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Determination of Heavy Metals from River Benue around the Makurdi Metropolis

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ABSTRACT

Water sample were collected from river Benue in five different locations: River MU (A), UAM water works (B), Coca-Cola/Brewery (C), River Agaba (D) and Wildlife Zoo (E). All the five sampling stations are located upstream of the river within Makurdi town. Six heavy metals: Pb, Zn, Mn, Fe, Cu, and Cd were analysed by Atomic Absorption Spectrometry (AAS). The concentration of Zn, Mn and Cu fall within the acceptable limit while that of Fe, Cd and Pb were found to be higher than the maximum accepted limit. The order was Fe>Pb>Cd, with Fe been highest in Coca-Cola Pb and Cd were highest in UAM water work.

Keywords: *Pollution; River; Anthropogenic; Metropolis.*

Introduction

Makurdi is located very close to river Benue but, only a small fraction of the people living in the metropolis have access to safe drinking water. River Benue serves as a major source of municipal water for towns and village along the river. Water is important for both plants and animals. However, if the quality needed for sustainable development of a region is not surveyed, water management becomes difficult, with subsequent health related implications (1). The abundance of water is not always the problem but the form and the quality. Many rivers/streams in the developing nations are heavily polluted due to anthropogenic actives (2). The pollution becomes a thing of concern when the WHO limit is exceeded. Interest is being focused on heavy metals because they are non-biodegradable, though the variation in concentrations may be seasonal (3). In many instance, heavy metals are present in low concentrations, since they may be useful to some living organisms. However detrimental high concentrations of Heavy metals are attributed to foreign introduction (4). The introduction of heavy metals into the atmosphere and subsequently into water bodies by anthropogenic source has greatly exceeded the contamination by natural means (5). The presence of heavy metals in water bodies have been detected in the free waters and in fishes (6) consumed by man and has led to health related problems (7). The distribution of these heavy metals in rivers is not always uniform and varies with region (8) even though there are indications that the concentrations heavy metals in African rivers are low (9).

Benue Brewery Limited (BBL) and Coca-Cola are the two main industries situated at about 5km away from Wurukum that discharge their effluent into this river. The main objective of this work is to evaluate the water quality of River Benue around the Makurdi area.

Materials and Methods

Study area

Benue State is located at geographic coordinates of longitude 7^0 47' and 10^0 0' East; Latitude 6^0 25' and 8^0 8' North. River Benue is in Longitude $6^0$45' 47 E and latitude 7^0 47' 10" N. it serves as the major source of water supply to Makurdi and its environs. Benue has a population of 4,780,389 (2006 census) and occupies a landmass of 32,518 square kilometers.

Sampling and sample preparation

Watersamples were collected from river Benue at points A, B, C, D and E (Table 1 at the depth between 25-30cm below the water surface. Sampling was conducted at every two weeks interval between 6:30 – 8:30 AM. Water samples at each sampling point were taken on both sides of the river bank adjacent to the chosen points. The samples were analyzed using Atomic Absorption Spectrometry (AAS).

Table 1: Types of human activities observed at sampling points

Station Code	Name	Human activities observer
A	River MU	Fishing/Farming
B	UAM Water Works	Fishing/Farming
C	Coca-Cola/Benue Brewery	Fishing/Farming
D	River Agaba	Fishing/Farming
E	Wild Life Zoo	Fishing

Result and discussion

Many heavy metals are toxic (10) but the exact amount varies, considerably. Cadmium, Mercury and Lead compounds are much more toxic than Iron and Chromium.

Heavy Metals	River MU	UAM water works	Coca-cola/Benue Brewery	River Agaba	Wild Life Zoo
Zn	0.3400	0.0379	0.0434	0.0272	0.0285
Fe	0.2149	0.4062	0.8351	0.6351	0.5544
Cd	0.0126	0.0138	0.0065	0.0031	0.0066
Pb	0.1824	0.2368	0.1643	0.2185	0.2227
Cu	**0.0571**	**0.0359**	**0.0846**	**0.0389**	**0.0793**
Mn	0.1946	0.3404	0.4726	0.2512	0.5381

