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**Original Research Article**

# The Analysis of Some Metals in the Bark of Mask Plant (*Polyaltha longifolia*)

Chioma Don-Lawson[1*], Reminus Okah[2]

[1]Department of Chemistry Rivers State University Nkpolu Oroworukwo, Port Harcourt, Rivers State
[2]Department of Science Laboratory Technology, Port Harcourt Polytechnic Rumuola, Port Harcourt

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***Corresponding author:** Chioma Don-Lawson
Department of Chemistry Rivers State University Nkpolu Oroworukwo, Port Harcourt, Rivers State

## Abstract

Heavy metal pollution is a serious environmental issue, particularly in developing countries like Nigeria. This research work focused on investigating the levels of heavy metals concentration *in polyalthia longifolia*. The metals analyzed include the following, Chromium (Cr), Lead (Pb), Calcium (Ca), Sodium (Na), Copper (Cu), Iron (Fe), Nickel (Ni), Aluminium (Al), Mercury (Hg) and Zinc (Zn) in the bark of *polyalthia longifolia*, the fresh bark samples were collected from Akwaka, Rivers-state. Atomic Absorption Spectrophotometry was used to analyze the fresh bark samples for heavy metals. The results obtained for fresh bark were; Chromium (0.03mg/100g), Lead (0.05mg/100g), Sodium (3.80mg/100g), Arsenic (0.01mg/100g), Copper (0.23mg/100g), Iron (5.21mg/100g) Nickel (0.01mg/100), Aluminium (0.30mg/100g), Mercury (ND), Zinc (2.97mg/100g) and Calcium (3.80mg/100g). from the results obtained it has shown that mercury is not detected, the values of iron, sodium, and zinc are considerably significant and which contributes to the nutritional and medicinal importance of the plant in building of the cells as coenzymes and effective metabolic rate in the body system, the values of arsenic, lead and mercury show that the plants is less toxic and may not be harmful to the human system. The consumption of this plant can contribute good fibre, high energy content and will effectively reduce dangerous health risks, the results are generally within the permissible limit of World Health Organization. . For separation and identification of various components of the *Polyathia Longifolia* sample extract, thin-layer chromatography (TLC) was performed using 95% ethyl acetate and 5% ethanol as eluents. This gave three separation spots with Rf factors of 0.1, 0.025 and 0.075 respectively. Extraction of the *Polyalthia Longifolia* plant bark was carried out by steeping washed, air-dried and ground sample in n-hexane for 48 hours, which was then filtered and evaporated to dryness to obtain a thick black viscous liquid The plant is rich in minerals and is properly cultiivated in Nigeria. Continuous research on other areas of *polyalthia longifolia*, should be carried out regularly in the area.

**Keywords**: Investigation, Heavy Metals, Developing Countries, Concentration.



## INTRODUCTION

Heavy metals are naturally occurring elements that are found throughout the earth crust. However, most environmental contamination and human exposure result from anthropogenic activities such as mining and smelting operation, industrial production, domestic and agricultural use of metals and metal containing compounds (Kabata- Pendia 2001). Most chemicals generated from industrial, agricultural and other human activities will eventually end up in our water ways which may therefore end up in our drinking (tap water) water katko *et al*., 2001. Therefore, posing a great damage to human lives. These heavy metals enter the rivers, lakes and underground water which supply our tap water (Lin *et al*., 2001). These heavy metals in tap water are linked often to human poisoning and other health challenges. (Jacobs and Testa 2005) these metals may include lead, Aluminium, iron, cadmium, copper, zinc, chromium. Some of these metals like iron, copper, Zinc are essential trace elements required by the body which show toxicity if found in excess (Guevara *et al*., 2004). Lead is a highly poisonous metal (if inhaled or swallowed) therefore affecting almost every organ and system in the body. Aluminium: Aluminium has been associated with Alzheimer's and Parkinson's disease, senility and dementia. Cadmium is a severe pulmonary and gastrointestinal irritant, which can be fatal if inhaled or ingested, after acute ingestion, burning sensation, nausea,

