IJST EXPLORE International Journal of Science and Technology
CENTRE OF PROFESSIONAL RESEARCH PUBLICATIONS
ISSN 2049-7318
International Journal of Science and Technology Volume 4 No. 10, October, 2015

Study On Concentrations Of Selected Heavy Metals: Cadmium, Lead Arsenic And Mercury In The Soft Tissue Of Periwinkle (*Tympanotonos Fuscatus* Var. Radula) Harvested From Brass Island River, Bayelsa State , Nigeria

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ABSTRACT

The heavy metals studied in this work were cadmium, lead, mercury and arsenic. The concentrations of the heavy metals in the soft tissues of periwinkle *Tympanotonos fuscatus var. radula* obtained from Brass Island of Bayelsa State Nigeria were analyzed in the laboratory .The soft tissue of the mollusk was carefully extracted, homogenized and prepared for analysis using atomic absorption spectrophotometer (series 240 varian).The mean concentration of metals recorded were: Hg(2.02ppm), Cd (0.042ppm), Pb(0.360ppm) and As (1.54ppm). There was no significant relationship(at $\alpha_{0.05}$ between the concentrations of the heavy metals in the sampled organisms. Considering the public health implications of heavy metal contamination, it becomes imperative to assess the heavy metal concentrations in sea foods regularly.

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

1. INTRODUCTION

The term, heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Examples of heavy metals include mercury (Hg), cadmium (Cd), arsenic (As), chromium (Cr), thallium (Tl), lead (Pb) etc. Heavy metals are natural components of the Earth's crust. To a small extent they enter our bodies via food, drinking water and air. As trace elements, some heavy metals (e.g. copper, selenium, zinc) are essential to maintain the metabolism of the human body

Among environmental pollutants, metals are of particular concern; due to their potential toxic effects and ability to bio-accumulate in aquatic ecosystems Censi, Spoto and Saiano (2006). Heavy metals contamination of river water is one of the major quality issues in fast growing cities because maintenance of water quality and sanitation infra-structure do not increase along with population and urbanization growth especially in developing countries Ahmad, Islam, Rahman, Haque (2010), Akoto, Bruce and Darko (2008). Heavy metal concentrations in aquatic ecosystems are usually monitored by measuring their concentrations in water, sediments and biota Camusso, Vigano, Baitstrini (1995), which generally exist in low levels in water and attain considerable concentration in sediments and biota Namminga. and Wilhm (1976). Sea food is a popular recipe in the Niger Delta region of Nigeria, it therefore becomes necessary to establish the heavy metal concentrations of periwinkle harvested from Bayelsa State ,Nigeria

2. METHODOLOGY

2.1. Area of study

The study area was Brass Island River, Brass local government area Bayelsa State of Nigeria; It lies along the Bonny River and is located in the Niger Delta. While Town-Brass, previously known simply as Brass or Brass town is a community on Brass Island in the Nun River estuary of Southern Bayelsa State, Nigeria, in the Brass Local Government Area. At one time the town was the main port of the Nembe Kingdom, called by one historian "the Venice of the Niger Delta", and was dominant in the palm oil trade of the region. In the mid-20th century it was the base of several fisheries and a centre for the shipping of palm products.

2.2. Sampling method

With clean dry plastic container, Periwinkles were collected from Brass Island. They were kept in containers labeled B1, B2, B3, B4 respectively. The samples were preserved with mud sediments and water from the river.

Sample preparation

Periwinkle

The perinkle shells were cracked and separated to obtain their tissue. The tissue was rinsed with distilled water and allowed to air dry. After which, the tissue sample for each station were blended or homogenized then added into different containers labelled B1-B4 and from which 2 gram of each was weighed using an electronic weighing balance. The weighed tissue sample was transferred to a beaker labeled B1-B4. 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 B1-B4 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), Arsenic (As).

3. RESULTS

Table 1. Results of the Concentration of Heavy Metals on Periwinkle Samples from Bayelsa State

	MERCURY (mean±SD)	CADMIUM (mean±SD)	LEAD (mean±SD)	ARSENIC (mean±SD)
Bayelsa State samples	2.02 (±2.46)	0.04225 (±0.02)	0.360 (±0.67)	1.535 (±0.86)

Table 1 shows the mean concentration of the metals; mercury, cadmium, arsenic and lead for eight periwinkle samples, four from Rivers state and four from Bayelsa State and the level of significance at α=0.05. There is no significant difference in the concentration of the periwinkle samples from Rivers state and periwinkle samples from Bayelsa State. ($p>0.05$).

