analyzed using descriptive statistics such as means and graphs.

**RESULTS AND DISCUSSION**

The result of heavy metals concentrations in all the rivers studied is shown in table 1. This revealed that in Azaraegbelu River, Lead (Pb), arsenic (As), cadmium (Cd) and zinc (Zn) had concentrations of 0.054, 0.020, 0.511 and 0.288 ppm respectively. The concentration values of lead, arsenic, cadmium and zinc in Ogochie River were 0.004, 0.001, 0.003 and 0.0098 ppm respectively. However, in Okatankwu River concentrations of lead was 0.028 ppm, arsenic, 0.0017 ppm; cadmium, 0.091 ppm and Zinc, 0.124 ppm. Lead was 0.069ppm, Arsenic, 0.010ppm, Cadmium, 0.166ppm and Zinc, 0.230ppm in Otamiri River.

Figure 1 show a comparison of the concentration levels of lead, arsenic, cadmium and zinc in different rivers. Azaraegbelu River recorded the highest concentration of Cadmium (0.511 ppm), while Arsenic recorded the least concentration values.

**Table 1: Concentration of Heavy Metals in some Rivers Studied in Eastern Imo State.**

River	Conc. Of Heavy Metal (Ppm)			
	Pb	As	Cd	Zn
Otamiri	0.069	0.010	0.166	0.230
Okatankwu	0.028	0.017	0.019	0.124
Ogochie	0.004	0.001	0.034	0.098
Azaraegbelu	0.054	0.020	0.511	0.288
Average	0.039	0.012	0.185	0.185
WHO standard values	0.0100	0.010	0.003	5.00

The findings in this study show that the concentration of heavy metals varied among the different water resources. Virtually, all the water samples from the sources and locations had lead (Pb) within acceptable range. However, Azaraegbelu and Otamiri Rivers recorded higher concentrations of 0.054ppm and 0.06ppm respectively, which are above WHO standards (0.05ppm) (WHO, 2006). Human and industrial activities may have contributed to the results obtained from Otamiri River (Aririatu, 2003). Proximity of the river to dump sites could lead also to the results obtained. Excavation activities and discharges from moving vehicles (considering the fact that the river crosses a very busy Owerri – Umuahia highway), could be the reason for the results obtained from Azaraegbelu River. Again, the use of this river by motorists to wash cars could be a contributor to the level of lead recorded.

The findings in this study show that the concentration of heavy metals varied among the different The concentrations of Arsenic in all the rivers were within the acceptable range, though it was higher in Okatankwu and Azaraegbelu Rivers (0.017ppm and 0.020ppm, respectively). This may be attributable to erosion of natural deposits, runoffs and industrial wastes that enter the water bodies (Singh, 2005).

The level of Cadmium in Azaraegbelu and Otamiri Rivers are indicative of the level of pollution of these resulting from industrial activities such as discharge of industrial effluents into Otamiri river on one hand, and activities of users of Azaraegbelu River and erosion on the other (Okereke, 2006).

Zinc was the only element out of all the heavy metals studied that was below acceptable concentration in all the rivers. This could be due to the insolubility of Zinc in water; hence, natural waters have less than 1ppm of Zinc (UNESO, 1983).

The concentration levels of Zinc, Cadmium, Arsenic and Lead were low in Okatankwu and Ogochie Rivers comparatively. This may be due to low level of industrial activities within their locations (Ikeduru and Ngor-Okpala, rural areas in Eastern Imo).