vomiting, salivation. Zinc is an essential trace element because very small amount of it is necessary for human health. It is also used for boosting the inner system, treating common cold and preventing lower respiratory infections. (Aher *et al*., 2009) However, if there is excess intake as earlier said, could cause abdominal pain, nausea, gastric irritation, Irritability and dizziness. (Dematha, *et al*., 2004). Iron is also an essential component of haemoglobin that transfers oxygen from the lungs to the tissues according to (Bars *et al*., 2001). Iron supports metabolism and it is necessary for growth and development. Acute in-take of more than the recommended intake of iron can lead to gastric upset, constipation, nausea, abdominal pain and it reduces zinc absorption. (Musa, *et al*., 2013). *Polyalthia longifolia* should be safe enough for general human consumption and should not represent any significant risks to health over a life time of consumption according to (Durube *et al*., 2007)

## MATERIALS AND METHODS

### REAGENTS/SOLVENT

- N-Hexane 95% BDH chemical
- Ethanol 95% BDH chemical
- Ethyl acetate 98% BDH chemical
- Distilled water

### SAMPLE

*Polyalthia longifolia* bark

### METHOD

### SAMPLE COLLECTION AND EXTRACTION

The *Polyalthia longifolia* bark sample was collected from a bush farm near Emouha community in Rivers State. The sample was thoroughly washed with distilled water and air-dried for two weeks, and crushed. The crushed sample was soaked in n-hexane for 48 hours then it was filtered. The filtrate was evaporated until it was completely free of solvent to give a dark viscous oil.

### THIN LAYER CHROMATOGRAPHY (TLC)

Thin-Layer Chromatography (TLC) was used to separate the possible components present in the plant extract.

### PREPARATION OF THE PLATE (TLC)

The thin layers chromatography plates (TLC) were cut and measured by 5 cm width and 5 cm length. The sample was spotted on the thin layer chromatography plates using a capillary tube. The spotted plate was dipped into the mobile phase and was brought out after about 90 seconds. The compounds separation detection was done by viewing plate using visible light and ultra violet light. Further detection was done by applying Maquis reagents (spray reagent). Three different separation spots were obtained. Retardation factor (RF) values of detected spots were calculated and results recorded. Retardation factor was calculated using the equation below.

$$\frac{DS}{DF} = \frac{\text{Distance moved by substance}}{\text{Distance moved by solvent font}}$$

### HEAVY METALS ANALYSIS

The sample extract was taken to the laboratory (Endpoint Laboratories and Equipment Limited) for atomic absorption spectroscopy in order to determine trace of heavy metals, specifically Arsenic (As), Lead (Pb), Mercury (Hg) and Iron (Fe),etc

**Analytical Procedure for Atomic Absorption Spectrophotometer**.

2.0g each of the finely grounded samples were thoroughly mixed by shaking, and 100ml of it was transferred into a glass beaker of 250ml volume, thereafter, 5ml of concentrated nitric acid was added and heated to boil until the volume was reduced to about 15-20ml, by adding concentrated nitric acid increments of 5ml till all the residue is completely dissolved.

-The mixture was cooled, transferred and made up to 100ml using metal free distilled water. The sample was aspirated into the oxidizing air- acetylene flame.

-When the aqueous sample was aspirated, the sensitivity for 1% absorption was observed.

-The quantity of each trace metal in each sample was calculated by proportion methods using the standard curve method.