Table 2: The Concentration of Heavy Metals in four Periwinkles Samples collected in Bayelsa State

S.N	PARAMETER	B1	B2	B3	B4
1	Cd, ppm	0.072	0.034	0.030	0.033
2	As, ppm	1.15	1.16	1.65	2.18
3	Pb, ppm	0.00	0.07	1.37	0.00
4	Hg, ppm	1.4	0.0	5.6	1.1

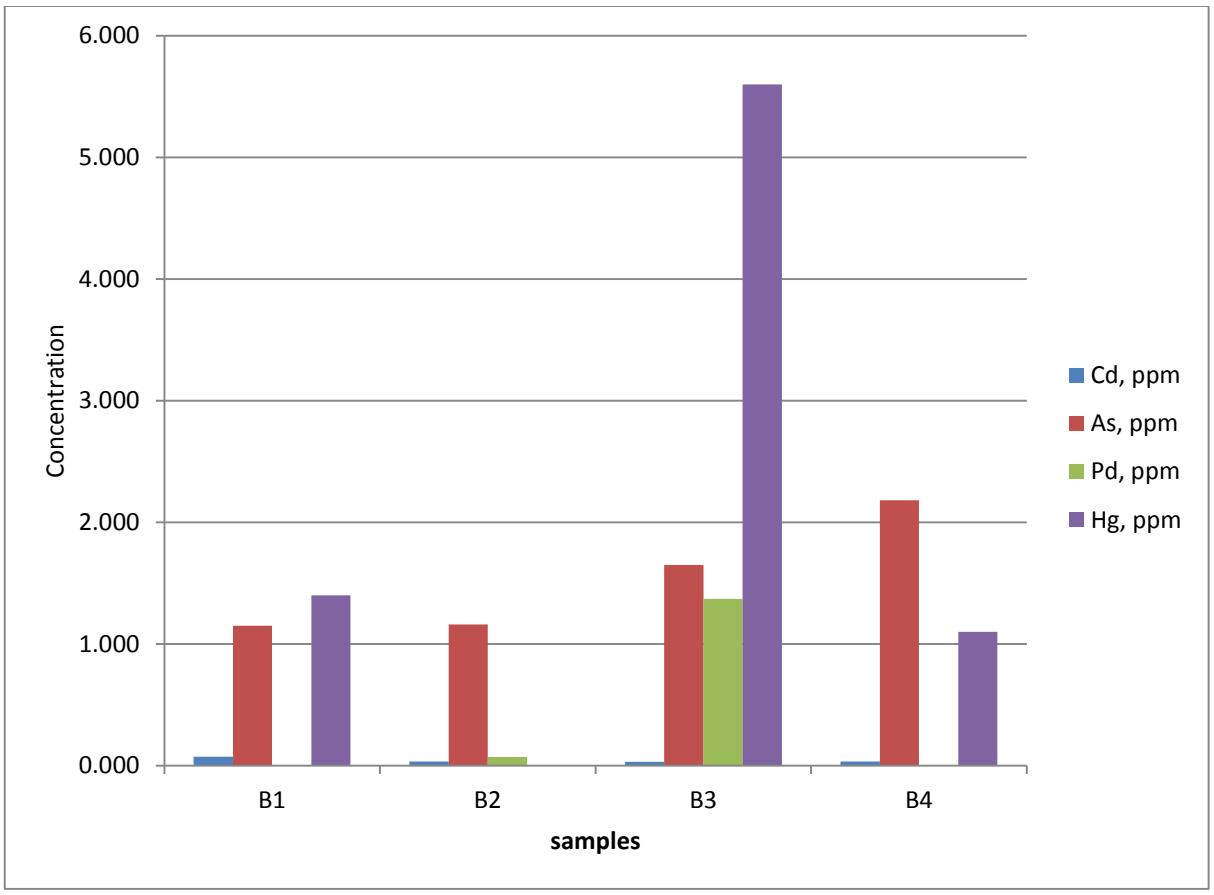

Fig1. A Graph of the Concentration of Heavy Metals on four Samples of Periwinkles collected from Bayelsa State

Fig 1, shows that B1 has the highest concentration of cadmium (0.072ppm) and B3 has the least concentration of cadmium (0.30ppm) also, B4 has the highest concentration of arsenic (2.18ppm) and B1 has the least concentration of arsenic (1.15ppm)also, B3 has the highest concentration of lead (1.37ppm) while B1 and B4 have the least concentration of lead (0.00ppm), and B3 has the highest concentration of mercury (5.6ppm) while B2 has the least concentration (0.00ppm).