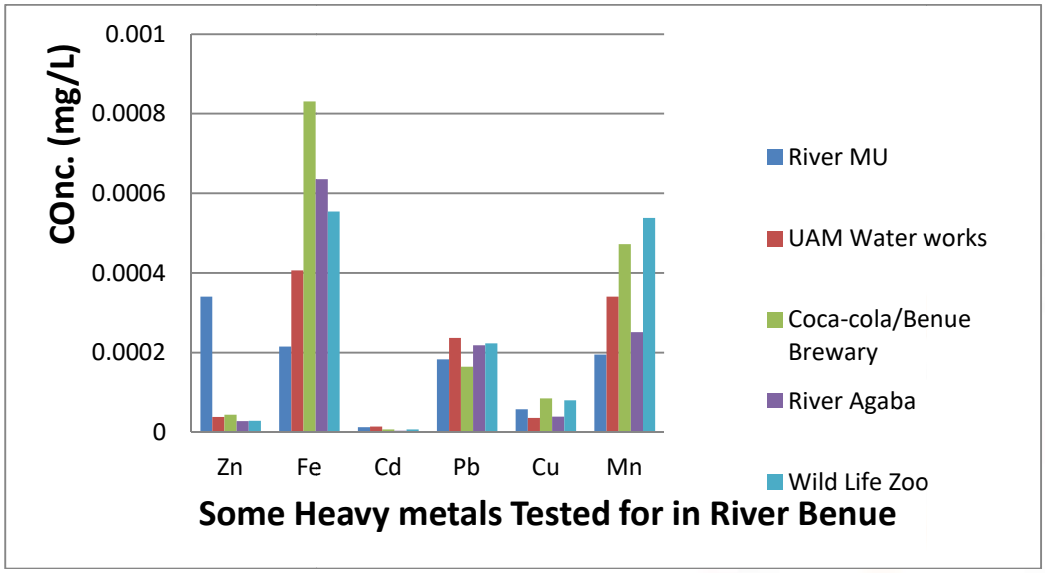

Figure 2: Concentration of heavy metals in Makurdi Metropolis

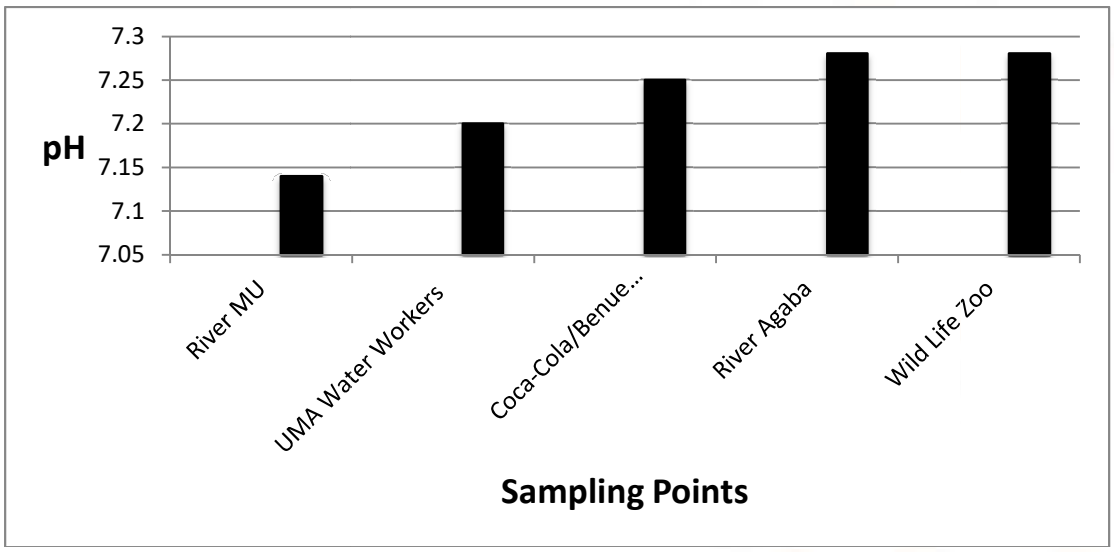

Figure 3: PH range of River Benue around Makurdi Metropolis

The variation in P^H along the sample site is attributed to wide ranging anthropogenic activities from factories, industries and agricultural practices around the Makurdi metropolis. However, the P^H still falls within the acceptable limit.

