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# Concentrations Of Cadmium, Lead, Arsenic And Mercury In The Soft Tissue Of Periwinkle( *Tympanotonus Fuscata* Var. Radula) In Eagle Island River, Rivers State , Nigeria

**K.O.Obasi[1], K. Chinedu[1], Okereke[2], J.N, Udebuani, A.C[2], Ezeji, E.U[2], Anyadoh S.N[2]**
[1]Department of Biological Science, School of Science; Federal University of Technology, Owerri.
[2]Department of Biotechnology, School of Science, Federal University of Technology, Owerri.

## ABSTRACT

The concentrations of some heavy metals(cadmium, lead, mercury and arsenic) in the soft tissues of periwinkle *Tympanotonos fuscatus var. radula* obtained from Eagle Island river in portHarcourt , Rivers State Nigeria were studied. It was an analytical study in which atomic absorption spectrophotometer( series 240 varian) was used to establish the concentrations of the metals. The mean concentration of metals recorded were: Hg (2.10ppm), Cd (0.067ppm), Pb (2.00ppm) and As (1.26ppm). There was no significant relationship(at $\alpha_{0.05}$ ) between the concentrations of the heavy metals in the sampled organisms. Considering the neurotoxic effects of some heavy metals, it becomes imperative to regularly monitor heavy metal concentrations in sea foods in order to ensure the safety of such food for pubic consumption.

**Key words***: Heavy Metals, Concentrations, Periwinkle, Eagle Island, Analytical, Atomic, Absorption, Monitoring*

## 1. INTRODUCTION

Heavy metals in the environment arise from both natural and anthropogenic sources. Exposure can occur through drinking water, food, air, soil and dust from old paint containing lead. In the general non-smoking, adult population, the major exposure pathway is from food and water. Heavy metal poisoning could result, for instance, from drinking-water contamination (e.g. lead pipes), high ambient air concentrations near emission sources, or intake via the food chain**.** Studies on heavy metals in rivers, lakes, fish and sediments have been a major environmental focus especially during the last decade Fernandes, Fontaínhas-Fernandes, Cabral and Salgado (2008), Özmen, Külahçı, Çukurovalı, and Doğru (2004), Öztürk, Özözen, Minareci and Minareci (2008), Pote, Haller, Loizeau, Bravo, Sastre and Wildi (2008), Praveena, Radojevic, Abdullah and Aris (2008), and heavy metals contamination of coastal water and sediment have been identified as a serious pollution resulting from industrialization. Heavy metals and other fluvial contaminants in suspension or solution, do simply flow down the stream, form complexes with other compounds and settle to the bottom and are ingested by plants and animals or adsorbed to the sediment Odiete (1999). Lead is among the most recycled non-ferrous metals and its secondary production has therefore grown steadily in spite of declining lead prices. Its physical and chemical properties are applied in the manufacturing, construction and chemical industries. It is easily shaped because it is malleable and ductile. There are eight broad categories of use: batteries, petrol additives (no longer allowed in the EU), rolled and extruded products, alloys, pigments and compounds, cable sheathing, shot and ammunition. Due to the dependence of the community on Eagle Island river for domestic water supply and its aquatic organisms (periwinkle) and other sea foods, as source of food nutrients, and considering the high level of industrial activity in the environment occasioned by the presence of oil industry and other anthropogenic activities, it became imperative to assess the level of heavy metal concentration in the river.

## 2. METHODOLOGY

### 2.1. Area of study

The study area was Eagle Island River, Port Harcourt Rivers State. It lies along the Bonny River and is located in the Niger Delta. According to the Nigerian census(2006), Port Harcourt has a population of 1,382,592. The area that became Port Harcourt in 1912 was before that part of the farmlands of the Diobu village group of the Ikwerre, an Igbo sub-group. The colonial administration of Nigeria created the port to export coal from the collieries of Enugu located 151 miles (243 km) north of Port Harcourt, to which it was linked by a railway called the Eastern Line, also built by the British.

In 1956 crude oil was discovered in commercial quantities at Oloibiri, and Port Harcourt's economy turned to petroleum when the first shipment of Nigerian crude oil was exported through the city in 1958. Through the benefits of the Nigerian petroleum industry, Port Harcourt was further developed, with aspects of modernization such as overpasses and city blocks. Oil firms that currently have offices in the city include Royal Dutch Shell and Chevron.

