Water Quality Characteristics of Nkisi River in Onitsha, Anambra State.

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ABSTRACT

Water quality characteristics for the Nkisi River were investigated with the view to determining the extent of pollution. Chemical elements such as chromium (Cr), copper (Cu), lead (Pb), cadmium (Cd), and iron (Fe) were investigated and their sources identified, stating also their environmental implications as it relates to human, animals, and plant life. This research work was based on the hydro-geo-pollution cycle as these chemical elements return back to man eventually. Analysis were performed and the results obtained were compared with the World Health Organization (WHO) standards for drinking water and discharge into the surface water using Duncan's multiple variance test. The results showed copper, lead, and iron to be above the WHO standards but chromium and cadmium were below the standards. From the results obtained, the pollution of the Nkisi River was found to be largely caused by effluents from industries located around the area, refuse dumps, and also from erosion and water from the municipality.

(Keywords: pollution, chemical elements, hydro-geo-pollution)

INTRODUCTION

Fresh water is a vital resource for human health and countless other human activities. Water also helps to protect organisms' against abrupt changes in temperature and moderates the Earth's climate. However, water superiority as a solvent also means that it is easily polluted by some water soluble wastes (Miller, 1994).

Despite the importance of water, it is one of the most poorly managed resources on Earth. We misuse it and pollute it due to various anthropogenic activities which are gradually intensifying due to population increase and civilization. The indiscriminate dumping of municipal and industrial wastes has greatly polluted our surface waters thereby denying them of their natural qualities.

The River Nkisi is a major river in Onitsha, Anambra State, Nigeria. It runs across many towns and communities, notably, Ogbunike, Nsugbe, and Oze. These populations are mostly farmers and fishermen. Also, the intake structure of greater Onitsha water scheme was located upstream of the River Nkisi. Over the years, there has been significant increase in human activities and population which has resulted in substantial increase in generation of wastes by the industries and municipality that are indiscriminately dumped into the river. This disposal pattern no doubt leads to serious contamination of surface/ground water. Based on the above, this research paper investigated the water quality characteristics of the Nkisi River in relation to World Health Organization (WHO) standards. This research work was achieved through:

1. Testing the physico- chemical characteristics of the river by drawing samples from different points for six months.

2. Testing the physico-chemical characteristics of effluent from identified nearby industries.

METHODOLOGY

Samples of both waste water from industries and water from the river were collected over a period of six (6) months (May to October) and analyzed using Atomic Absorption Spectrometer (AAS) and other equipment. Samples were analyzed within twelve (12) hours after collection to avoid changes which usually occur in the concentration and a value of certain parameters in water samples if analysis is delayed. In the statistical analysis of the result, one way analysis of variance was used in determining the metal concentrations between months.

RESULTS AND DISCUSSION

The experimental data were collected and the statistical analysis done, the following results were obtained (Table 1).

Metals in water occur as complexes in diverse mixtures of soluble and insoluble forms. They may be present as ionic species, inorganic and organic complexes. This can be associated with colloids and suspended particulate materials. (Sharron et al., 1993). In rivers, the majority of copper was present as humic complexes (Sharron et al., 1993) but metallic copper was found to have its lowest concentration in June. When the overall results of the highest concentration of copper (918.10) in September was compared with WHO standard of (200.00), the river can be said to have a high concentration of copper. Even the lowest concentration in June is still high.

Chromium was highest in June (961.00) as against WHO standard of (50.00) which shows that the inhabitants stands the chance of chromium contamination during dry season. But this decreases as rainy season increases.

Concentration of lead in the water in the month of October (995.2) was above acceptable value of WHO standard of (50.00). Its lowest concentration of (467.20) in July was still higher then WHO standard. This high concentration of lead in the water can be attributed to effluents from major and minor mechanic workshops that also channel and dump their waste into the river. The deviation of the lead content of this river from the set standard calls for thorough treatment before use, especially for domestic purpose due to its carcinogenic effect.

Cadmium is not commonly found in nature, so the cadmium concentration in this river is not very high. It has its highest concentration in July (9.20). This small concentration must have been washed out from heaps of refuse along the river bank. Iron having been found to be readily available in commercial quantity in Anambra State also shows its abundance in this river.

