

Chemical and Microbiological Assessment of Water and Bottom-sediments Contaminations in Awba Lake (U.I.), Ibadan, SW–Nigeria

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Abstract: Environmental contamination assessment of Awba Lake, (Ibadan-Nigeria) revealed environmental contamination of the water column through human and animal waste inputs with coliform counts of $1-2 \times 10^4$. Average concentrations of Cu, Pb, Zn, As, Cd and Hg range between 0.2 to 23.7 mg/kg while positive correlation with %clay suggests trace metal enrichment within the bottom-sediments through both geogenic and anthropogenic sources.

Key words: lake; water quality; trace metals; sediments; coliform count; Ibadan-Nigeria.

INTRODUCTION

There is no gain saying in that human activities are the major causes of environmental contamination of the environment including water bodies. Trace metals, as important contaminants, tend to accumulate in sediments and as such may be directly available to benthic fauna or released to the water column through sediment re-suspension (PEKEY ET AL., 2004) with possible attendant threats to human health and aquatic life. In many developing countries, increasing agricultural activities, urbanization and industrialization leads to ever increasing contamination of streams/rivers and lakes/reservoirs, which are usually the main sources of drinking

water. Hence this study assesses the environmental contamination of water and bottom sediments from Awba Lake UI-Ibadan, SW. Nigeria with reference to trace metals and microbiological composition.

STUDY AREA AND METHODS

The study Awba Lake is a natural water body (with surface area of about 185,600 m²) located within the University of Ibadan campus, Ibadan, Nigeria. It is the major source of potable water for more than forty thousand people (residents and non-residents) in the campus. Awba Lake receives surface runoff from the catchment area as well as domestic wastes/effluents mostly from the stu-

dent residential complex, which are subject to limited treatments. Water and bottom sediment samples from 18 sampling points within the lake and 6 locations from the feeding streams were collected in March 2001 and 2003. A number of trace metals were analyzed using Atomic Absorption Spectrophotometer (*Model – Buck 2000*) while total heterotrophic bacteria and coliform counts were carried using and on Eosin Methylene Blue (EMB) agar medium following standard procedure. Data evaluation involved estimation of some environmental contamination indices.

RESULTS AND DISCUSSION

Trace metals contamination: The summary of the physico-chemical data for water and bottom sediments as presented in Table 1 show generally low metal concentrations in the water column (<1.5mg/l) compared to those of the bottom-sediments (0.2-24 mg/kg) which is an indication of trace metal parti-

tioning in the sediment phase. Significant correlation of %Clay fraction with for Pb, Zn, Cd and Hg as well as similar peaks and trends along the axis of the lake as presented in Fig. 1 is a confirmation of the preferential partitioning in the sediment phase. Furthermore, the highest clay fraction of 20.5 % and highest TDS of 299 mg/l obtained at location S-07 close to discharge in-let of one of the feeding streams (location S-19) is a clear indication of anthropogenic inputs from catchment area. Evaluation of the estimated metal contamination indices (AF, Igeo, Kd; Table 1) revealed that the enrichment of Cd, Hg and As are due to anthropogenic sources while those of Cu, Pb and Zn are mostly related to the geogenic inputs through weathering/erosion and run-off from the catchment area.

Microbiological contamination: The results of the microbiological analyses summarized in Table 1 indicate general microbial contamination of both water column and bot-

Table 1. Summary of trace metal concentrations and metal contamination indices*

Parameters	Sediments (mg/kg) N=24		AF*	Igeo	Water (mg/l) N=44		CF*	Kd*
	Mean	St.dev*			Mean	St.dev		
Cu	5.93	0.30	0.41	- 1.86	0.010	0.017	0.026	193.1
Pb	10.49	2.09	0.20	- 2.91	0.184	0.465	1.20	68.9
Zn	23.74	3.86	0.25	- 2.56	0.001	0.002	0.002	779.0
Cd	0.17	13.57	0.82	- 0.88	0.037	0.036	4.30	3.98
As	7.32	0.03	4.67	1.72	1.400	1.705	43.00	0.65
Hg	7.99	2.05	85.63	5.87	0.921	1.288	178.0	3.29
%Clay	10.56	3.38	-	-	-	-	-	-
THBC	3.2×10^5	1.0×10^2	-	-	2.0×10^4	1.2×10^1	-	-
E. Coli	6.0×10^3	7.0×10^1	-	-	2.3×10^3	1.3×10^1	-	-

* St.dev = Standard deviation; Igeo = Geo-accumulation Index; AF = Anthropogenic factor; CF = Single metal contamination factor; Kd = Metal partitioning coefficient; THBC = Total heterotrophic bacteria count.

tom-sediments of the Awba Lake, although the total heterotrophic bacteria count (THBC) are commonly observed in both water and sediment phases compared to *E. Coli*. This implies that the contamination is not only through anthropogenic human/animal wastes inputs but also a function of the general microbiological activities within the lake environment. However, the in-let point of the feeding stream at location S-23, which exhibited the highest range of THBC, and *E. coli* counts (i.e. 2.0×10^9 and 4.1×10^8 respectively) represents discharge from the Zoological garden and hence a clear indication of contamination from animal wastes. Nonetheless, it should be noted that the absence of coliforms at some sampling points might be due to possible unfavorable conditions hindering the multiplication of the coliforms in the water body e.g. ultra-violet ray of the sun had been reported to destroy coliforms in water (DURAN ET AL., 2002). But the high microbial load recorded in the sediments could be attributed to the presence of suspended/particulate solids rich in organic matters, which serve as nutrients for the microorganisms.

CONCLUSIONS

This study revealed the preferential enrichment of some contaminant trace metal in the bottom-sediments of Awba Lake (Ibadan-Nigeria). However, the possible re-suspension of such sediment-borne trace is a serious environmental concern in terms of toxic effects on the aquatic life. Also, the observed high THBC and most especially *E. coli* bacteria counts in water column and bottom-sediments are strong indication of impacts of effluent discharges from the lake catchment and hence a source of potential water-borne related epidemics if adequate and proper treatment measures are not employed before usage of the water for drinking purpose.

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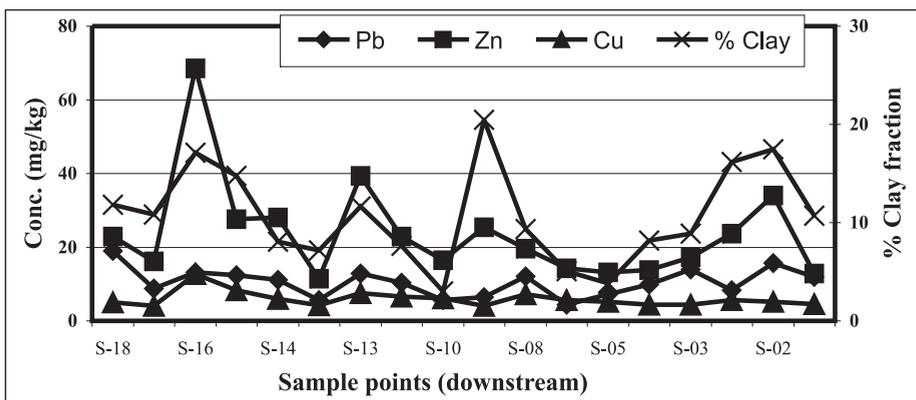


Figure 1. A representative plot showing the correlated trends of selected trace metal concentrations and % Clay.

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