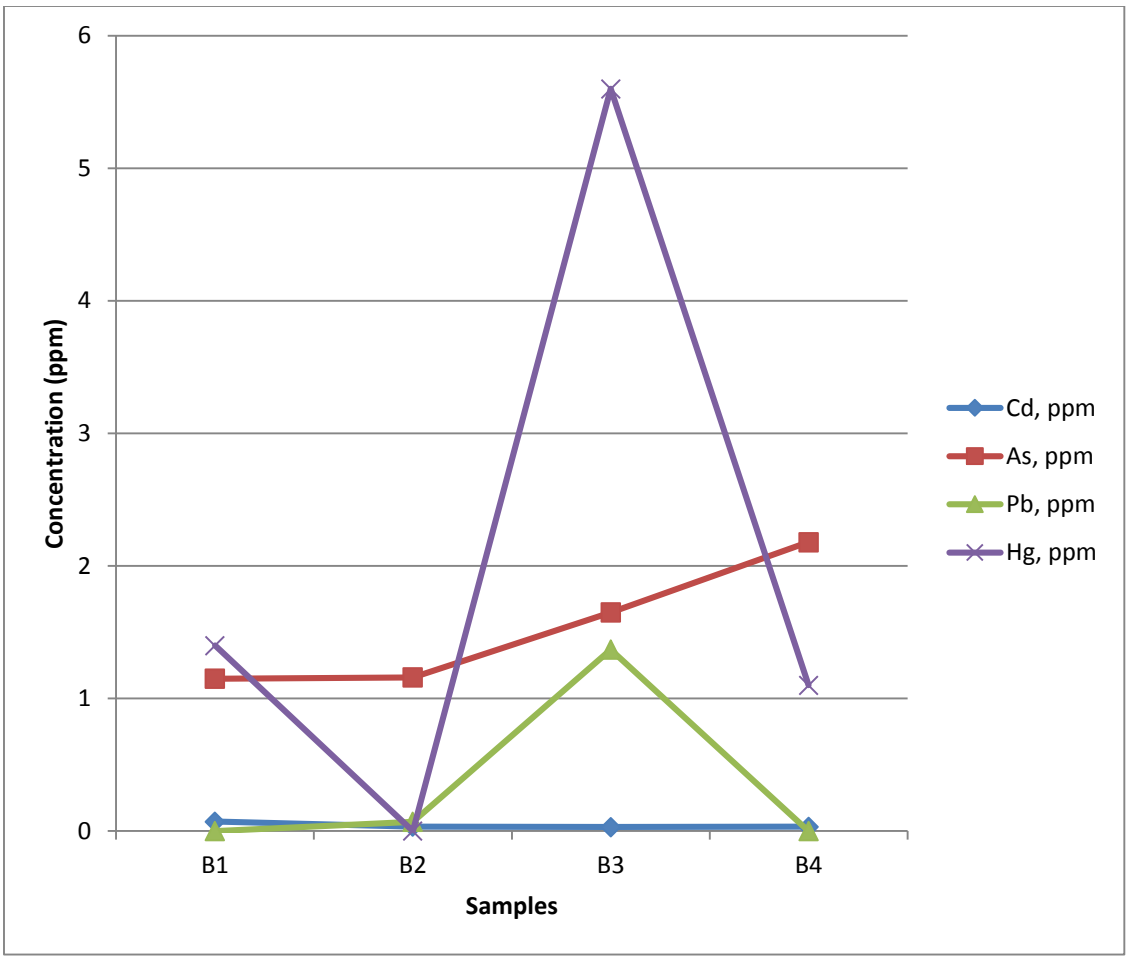

Fig 2: A line Graph of the Concentration of Heavy Metals in Periwinkles collected from Bayelsa State

Fig 2, shows that B1 has the highest concentration of cadmium (0.072ppm) and B3 has the least concentration of cadmium (0.30ppm) also, B4 has the highest concentration of arsenic (2.18ppm) and B1 has the least concentration of arsenic (1.15ppm) also, B3 has the highest concentration of lead (1.37ppm) and B1 and B4 has the least concentration of lead (0.00ppm) while B3 has the highest concentration of mercury (5.6ppm) and B2 has the least concentration (0.00ppm).

