Heavy Metals Characteristics of Water Samples from Muokolu River in Eleme Local Government Area of Rivers State, Nigeria.

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Abstract- ***Industrial effluents discharged into the environment pose a serious threat to our agricultural products and health. In view of this, the study examined the heavy metals characteristics such as Zn, Pb, Fe, Cu, Cr, Cd, Ni, As and Co in the water samples of Muokolu River in Eleme Local Government Area of Rivers State, Nigeria. The heavy metals characteristics were analysed using atomic absorption spectrophotometer (AAS). The concentration of the metals in water samples in mg/L from "station 1" determined were Zn (8.12), Pb (5.89), Fe (4.12), Cu (3.73), Cr (6.46), Cd (1.37), Ni (4.39), As (2.64) and Co (1.81), "station 2" were Zn (5.92), Pb (3.41), Fe (2.89), Cu (1.96), Cr (4.81), Cd (0.43), Ni (3.81), As (0.39) and Co (1.23), and from "station 3" determined were Zn (3.84), Pb (3.74), Fe (1.65), Cu (2.08), Cr (2.11), Cd (0.24), Ni (2.71), As (1.06) and Co (0.41). The values of all the metals analysed in the water samples were above values recommended by the World Health Organisation (WHO) limits and there is need for adoption of proper waste management system for the treatment of waste generated from the industry before discharge into the river and a necessary step is required in order to remedy the situation in order curb loss of livelihood and health risk that could result from the consumption of the seafood.***

Indexed Terms- ***Contaminantion, Heavy Metal, Muokolu River, Pollution, Water***

I. INTRODUCTION

Water is an inorganic compound with the chemical formula H_2O. It is a transparent, tasteless, odorless, and nearly colourless chemical substance, which is the main constituent of Earth's hydrosphere and the fluids of all known living organisms. Although water is the most important and common chemical on earth, only 2.6% of global water is freshwater and available as drinking water [17]. Rivers are known to play major roles in transportation of goods and services. Also, they are involved in the transportation of wastes arising from both municipal, domestic and industrial wastes. Runoffs from agricultural farms and other pollutant generating sources eventually are deposited in water columns of rivers which therefore, introduce pollutants into the river [4]. The major public health problem is the availability of sufficient amount of drinking water, though freshwater has remained the major sources of drinking water in most rural and urban cities of the world. Human activities have impacted negatively into water, soil and air compositions which can lead to the pollution of the environment [2]. Water is a crucial factor for development and the quality of life in many countries and it has even become a survival factor for individual in arid areas [6]. Water quality is physical, biological, chemical and radiological characteristics of any sample of water which measures the condition of water relative to the human purpose or requirement [5].

Due to the incessant increase in population growth, which is accompanied with rapid urbanization and

industrial activities, discharges of wastes into the aquatic environment is on the increase. Aquatic flora and fauna are always in continuous contact with water, which implies that they are directly affected by any change in water quality. Over exploitation and exploration of the natural environment without recourse to laid down rules or principles results in the deposition of toxic substances in the ecosystem [9]. Metals such as copper (Cu), chromium (Cr), iron (Fe), magnesium (Mg), nickel (Ni), manganese (Mn), zinc (Zn), molybdenum (Mo), cobalt (Co) and selenium (Se) are known as essential nutrients that are required for various biochemical and physiological function. Variety of deficiency diseases or syndromes are as a result of inadequate supply of these micro-nutrients [16]. Contaminants which originated from agricultural waste, factory discharge channels and effluents sources are discharged into the environment, which enhances or increases the total contaminant burden of the receiving environment (whether aquatic or terrestrial). Furthermore, the degree and nature of the movement of contaminants is dependent on the characteristics of the source and the receiving environment [7]. Water as an essential part of life is used in homes and industries, proper handling and treatment of the water for consumption is therefore necessary [13].

This study is therefore aim at evaluating the levels of heavy metal characteristics of Muokolu River in Eleme, Rivers State to determine the contamination level.

II. MATERIALS AND METHODS

- Samples Collection

Water samples were collected with pre-rinsed plastic bottles below the water surface at a depth of about 20cm, few drops of concentrated nitric acid (HNO_3) were added and corked immediately. The samples were immediately transferred into ice-chest containers without further treatment and then transported to the laboratory.

- Analysis of Sample

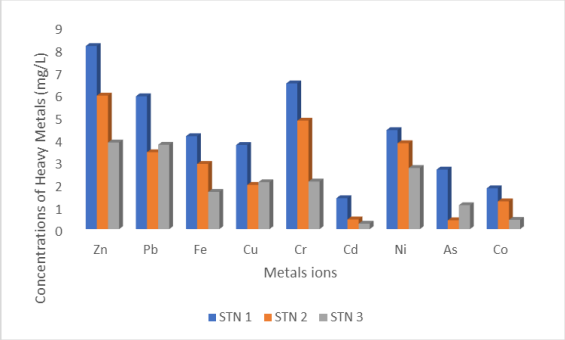
samples were prepared according to APHA recommended methods [3] and the concentrations of the heavy metals were determined using atomic absorption spectrophotometer (AAS) in the laboratory.