Iron has its highest concentration in June (611.40) which is above the WHO recommended concentration of (300.00) and the lowest in July (1.90). In the statistical analysis of the result using one sample T-test statistics and 95% confidence interval of the difference, the table below was obtained and the corresponding analysis made.

From Table 2, apart from chromium which has no significant difference with the WHO standard, other metals analyzed showed significant difference with the WHO standard.

Table 1: Monthly Metal Concentration in Samples (mg/l).

Period	Chromium Cr	Copper Cu X^{-3}	Lead Pb X^{-3}	Cadmium Cd X^{-3}	Iron Fe X^{-3}
May	20.20	519.70	859.70	6.20	63.20
June	961.00	-349.00	685.80	6.60	611.40
August	6.90	796.40	597.30	7.40	100.10
September	167.70	918.10	855.80	-	123.80
October	-	742.90	995.20	-	117.3
WHO	50.00	200.00	50.00	-	300.00
CV	768.30	892.10	481.40	212.20	474.80
SE	79.30	189.30	146.20	0.90	166.60

(Data Source: Field Work)

Table 2: One Sample T-test on Concentration of Copper, Lead, Cadmium, and Iron in Nkisi River against WHO Standards.

Metals	X x^{-3}	SD x^{-3}	SE x^{-3}	T x^{-3}	DF x^{-3}	P x^{-3}	WHO STD x^{-3}	REMARKS
Copper	500.00	590.00	10.00	- 147.00	330000.00	0.000	200.00	Significant
Chromium	7.00	169.00	31.00	522.00	29000.00	605.00	50.00	Not significant
Lead	740.00	370.00	60.00	390.00	35000.00	0.00	50.00	Significant
Cadmium	-	-	-	-	-	-	-	-
Iron	850.00	460.00	70.00	730.00	35000.00	0.00	300.00	Significant

(Data Source: Field Work)

Table 3: Mean Sample Concentration of Selected Metals in mg/l in Water Samples.

Sample	Chromium (Cr)	Copper (Cu)	Lead (Pb)	Cadinum (Cd)	Iron (Fe)
A	66.30	419.80	1000.80	8.00	818.30
B	7.80	428.90	712.80	7.10	760.80
C	151.20	571.50	749.70	7.50	889.10
D	58.90	560.70	730.30	6.50	908.70
E	24.9	432.4	636.50	7.30	782.6
F	87.8	631.80	636.50	7.50	995.8
WHO	50.00	200	50.00	Nil	300.00

(Data Source: Field Work)

Sample Notes:

A. Effluent from the industry located around the river

B. Effluent from the municipality

C. Point at which A α B join the river

D. 100m right away from where A α B join the river

E. 100m centre away from where A α B join the river

F. 100m left away from where A α B join the river

From Table 3, the highest concentration of Chromium was found in sample C (151.20) and the lowest in Sample B (7.80)

Copper had its highest concentration in F (631.80) and the lowest in sample A.

CONCLUSION

Evidence of human morbidity and mortality as a result of consumption of fish polluted by heavy metals abound in the literature. For instance, in Ghana in 1967, there were 144 deaths recorded resulting from heavy metal poisoning from fish. Similar poisoning also occurred in Pakistan in 1967 with a death toll of 100. Iraq also had a death toll of 100 from the same type of poisoning (Guidelines and Standards for Environments in Nigeria, 1999.). The presence of heavy metals in high doses in this river places the inhabitants in the danger list of fish-poisoning. Carcinogenic impacts of the detected metals are not ruled out. In Egboka et al., 1989, it was maintained that the contaminants introduced into a river are dispersed from one point of the hydrologic cycle to the other and can be considered a risk to human health.

The presence of these metals on leaves, roots, and other vegetable materials in the area is yet to be examined. Having seen from the results that the metals are much in excess of WHO standards, and the sources from which they come, it is therefore concluded that the pollution of this river is from the heaps of refuse along the bank, erosion, effluent from industries and the municipality discharge. The dangers of river water pollution are being noticed across many countries and cannot be overemphasized. It is therefore, recommended that the State Government should take the case of environmental monitoring and awareness

seriously so as to safeguard the lives of the citizenry.

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