### 2.2. Sample collection

With clean dry plastic container, Periwinkles from Eagle Island River Portharcourt were collected. The periwinkles were kept in their respective containers

labeled RS1, RS2, RS3, RS4 .The samples were preserved with mud sediments and water from the river.

### 2.3. Sample preparation

**Periwinkle**

The shells of the fresh periwinkle (*Tympanotonos fuscatus*) sample were cracked and separated to obtain their tissue . The tissue separated was rinsed with distilled water and allowed to air dry. After which, the tissue sample for each station were blended or homogenized to powder form and put into different containers labelled RS1-RS4 and from which 2 gram of each was weighed using an electronic weighing balance. The weighed tissue sample was transferred to a beaker labelled RS1- RS 4 . Into each of the beaker, was added 20 ml of acid mixture (650ml conc. of trioxonitrate (v) acid (HNO3), 30ml of perchloric acid and 20ml conc. of $H_2SO_4$), and stirred, 25 ml of distilled water was also added. Each beaker was placed on the hot plate and heated for digestion to take place. After heating, the samples were allowed to cool. Then by means of funnel and filter paper, each of the samples labeled RS1-RS4 were filtered. The filtrate was collected and the sample was thoroughly mixed by shaking and 100ml of it was transferred into a glass beaker of 250 volumes. The sample was aspirated into the oxidizing air-acetylene flame or nitrous oxide acetylene flame. When the aqueous sample was aspirated, the sensitivity for 1% absorption was observed. Then the prepared samples were ready for Atomic Absorption Spectrophotometric analysis. The samples were analyzed for Lead (Pb), Mercury (Hg), and Cadmium (Cd), and Arsenic (As).

**Table 1. The Concentration of Heavy Metals in Periwinkles Samples Collected in Rivers State**

| S.N | PARAMETER | RS1 | RS2 | RS3 | RS4 |
|---|---|---|---|---|---|
| 1 | Cd, ppm | 0.039 | 0.083 | 0.025 | 0.100 |
| 2 | As, ppm | 1.14 | 0.64 | 2.11 | 1.16 |
| 3 | Pb, ppm | 6.21 | 1.48 | 0.00 | 0.32 |
| 4 | Hg, ppm | 2.9 | 2.2 | 1.2 | 2.1 |

