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DETERMINATION OF HEAVY METALS IN SOILS UNDER PERIWINKLE SHELL DUMPSITES LOCATED IN CHOBA AND NKPOLU MARKETS IN PORT HARCOURT, NIGERIA

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Abstract: **Soil samples under periwinkle sediments were collected from Choba and Nkpolu markets in Port Harcourt. Analysis was carried out on them using AAS to detect the presence of heavy metals. The results showed that the concentrations of these metals ranged from 0.548-1.024mg/kg for chromium; 0.174-0.263mg/kg for zinc; 0.439-0.643mg/kg for copper; 1.535-1.676mg/kg for iron; 0.323-0.499mg/kg for cadmium; 0.561-0.864mg/kg for manganese; 0.255-0.0468mg/kg for nickel and 0.302-0.535mg/kg for cobalt. Heavy metals are not easily excreted from shells but tend to bio-accumulate over a long period of time, especially during the rainy season. Heavy metal concentration above the permissible limit is harmful to soil, plant growth and causes severe health problems to humans. The use of waste shells in road and house construction is the best approach to reducing the effect of heavy metal pollution by shells.**

Keywords: **Periwinkle Shells, AAS, Heavy Metals, Soil, Sediments, Pollution.**

1. INTRODUCTION

In coastal communities worldwide, periwinkle is a major source of proteins and other vital minerals in most delicacies (Amikhle and Lekia 2021). The *Tympanotonus fuscutus*, commonly known as periwinkle are found in large stretch of mangroves, swamps and mudflat that characterize the region (Olutoge et al, 2012). The booming seafood industry has seen an increase in the number of waste shells generated globally annually. For instance, there are about ten million tonnes of waste shells generated in China (Mo et al, 2018), nearly two million tonnes in Japan (Sawai, 2011) and two hundred and five tonnes in France (Nguyen et al, 2017). Similarly, there are about twelve million tonnes of waste shells disposed on land and the seashores in Nigeria annually (Hart, 2020).

Seashells have been one of the waste materials generated in coastal areas and countries produce significant amount of seafood. A huge proportion of shells are still discarded as waste, posing a challenge in locations where they have yet to find major usage, with a considerable deposit having been collected in several places over the years (Afolayan et al, 2019). Seashell waste generates environmental degradation and emissions as a result of both water contamination and landfill management difficulties (Bamigboye et al, 2021). Bioaccumulation studies showed that the *typanotonus fuscatus* tissue had more metal content than the sediments (Chindah et al 2000) and this is expected because heavy metals that are not easily excreted from the body tend to bio- accumulate over a long period of time. (Opaluwa et al 2010). According to Hou et al, (2016), the seashell waste can cause contamination of costal fisheries, public water, surface management, a foul smell as a result of discomposure of organics attached to the shells, harm to the natural environment, and health issues. The reuse capacity of these shells can be expanded by utilizing them for the development of value-added products. In that sense, the utilization of shell waste is a valuable strategy for sustainable resource management, reduced waste storage, reduced material costs, and wealth creation. (Jovic et al, 2019).

Heavy metals are generally, referred, to as those metals, which possess specific density of more than 5g/cm3.(Khlifi et al, 2010) Although heavy metals are naturally occurring elements that are found throughout the earth's crust, most environmental contamination and human exposure result from anthropogenic activities such as mining and smelting operations; environmental contamination can occur through metal corrosion, atmospheric deposition, soil erosion of metal ions and leaching of heavy metals. There are several examples of heavy metals, some micronutrient elements may also be toxic to both plants and animals at high concentration which includes Copper (Cu), Chromium (Cr), Molybdenum (Mo), Nickel (Ni), Selenium (Se), or Zinc (Zn). Other trace elements such as Arsenic (As) Cadmium (Cd), Mercury (Hg), and Lead (Pb) are toxic even at small concentration and are harmful to human and the environment. (Jafari, and Hassanpour, 2014).

The pollution of the environment with heavy metals has become a world-wide problem and of scientific concern because these are not degradable and most of them have toxic effects on organisms (Oronsaye et al, 2010). Toxicity is realized when these heavy metal levels are higher than the recommended limit, which is different for individual element in water and soil. The sources of heavy metals include weathering of rock and a variety of antropogenic activities that are affected by seasons increase the concentrations of these heavy metals (Oguzie et al, 2009). The scope of this study is to determine the presence and concentration of heavy metals in soils under periwinkle sediments in Choba and Nkpolu markets in Port Harcourt. The results of this study will help to identify any potential environmental risks posed by heavy metal contamination in the area.

2. METHODOLOGY

Sample Collection and Preparation

A random sampling was done and samples were collected in a black polythene bag. These collected samples were immediately sent to the laboratory, where they were washed, air-dried and filtered, then stored in the refrigerator to be used/digested as soon as possible.

Sample Digestion (wet digestion)

A total volume of 100ml HCL and HNO_3 in the ratio of 3:1 was mixed together to form an aqua regia solution. 1g of the sample was weighed into a conical flask. 20ml of the mixed acid was taken into each of the sample in the conical flask. The sample was digested in a fame cupboard with hot plate until white fumes appeared. The samples were cooled and filtered into a 100ml volumetric flask and made up to the ml mark with distilled water. Portions of the solution for required metal determinations were taken and analysed using the Atomic absorption spectrophotometer.

3. RESULTS AND DISCUSSION

Results

Table 1: Heavy Metals Concentrations in Nkpolu(Sample A) and Choba (Sample B) Markets.