## RESULT AND DISCUSSION

**Table 1.0: TLC of *Polyalthia longifolia* plant bark extract using in Ethanol and Ethyl Acetate mixture as mobile phase**

| 5% Ethanol 95% Ethyl Acetate | Retention Factor (R.F) Value |
|---|---|
| Spot 1 | 0.1 |
| Spot 2 | 0.025 |
| Spot 3 | 0.075 |

**Table 2.0: Heavy Metal Concentration (mg/100g)**

| Metals (mg/100) | (mg/100g | FAO'S Permissible limit |
|---|---|---|
| Aluminum (Al) | 0.30mg | +__ 0.001-0.14mg/100g |
| Chromium | 0.03mg | |
| Lead | 0.05mg | |
| Sodium | 3.80mg | |

| Metals (mg/100) | (mg/100g | FAO'S Permissible limit |
|---|---|---|
| Arsenic | 0.01mg | |
| Copper | 0.23mg | |
| Iron | 5.21mg | |
| Nickel | 0.01mg | |
| Mercury | ND | |
| Zinc | 2.97mg | |
| Calcium | 3.80mg | |

## DISCUSSION

The results in Table 1.0 show the thin-layer chromatography analysis of *Polyalthia longifolia* plant bark extract, using 5% ethanol extract and 95% ethyl acetate solvent mixture as the mobile phase, which revealed three spots. The retention factor (Rf) value was calculated for each spot and the values obtained were 0.1, 0.025 and 0.075. This is evidence that there are at least three different components with different polarities present in the sample extract. Rf value of 0.1 corresponds to compound groups such as glycol and aromatic hydrocarbons. The Rf value of 0.025 corresponds to hydrocarbons alkanes and fats whereas Rf value of 0.075 corresponds to proteins, amine and amino acids.The heavy metal trace determination was performed using atomic absorption spectroscopy and the results obtained are as shown in table 2.0.

The constitution of heavy metals analyzed include calcium, chromium, sodium, nickel, copper, lead, iron, zinc, Aluminium and mercury in *longifolia polayalthia* bark extract. These results indicate the various concentrations of calcium, lead, iron, zinc, nickel, aluminium, copper, sodium, chromium and mercury determined in the sample of the bark extract according to Anderson *et al*., 2008. The presence of these heavy metals are attributed to the mineral nutrients and organic matters absorbed by the roots of the plants. However, heavy metals like mercury and lead are toxic in nature when present in a system in high concentrations especially when it is beyond the permissible limits, this can lead to some serious hazards or disorders. (Patioia *et al*., 2009). High concentrations of these metals in the sample extract can lead to some health challenges like liver disorders, cancer, anaemia that is beyond the permissible limit particularly, lead is known to present environmental problems generally because of its wide applications in industries. Recent toxicological studies in lead (Pb) have shown that the metal is not only a neurotoxin but has been linked up with several symptoms such as fatique, loss of appetite, chronic anaemia, renal dysfunction, low sperm count and death. the concentrations of lead and mercury are above world health standards in both salt water periwinkles and freshwater periwinkles, therefore excessive consumption of these sea foods may have some adverse effects. The result for mercury was not detected (ND) showing that the concentration was negligible and may have no consequential effect, the concentrations of sodium, zinc, iron and calcium which are 3.80mg. 2.97mg, 5.21mg and 3.80mg/100mg is an indication that the plant absorbed relevant and potential minerals that are very useful to the metabolical systems of the plant and animals. However, the consumption of the plant can be useful in body building of the plant and proper physiological functions. Generally, the bark has been severally applied for medicinal purposes for the treatment of haemohorrds, anaemia, hypertention and dental malfunctions.

## CONCLUSION

The *Polyalthia longifolia* plant bark extract consists of at least three components, which was evident in the thin-layer chromatography (TLC) results. The three components represented by three different spots had Rf value of 0.1, 0.025 and 0.075 which reflects the difference in the polarity of the components and the possible presence of glycol and aromatic hydrocarbons, alkanes and fats, and also proteins, amine and amino acids. It was also found in this study that the *Polyalthia longifolia* plant bark did not significantly contain any toxic heavy metals in form of: lead (Pb), arsenic (As), and mercury (Hg). However, Iron (Fe) was detected in the sample extract. The Iron (Fe) concentration of was found to be 5.21mg/100g, which is within the permissible limit of 150mg/kg by the world health organization (WHO). This is an indication that the *Polyalthia longifolia* plant is safe for human consumption and it could also some potential health benefits.

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