Table 3: Physico-Chemical parameter of River Benue

Parameter	River MU	UAM Water works	Coca-cola/Benue Brewery	River Agaba	Wild Life zoo
pH	7.14	7.20	7.25	7.24	7.28
Conductivity(µs/cm)	75.70	77.60	91.9	80.5	81.2
Temperature ($_0$C)	29.2	29.2	28.5	28.2	28.2
TDS(mg/L)	37.80	38.80	40.30	40.20	40.50
TSS(mg/L)	73.30	80.00	53.30	68.30	87.00
DO(mg/L)	1.62	2.0	1.67	1.93	1.69
Turbidity (NTU)	5.00	5.00	5.00	5.00	5.00

Hardness(mg/L)	10.5	10.7	12.7	12.3	11.3
Alkalinity(mg/L)	3.10	2.70	3.10	3.10	3.10
BOD(mg/L)	13.30	16.70	13.30	15.00	10.00
COD(mg/L)	122	122	122	122	122
Chloride(mg/L)	1.44	1.8	1.75	1.18	1.51
Phosphate(mg/L)	4.30	9.70	3.30	9.20	3.80

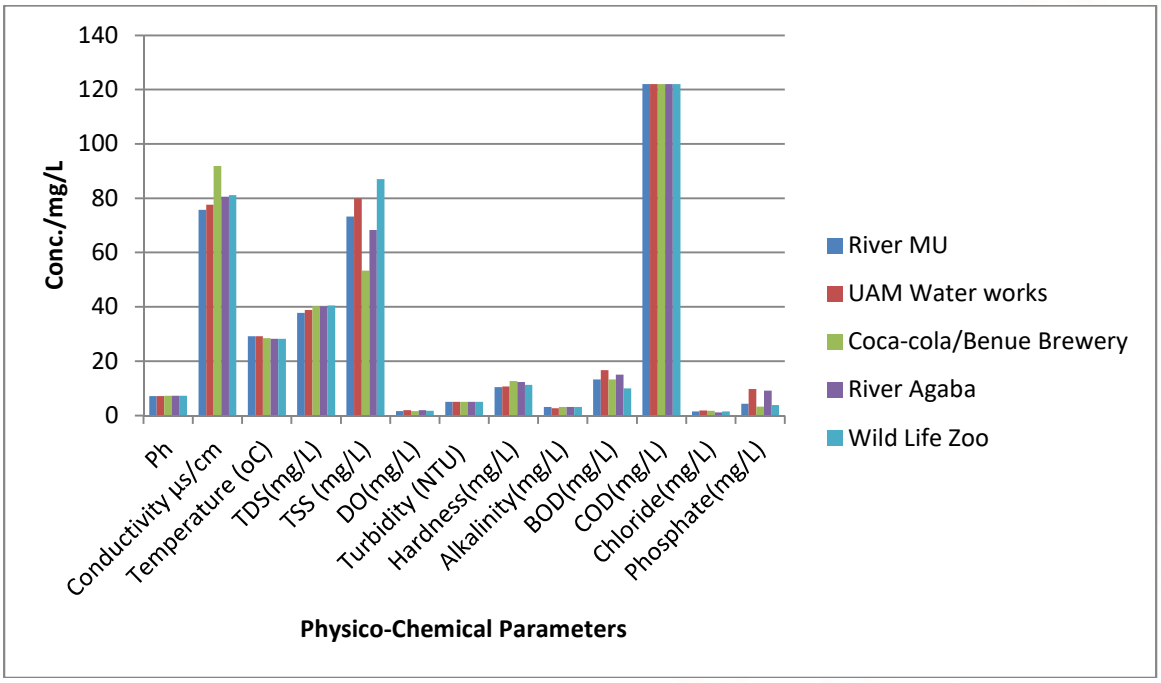

Figure 4: Physico-Chemical parameter of River Benue

Conclusion

The presences of metals in rivers are noticeable near industrial pollution sources (11). The detection of heavy metals in river Benue around the Makurdi metropolis may be attributed to wide ranging anthropogenic activities, with varied concentrations. The concentration of Zn, Mn and Cu fall within the acceptable limit while that of Fe, Cd and Pb are above the limit. The concentrations of Fe and Cd were highest in Coca-cola(C) alone and pb was highest in UAM water works. The samples were also analyzed for P^H, electrical conductivity, alkalinity, total dissolved oxygen.

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