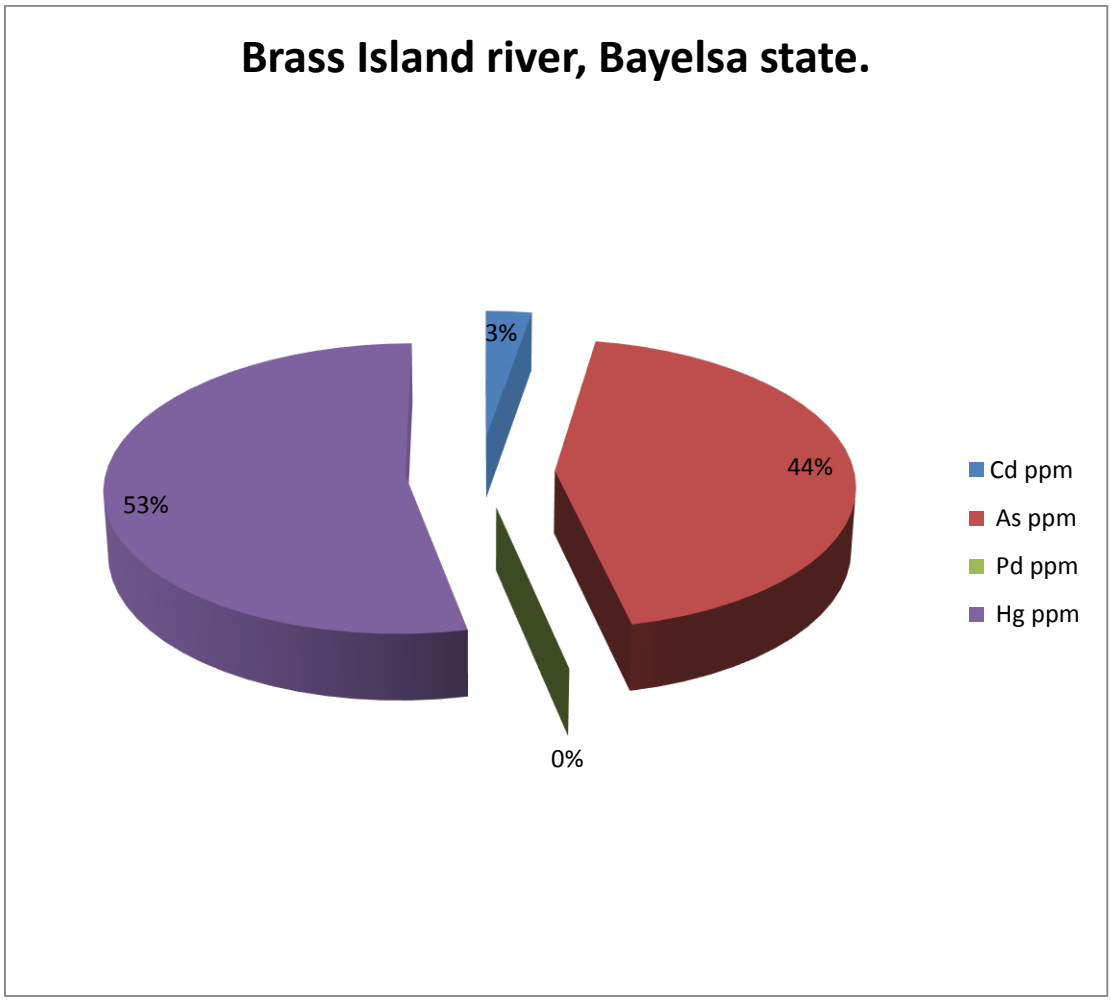

Fig3a. A Pie Chart of the Percentage Concentration of Heavy Metals on four Samples of Periwinkles collected from Bayelsa State

Fig 3a. is a pie chart of the percentage concentration of heavy metals. Lead has the least percentage concentration (0%) of the four periwinkle samples followed by Cadmium with percentage concentration (3%) followed by arsenic with percentage concentration (44%) and mercury with percentage concentration (53%).

TEST OF HYPOTHESIS

Brass island River, Bayelsa state

H_0 (null): There is no significant difference between the mean concentrations of the heavy metals studied in Brass island River at $\alpha_{0.05}$.

H_1 (alternative): There is a significant difference between the mean concentrations of the heavy metals studied in Brass island River at $\alpha_{0.05.}$

SAMPLE	CONCENTRATIONS			
	As	Pb	Hg	Cd
B1	1.150	0.000	1.400	0.072
B2	1.160	0.070	0.000	0.034
B3	1.650	1.370	5.600	0.030
B4	2.180	0.000	1.100	0.033

Anova: Single Factor				
SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	4	6.14	1.535	0.239367
Column 2	4	1.44	0.36	0.454467
Column 3	4	8.1	2.025	6.0425
Column 4	4	0.169	0.04225	0.000396

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	10.65352	3	3.551172	2.108543	0.15254	3.490295
Within Groups	20.21019	12	1.684182			
Total	30.8637	15				

4. Conclusion: Since F<F crit. and P-value (>0.05) at confidence level of 95%, the null hypothesis is therefore been accepted.

5. DISCUSSION

The high concentration of mercury(2.03ppm) is in line 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 concentration 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).

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).

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