III. RESULTS

The concentrations of heavy metal characteristics of Muokolu River in Eleme are given in table 1. The average concentration of studied metals in water followed a decreasing order of Zn > Cr >Pb > Ni > Fe > Cu > As > Co > Cd.

Table 1: Heavy Metals Characteristics of Water from different Stations in Muokolu River in Eleme

Parameters (mg/L)	Station 1	Station 2	Station 3	Mean ± SD	WHO Standard
Zn	8.12	5.92	3.84	5.96 ± 2.14	5
Pb	5.89	3.41	3.74	4.35 ± 1.35	0.01
Fe	4.12	2.89	1.65	2.89 ± 1.24	0.03
Cu	3.73	1.96	2.08	2.59 ± 0.99	1
Cr	6.46	4.81	2.11	4.46 ± 2.19	5
Cd	1.37	0.43	0.24	0.68 ± 0.61	0.003
Ni	4.39	3.81	2.71	3.64 ± 0.85	0.02
As	2.64	0.39	1.06	1.36 ± 1.15	10
Co	1.81	1.23	0.41	1.15 ± 0.70	



IV. DISCUSSION

The values of heavy metal characteristics obtained from Muokolu River in Eleme in all the stations were as follows; Zinc (Zn) values from the study varied from 3.84 – 8.12 mg/L and a mean value of 5.96 ± 2.14 mg/L. The values observed were higher than the WHO standard limits and was also higher than the value obtained in the determination of physicochemical parameters and some heavy metals levels of surface and ground water of Ibiaku Osuk Community, Akwa Ibom State [10]. The average concentration of Pb in water was 4.35 ± 1.35 mg/L which were higher than the drinking water quality standard and was lower than the value observed in the study of heavy metal pollution in surface water and sediment: a preliminary assessment of an urban river in a developing country (Islam et al., 2015). The concentrations of the Fe varied from 1.65 to 4.12 mg/L higher than the value obtained in the studies on the levels of heavy metal ions in stream and borehole water within Ibiaku Osuk ([11]. The concentration of Fe in the study were lower compared to the values Fe (2.56 ± 00 mg/L to 10.2 ± 00 mg/L) reported by [1] who studied the assessment of some heavy metal concentration in fish, water, and sediment of River Ndakotsu, Lapai, Niger State. These concentrations of Fe were greater than 0.03 mg/L which was the standard concentration of Iron in drinking water [12].

The average concentration of Cu observed was varied between 1.96 mg/L and 3.73 mg/L across the stations. Interestingly the value of Cu observed was higher than the WHO standard limits for drinking water. The higher values of Cu in the study area might be attributed to the domestic sewage and runoff from extensively farmed areas. The mean concentration of Cr in water varied from 2.11 mg/L to 6.46 mg/L and a mean concentration of 4.46 ± 2.19 mg/L which was much higher than the WHO standard level for drinking water (5 mg/L). The concentration of Cd ranged from 0.24 mg/L to 1.37 mg/L greatly exceeded the drinking water standard value (0.003 mg/L). The values of Ni concentration in the study ranged from 2.71 – 4.39 mg/L which were higher than the mean values (0.005 ± 0.005 mg/L) in surface water observed in the determination of physicochemical parameters and some heavy metals levels of surface and ground water of Ibiaku Osuk Community, Akwa Ibom State [10]. The concentration of Ni in the study were also higher compared to the mean value of Ni (0.005 ± 0.01 mg/L) recorded in the study of determination of the heavy metal levels in surface water and sediment of *Mini-Ezi* Stream, Elele-Alimini, Rivers State, Nigeria [14]. Arsenic forms a variety of inorganic and organic compounds of different toxicity reflecting the physicochemical properties of arsenic at different valences. The average concentration of As was 1.36 ± 1.15 mg/L which was lower than the WHO standard (10 mg/L). The concentration of As in the study was lower compared to the value of 46 ± 27 mg/L as was reported in the study of heavy metal pollution in surface water and sediment: A preliminary assessment of an urban river in a developing country [8]. The concentration of the Co ranged from 0.41 mg/L to 1.81 mg/L and with a mean concentration of 1.15 ± 0.70 mg/L. Considering the toxicity reference values (TRV) proposed by [15] almost all the heavy metals especially Cr, Cd and Pb greatly exceeded the limit for safe water, indicated that water from this river is not safe for drinking and/or cooking.

CONCLUSION

The results obtained from the study showed that all the heavy metals analysed in the water samples from Muokolu River in Eleme Local Government Area of Rivers State, Nigeria were above the national and international standard for drinking water. The water would therefore pose negative effect on the human that consumed the water and other food from the river. Therefore, necessary steps are needed in order to curbed the discharged of untreated wastes from the industry into the river to prevent contamination.

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