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# Determination of Selected Heavy Metals in Seasonal River in Maru Town, Zamfara State, Nigeria.

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**Abstract**
The presence of heavy metals in our environment has been of great concern because of their toxicity when their concentration is more than the permissible level. The main threats to human health from heavy metals are associated with exposure to Lead and Cadmium. These metals have been extensively studied and their effect on human health regularly monitored and reviewed by international bodies such as the WHO and USEPA. Total levels of Cd, Pb, Cu, Zn and Cr were determined in seasonal river in the eastern part of Maru using Flame Atomic Absorption Spectrophotometer (FAAS). The results of total metals concentration (ppm) in the river were 0.0211±0.0014, 0.177±0.0004, 0.0201±0.0031, 1.1367±0.0493 and 0.0058±0.0003 for Cd, Pb, Cu, Zn and Cr respectively. The study showed that the sample was contaminated with Zn when compared to others. The level of Cd and Pb were high when compared to their safety limit (0.01 and 0.10) by U.S.E.P.A.
**Keywords:** Maru, Heavy Metals, Seasonal Rivers, Contamination.

## 1.0 INTRODUCTION

Maru is the headquater of Maru Local Government Area of Zamfara State, in the Northwestern part of Nigeria. It is situated at $12^0$ 20' 00''N $6^0$ 24' 00''E and $12.333^0$ N $6.40000^0$ E (en.wikipedia.org/wiki/maru, Nigeria). It has a seasonal river in the eastern part of the town popularly called "gulbi" by the people of the area. This river served as a major source of domestic water and food, where they fish during the raining season and during the dry season, they dig a well/ hole on the path of the river to get water. The river take it source from Funtua in Kastina State of Nigeria and passes through Gusau and Bungudu befores getting to Maru and drains into Bakalori Dam in Maradun Local Government Area in Zamfara state.

The pollution of the aquatic environment with heavy metals has become a worldwide problem during recent years, because they are indestructible and most of them have toxic effects on organisms. Among environmental pollutants, metals are of particular concern, due to their potential toxic effect and ability to bioaccumulate in aquatic ecosystems (Shrivastava *et al.*,2011). Heavy Metals are sometimes called "trace elements". They are part of the metallic elements of the periodic table (Salem, Eweida and Farag, 2000). Heavy metals are released into the environment by both natural and anthropogenic sources. The main natural sources of metals in waters are chemical weathering of minerals and soil leaching. The anthropogenic sources are associated mainly with industrial and domestic effluents, urban storm, water runoff, landfill, atmospheric sources and inputs rural areas (El Bouraie *et al.*, 2010). With the exception of soil derived from the physical and chemical weathering of parent materials containing elevated levels of trace elements (e.g. black shales and basic igneous rocks), the presence of elevated metal concentrations in the environment is related to man's activities (Jang, 2001; Jung, 2008).

Over the last decades, there has been growing interest in determining heavy metals level in the marine environment and attention was drawn to the measurement of contamination levels in public food supplies (Tariq, Jaffar and Asharaf, 1993; Kalay, Aly and Canil, 1999; Asraf, 2004), pose to human health are well documented (Goyer and Clarkson, 2001; Ogunfowokan, *et al*., 2013). The attention given to the presence of heavy metals in the environment is primary due to their toxicity and threat to human life at elevated levels, and also because of their tendency to aggravate environmental degradation. Metals are known to constitute highly persistent environmental pollutant (McAloon and Mason, 2003). Thus, their tendency to remain as an environmental contaminant for a long period and to be magnified through food chains is high. Pure water does not exist in nature. The contamination of water is directly related to the degree of contamination of our environment. Rain water collects impurities while passing through the air. Streams and rivers collect impurities from surface run off and through the discharge of sewage and industrial effluents; these are carried to the rivers, lakes or reservoirs that supply our drinking water (Skeat, 1969; Salem *et al*., 2000). All of the chemicals generated by man will eventually end up in our water supplies and can contaminate our water (Salem *et al*., 2000). Toxic dose of chemicals causes either acute or chronic health effects (Salem *et al*., 2000). The levels of chemicals in drinking water, however, are seldom high enough to cause acute health effects. They are more likely to cause chronic health effects that occur long after exposure to small amounts of a chemical. An example of chronic health effects includes cancer, birth defects, organ damage, disorders of the nervous system, and damage to the immune

system (USGAO Report, 2000). Pb, Zn, Cu, Mn, Co, Ni, Cd, Cr and Mo are toxigenic and carcinogenic agents consistently found as contaminant in human drinking water supplies in many areas around the world (Groopman, Wolff and Distlerath, 1985). Salem *et al*., 2000, opined that one of the major symptoms of chemical toxicity seems to be a breakdown of immune system, which opens the gate way for all kinds of disease in the body. Also, another major symptom seems to be damage of the nervous system and increased nervousness. Nsofor *et al.*, 2014, suggested that Surveillance and monitoring of concentrations of heavy metals in water bodies may serve as an early alert system on bioaccumulation of heavy metals in aquatic food chain therein.

## 2.0 MATERIALS AND METHODS

Sample container was thoroughly washed with detergent, rinsed with water followed by distilled water before soaking in 5% $HNO_3$ for about 24 hours. Water sample were collected half meter from water surface from different location randomly into the 4 litres acid washed polypropylene container, for total recovery of metals. The samples digested according to standard methods for the examination of water and wastewater, (ASTM, 1985; Rohrbough, 1986). Metals analyses were carried out using Flame Atomic Absorption Spectrophotometer (FAAS) after wet digestion. The elements determined included Cadmium, Lead, Copper, Zinc and Chromium.

