

Post Flooding Assessment of the Heavy Metal Pollution of Water and Fish of Rivers Niger and Benue in Lokoja, Nigeria

Kehinde Israel OMONIYI, Adamma Patricia EKWUMEMGBO and Isuwa BAWA

Abstract - The study reports the water quality and heavy metal concentrations in *Clarias gariepinus*, *Oreochromis niloticus* and *Synodontis nigrita* obtained from rivers Niger and Benue in Lokoja, Nigeria following the 2012 flooding in Nigeria. The chemical oxygen demand, dissolved oxygen, turbidity and biological oxygen demand of the water ranged: 98.25-141.73 mg/L, 2.26-14.39 mg/L, 5.33-23.13 NTU, 5.56-15.59 mg/L respectively in 2013. Cd, Co, Cr, Cu, Pb and Zn in the water ranged from 0.0082-0.0276, 0.0042-0.0279, 0.0480-0.1391, 0.0979-1.8037, 0.0003-0.0047 and 0.7671-2.8510 mg/L respectively. There was significant difference in the metal levels of the rivers and by sampling periods ($P < 0.05$). The bio-accumulation of Cd, Co, Cr, Cu and Pb by the fish follows the ranking: bone > brain > flesh. Cd and Pb accumulated in the order *O. niloticus* > *C. gariepinus* > *S. nigrita*. The results indicate pollution of the rivers, so enforcement of environmental laws is imperative.

Keywords--- Bio-accumulation, Fish, Flooding, Rivers

I. INTRODUCTION

THE most often polluted of the environmental phases is the aquatic systems, which include the water, sediments, fishes and other faunas. This is because contaminants in the air, soil or on land ultimately end up in the aquatic systems [1]. Physicochemical characteristics of water are important parameters as they may directly or indirectly affect its quality and consequently its suitability for the distribution and production of fish and other aquatic animals [2]. Fish may absorb dissolved elements and heavy metals from surrounding water and food, which may accumulate in various tissues in significant amounts and elicit toxicological effects at critical targets [3]. Also, fish may accumulate significant concentrations of metals in water even if those metals are below the limit of detection in routine water samples [4].

Flooding was experienced in towns along River Niger and River Benue in 2012. The concomitant effects among a plethora of others could be the reports by fish marketers that quantity of fish in Lokoja market has dropped drastically compared to past years.

OMONIYI is with the Department of Chemistry, Ahmadu Bello University, Zaria, Nigeria (corresponding author phone: +234-08036257789;; e-mail: israelflourish@yahoo.com).

EKWUMEMGBO is with the Department of Chemistry, Ahmadu Bello University, Zaria, Nigeria (e-mail: pat_adamma@yahoo.com).

BAWA is a postgraduate student with the Department of Chemistry, Ahmadu Bello University, Zaria, Nigeria (e-mail: isuwabawa@yahoo.com).

Enokela and Salifu (2012) reported the pH, turbidity, DO and BOD of River Niger water in Lokoja, Nigeria to be 7.42, 42.75.60 NTU, 8.73 mg/L and 2.24 mg/L respectively for River Niger; with Na^+ , Ca^{2+} , Mg^{2+} , Cl^- and SO_4^{2-} found within the tolerable limit set by WHO [5]. The metal concentration in the water of River Niger in Lokoja was in the sequence $\text{Mn} > \text{Zn} > \text{Cu} > \text{Cr} > \text{Ni} > \text{Cd} > \text{Pb}$ [6]. On the other hand, water from River Benue at Makurdi, Nigeria recorded pH (5.00 - 9.00), TDS (6.81 - 521.33 mg/L), turbidity (3.00 - 258 NTU), conductivity (9.90 - 1071.00 $\mu\text{S}/\text{cm}$) and copper (0.00 - 1.45 mg/L) and the ranking for heavy metals was $\text{Cd} < \text{Cu} < \text{Zn} < \text{Mn} < \text{Pb} < \text{Cr} < \text{Fe}$ [7], [8].

Tukura *et al.* (2005) stated that except for chromium, metal levels in water were higher than in *Clarias gariepinus* and *Tilapia zilli* and that zinc and lead bio-accumulate most in the gills of the fish species studied [9]. Heavy metals accumulate more in the visceral tissues (liver, kidney, intestines etc) than in other organs and least in the muscles of *Tilapia* and shrimps [10].

This work is aimed at furnishing scientific data on the quality of the water and fish from River Niger and River Benue in Lokoja, Nigeria, since these rivers supply bulk of fish for commercial purpose and serve as source of water for municipal and industrial utilization.

II. MATERIALS AND METHODS

A. Study Area

The study area is located in Lokoja, the capital of Kogi State, Nigeria lying between latitude $7^{\circ}49'N$ to $7^{\circ}8.89'N$ and longitude $6^{\circ}44'E$ to $6^{\circ}5.85'E$. The annual rainfall of the area is between 1016 mm and 1524 mm. The rainy season lasts from April to October [11]. River Niger and River Benue meet in Lokoja.

B. Sampling

Water samples were collected from nine sampling points (A - I) as indicated in Fig. 1, each 500.00 metres apart. The sampling was carried out four times: March, June, September and December 2013.

C. Water Pretreatment

About 2000.00 cm^3 of water sample was collected in triplicates at the centre of the river for each sampling point using an improvised sampler into plastic gallons earlier washed with 1.00M nitric acid and rinsed with deionised water.