RS1…4= Sampling points1 to 4

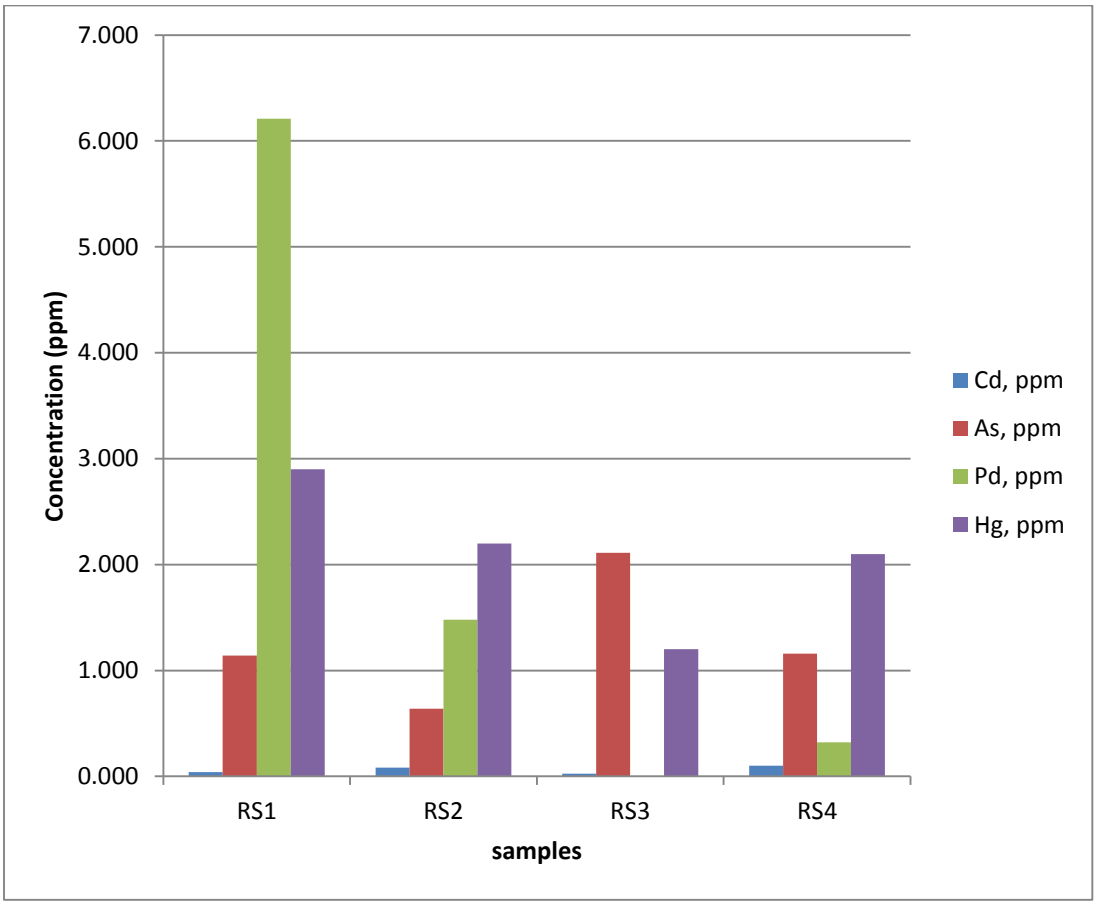


**Fig 1: A graph of the concentration of Heavy Metals on Samples of Periwinkles Collected from Rivers State**

Fig1. shows that RS4 have the highest concentration of cadmium (0.100ppm) and RS3 have the least concentration of cadmium (0.25ppm) also, RS3 have the highest concentration of arsenic (2.11ppm) and RS2 have the least concentration of arsenic (0.64ppm)also, RS1 have the highest concentration of lead (6.21ppm) and RS3 have the least concentration of lead (0.00ppm) and RS1 have the highest concentration of mercury (2.9ppm) and RS3 has the least concentration (1.2ppm).