## 3.0 RESULTS AND DISCUSSION

The Seasonal River in Maru was analyzed for Cd, Pb, Cu, Zn and Cr. The total heavy metals analyzed were detected as shown in table 1 below. Table 2 shows the concentration of heavy metals in ppm of sample location, U.S.E.P.A (1994) recommended concentration limits for drinking water (U.S Environmental Protection Agency) and the result from another study area where there was heavy metals toxicity (Salem *et al*., 2000 ).

The results of the analyses indicated that concentration of Zn is high when compared to other heavy metals in the study area. The level of Cd and Pb where high when compared to the safety limit which identify as standard in drinking water by U.E.P.A. (1994), but when compared to the other study area where heavy metals toxicity was observed (Salem *et al*., 2000) their level is manageable.

Salem *et al*., 2000, in their study, determined the relationship between the contaminant drinking water and its impact on human health in some of the Great Cairo Cities, Egypt. They discovered that patients who suffered from renal failure could be related to their contaminated drinking water with lead (Pb) and cadmium (Cd), liver cirrhosis to copper (Cu) and molybdenum (Mo), hair lost to nickel (Ni) and chromium (Cr), and chronic anemia to contaminant drinking with copper (Cu) and cadmium (Cd).

The presence of heavy metals in Maru water sample may be attributed to the huge amounts of raw sewage, agricultural and industrial wastewater discharged into the river (Abdel-Moati and El-Sammak, 1997). The high levels of Cd and Pb in the water can be attributed to industrial and agricultural discharge, i.e. the use of Cd-containing fertilizers in the near-by crop farms (Mason, 2002; Nsofor *et al.*, 2014). The high level of Pb in the water can also be attributed to dust which holds huge amount of lead from the combustion of petrol in automobile cars, because of heavy traveled road that run along the path of the water (Hardman *et al*., 1994; Banat *et al*., 1998).

The high concentration of Zn in water sample of lake and rivers may be due to considerable amount of Zinc leached from protection plates (Hamed, 1998). In addition, Zn in the river, must have probably come from other sources such as agro-chemicals, sewage, refuse dumps, effluent from paper and pulp, batteries, burning of fossil fuels and paint products (Prakash *et al.*, 2011; Nsofor *et al.*, 2014) deposited into the body of water as it passed through its rute.

## CONCLUSIONS

Long-term metals exposure by regular consumption of food and water which contain them, poses potentials health problems to animals and residents in the vicinity, although no adverse health effects have yet been observed. As a matter of urgency government should provide a safe drinking water for the safety of human health in the community. The people of these area should be enlighten on the consequences of unsafe disposal of waste into the water ways for their health and health of their children and also urgent steps are needed to be taken to legislate the prohibition of dumping of waste into rivers and canal in nigeria.

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**Table 1: Concentration of Heavy Metals in ppm from Seasonal River in Maru**

| **Metal** | **Concentration (ppm)** |
|---|---|
| Cadmium (Cd) | 0.0211±0.0014 |
| Lead (Pb) | 0.177±0.0004 |
| Copper (Cu) | 0.0201±0.0031 |
| Zinc (Zn) | 1.1367±0.0493 |
| Chromium (Cr) | 0.0058±0.0003 |

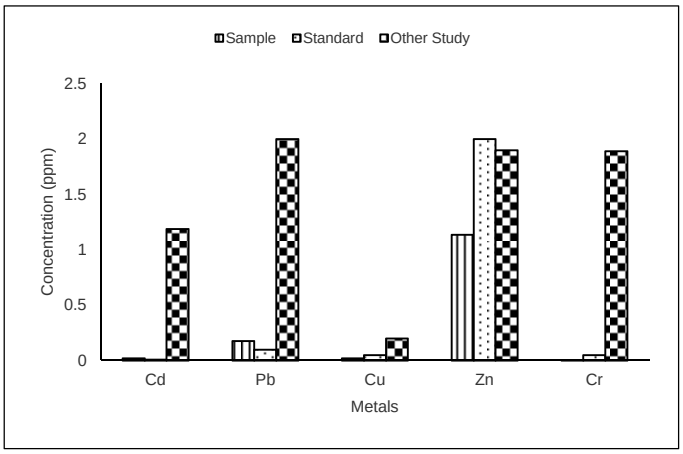
*Mean±SD (Standard Deviation)

**Table 2: Comparism of Heavy Metals Concentration in Seasonal River in Maru, Standard Limits and other Study**

| Metal | Conc. (ppm) | Std. (ppm) | Other Study (ppm) (Cairo, Egypt) |
|---|---|---|---|
| Cadmium (Cd) | 0.0211 | 0.01 | 1.19 |
| Lead (Pb) | 0.177 | 0.10 | 2.0 |
| Copper (Cu) | 0.0201 | 0.05 | 0.20 |
| Zinc (Zn) | 1.1367 | 2.00 | 1.90 |
| Chromium (Cr) | 0.0058 | 0.05 | 1.89 |

**Figure 1: Comparism of Concentration of Heavy Metals in Maru Seasonal River, Standard Limits and other Study**



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