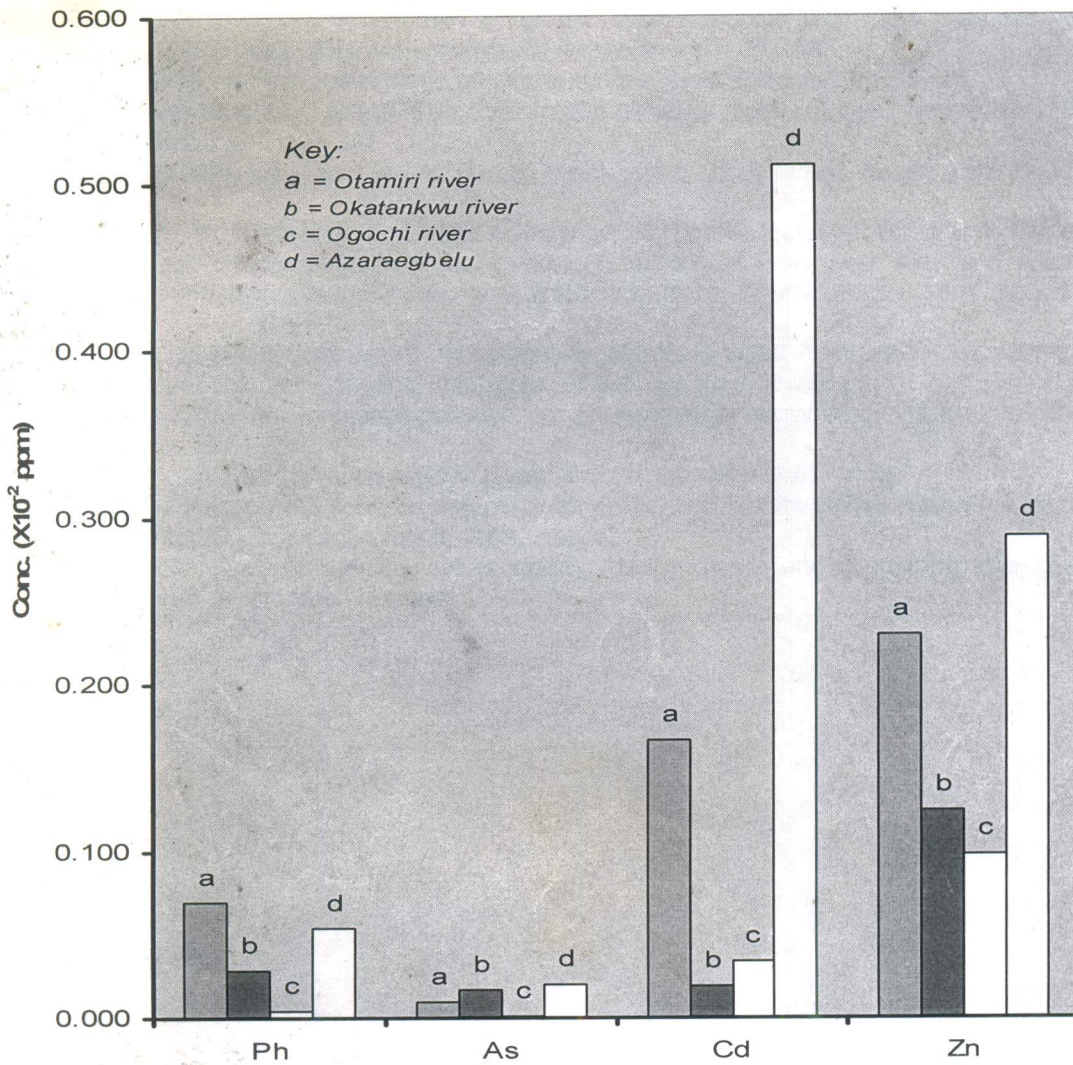


Fig.1 Concentration of heavy metals in diferent rivers in eastern Imo

**CONCLUSION**

The rivers investigated have some of the heavy metals above the acceptable concentrations particularly Azaraegbelu River, which virtually is the source of water to many commercial water to unsuspecting consumers within the zone. Even though some of the water sources studied could be termed polluted, studied elsewhere in Nigeria and abroad are more highly polluted with heavy metal-containing pollutants (Henriksen and Wright, 1978; Kanu *et al.*, 2006).

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