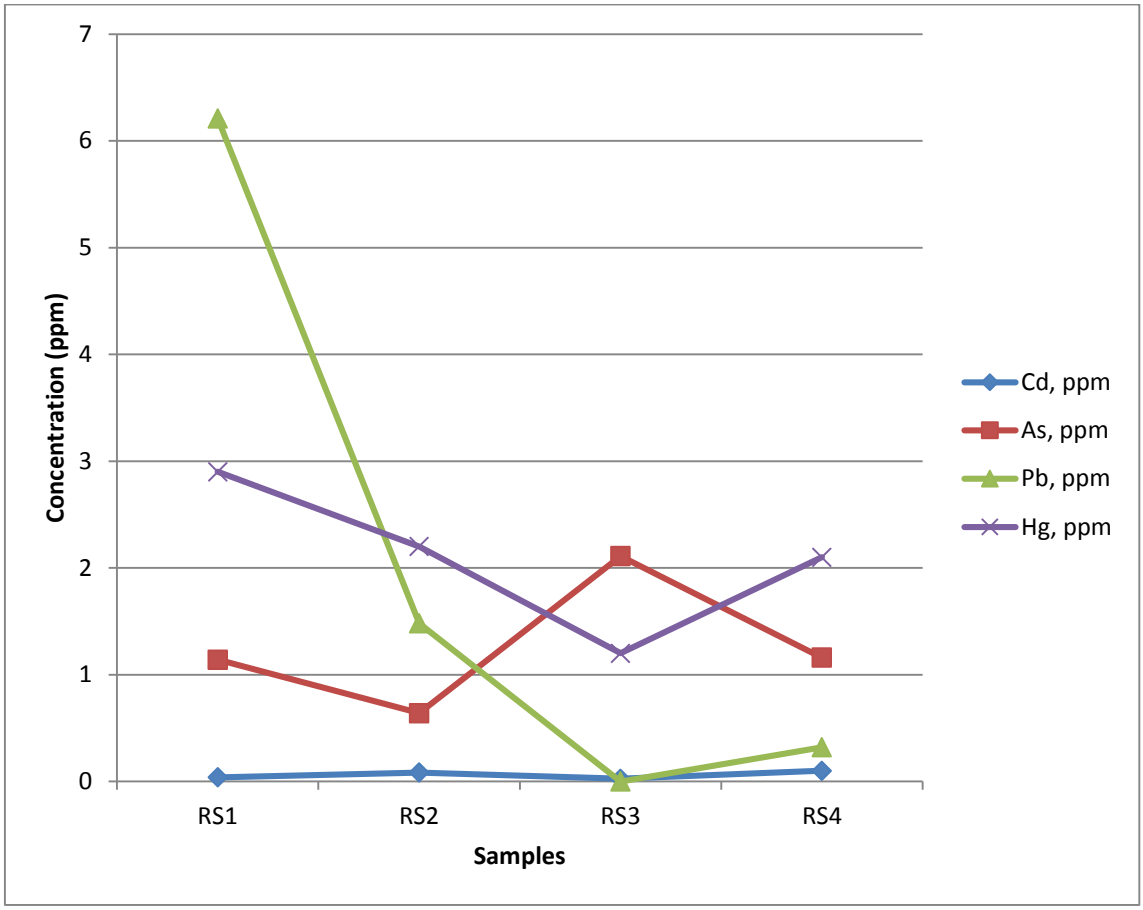


**Fig 2: A line graph of the Concentration of Heavy Metals on four Samples of Periwinkles Collected from Rivers State**

Fig 2 shows that RS4 have the highest concentration of cadmium (0.100ppm) and RS3 have the least concentration of cadmium (0.25ppm) also, RS3 have the highest concentration of arsenic (2.11ppm) and RS2 have the least concentration of arsenic (0.64ppm)also, RS1 have the highest concentration of lead (6.21ppm) and RS3 have the least concentration of lead (0.00ppm) and RS1 have the highest concentration of mercury (2.9ppm) and RS3 has the least concentration (1.2ppm).

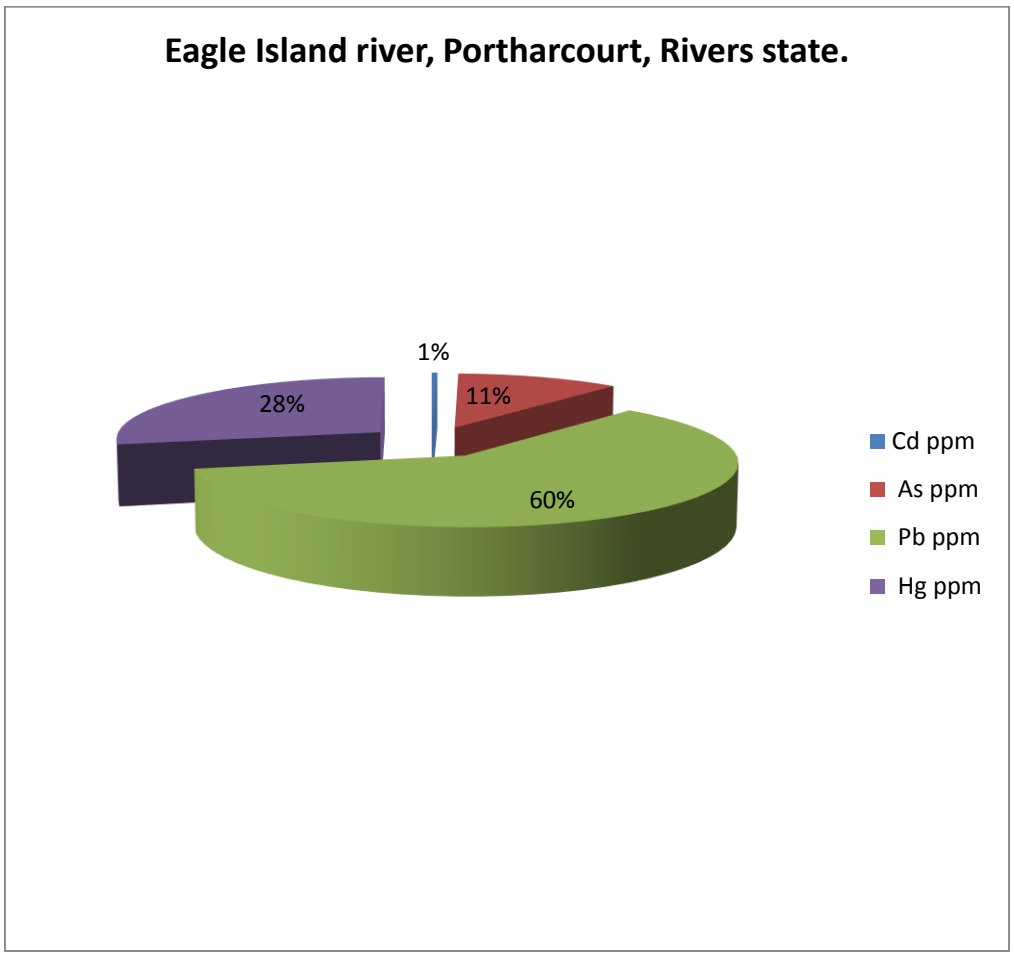


**Fig 3. A Pie Chart of the Percentage Concentration of Heavy Metals in Samples of Periwinkles collected from Rivers State**