Heavy Metals	Sample A1 Conc. (mg/kg)	Sample B1 Conc. (mg/kg)
Chromium (Cr)	0.548	1.024
Zinc (Zn)	0.174	0.263
Copper (Cu)	0.439	0.643
Iron (Fe)	1.535	1.676
Cadmium (Cd)	0.499	0.323

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Manganese (Mn)	0.864	0.561
Nickel (Ni)	0.255	0.468
Colbalt (Co)	0.302	0.535
Lead (Pb)	Not detected	Not detected

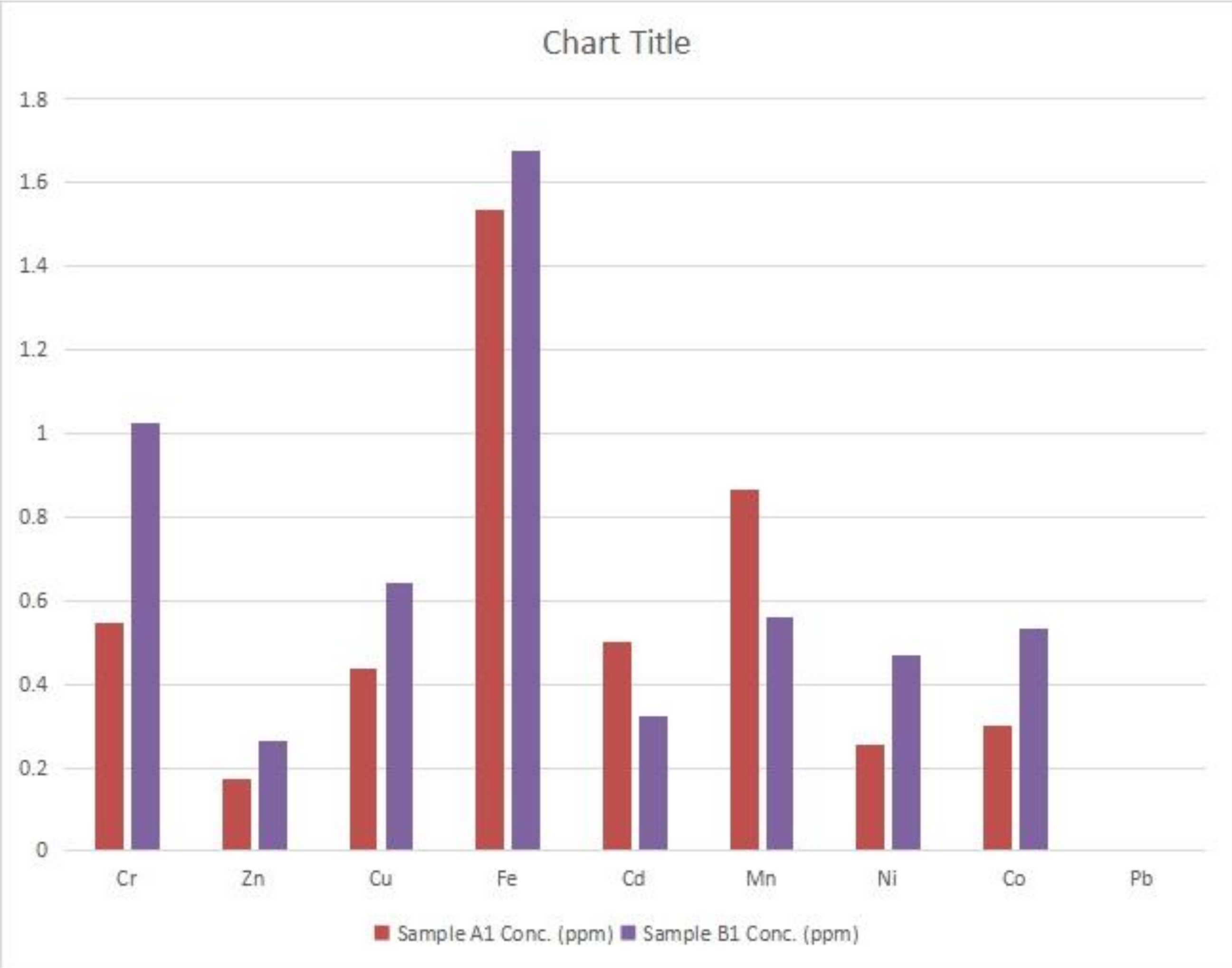

Figure 1: Chart showing the concentration of heavy metals in soils from Nkpolu and Choba Markets.

4. DISCUSSION

The results as presented in table 1 and figure 1 indicated the presence of heavy metals in both locations. The results showed that the concentrations of these metals ranged from 0.548-1.024mg/kg for chromium; 0.174-0.263mg/kg for zinc; 0.439-0.643mg/kg for copper; 1.535-1.676mg/kg for iron; 0.323-0.499mg/kg for cadmium; 0.561-0.864mg/kg for manganese; 0.255-0.0468mg/kg for nickel and 0.302-0.535mg/kg for cobalt. No doubt, the accumulation of heavy metals in soils causes ecosystem malfunction and water degradation (Bamigboye et al,2021). Besides, in 2016, Osu and Onyema reported that heavy metals restrict the uptake of nutrients in soil by forming insoluble compounds. In this case, nutrient uptake is thereby inhibited by metal toxicity especially when the concentration of the metal exceeds permissible limits. Furthermore, in 2011, Muhammad and Muhammad, reported that excess metal concentration affects absorption by roots, impairs plant metabolism, inhibits photosynthesis and transpiration, and causes ultrastructural modifications.

In effect, there is a gradual build up of heavy metals in the soils of these periwinkle shell sediments. Definitely, these heavy metals will cause the malfunction of the immediate and extended soils. Therefore, it will be advisable, to discourage the habit of heaping these sediments around our environment. Rather, these periwinkle shells can find use in road and house construction.

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