Fig 3 is a pie chart of the percentage concentration of heavy metals. Cadmium has the least percentage concentration (1%) of the four periwinkle samples followed by arsenic with percentage concentration (11%) followed by mercury with percentage concentration (28%) and lead with percentage concentration (60%).

## 3. DISCUSSION

The high level of lead concentration (2.00ppm) and mercury (2.1 ppm) in the samples could be explained by the mechanism of bioaccumulation within the food chain as the periwinkles feed on aquatic organisms that might have absorbed some quantity of the lead that have found its way into the water bodies, and also by the principle of bio concentration over a period of time, since the water body is not static but flowing, thereby washing away the heavy metals at any particular sediment site. This finding is in consonance with the report of several other researchers Jakimska, Konieczka, Skora and Namiesni (2011), Akan, Mohmoud, Yinkala, and Ogugbaja (2013), who also reported increase in heavy metals in the body of marine animals found in polluted water at a concentration higher than the surrounding environment. This is expected because the heavy metals are not easily excreted from the body, but tend to bio accumulate over a long period of time. This finding is also in agreement with the finding of Opaluwa, and Umar (2010). The result of this work also shows that Lead concentration in the Periwinkle samples of Eagle Island River falls within the acceptable limit (UNEP 1985& EC 2005).

On the contrary, the mean concentration of lead in periwinkle in Eagle Island river when compared with the acceptable tolerable Values of metals in aquatic organism are found to be high and well above the tolerable values. Quite a good number of factors may have contributed to lead contamination of the Eagle Island River. These contributing factors could be; weathering (natural phenomenon) and anthropogenic activities.such : disposal of old car batteries, metals and metal components into the river, leaching of metals from garbage and solid waste heaps,

Apart from oil companies located in the communities, it was observed that the people in the communities disposed all kinds of waste materials into the river, including batteries and other materials that could be a source of heavy metal contamination. In addition, the people in these communities live near the river and have their bathrooms and toilets built very close to the river. Thus, there is a possibility that detergents, soaps and creams are washed into the water body directly.

This high level of lead in the periwinkle may be a potential source of lead poisoning to the individuals who consume them. There is the possibility that the high lead level in the periwinkle may not have any adverse effect on the periwinkle, but may have a devastating effect on higher animals that consume them. This is a well-known fact in ecological studies of bioaccumulation arising from food chain as a result of Trophic Transfer Factor (TTF). The TTF comes very handy when explaining the heavy metal transfer at different trophic levels in a food chain, mostly from a lower level to a higher level, just as the case with the humans and periwinkle, Jakimska, Konieczka, Skora and Namiesni (2011)

There is sufficient evidence in the literature highlighting the pathological effects of heavy metals in human physiology even at low concentrations. Toxic levels of lead may adversely affect sperm shape, motility, and DNA integrity, thereby giving rise to infertility in males, Eibensteiner, Del CarpioSanz, Frumkin Gonzales and, Gonzales (2005). There are reports that lead accumulation can also lead to altered cellular functions including growth and immune functions, Jakimska, Konieczka, Skora and Namiesni (2011).

In fact, lead is known to interfere with a host of human physiological processes in the organs and tissues, including, the nervous system, reproductive system, cardiac and nervous systems, where it interferes with enzyme functions, and sometimes giving rise to metabolic block in physiological pathways. A very important fact about heavy metal poisoning is the fact that they are not easily excreted out of the body, and their effect on the body is not immediate, so individuals can go on accumulating the heavy metal over a long period of time without knowing, only to manifest much later in life, and at a time for which an appreciable dose has been accumulated. One of the cardinal effects of lead on metabolic processes is that it produces reactive oxygen species which destroy the cellular structures including the cell membranes and DNA transcription enzymes, giving rise to the deficiency of a host of enzyme systems necessary production of blood cells, synthesis of vitamins, collagens bones etc., Flora, Mittal, and Mehta (2008), and this has an adverse effect on body metabolic functions requiring the participation of such enzyme systems.

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