

Original Research Article

HEAVY METAL PROFILE OF SOME MEDICINAL PLANTS FOUND IN THE VICINITY OF QUARRY SITE IN DEMSA LOCAL GOVERNMENT AREA OF ADAMAWA STATE

ABSTRACT

Heavy metals profile of ethanolic leaves extracts of some medicinal plants was carried out. The plants include *Anogeissus leiocarpus*, *Bauhinia reticulata*, *Prosopis oblonga*, *Sterculiar tomentosa* and *Tamarindus indica*. The higher value for Mn was obtained from *Anogeissus leiocarpus* sample with 5.31mg/l from the Quarry site and followed by *sterculia tomentosa* with 1.6mg/l, *Tamarindus indica* with 1.56mg/l, *Prosopis oblonga* with 1.46mg/l and least is *Bauhinia reticulata* with 1.22mg/l all from the quarry site. The samples away from the Quarry site has 0.68mg/l of Mn in *Bauhinia reticulata* while both *Anogeissus leiocarpus* and *Tamarindus indica* has values of 0.03mg/l. Lead (Pb) is detected in only one of the control sample site which is 0.08mg/l of *Bauhinia reticulata* and in three plant samples from the Quarry site which include *Anoggeissus leocarpus* with 0.06mg/l and 0.07mg/l for *Bauhinia reticulata* and 0.07mg/l for *prosopis oblonga* respectively.

Keywords: Heavy metals, *Sterculiar tomentosa*, sample, manganese, quarry

INTRODUCTION

Any toxic metal may be called heavy metal, irrespective of their atomic mass or density [1]. Heavy metals are a member of an ill-defined subset of elements that exhibit metallic properties. These include the transition metals, some metalloids, lanthanides, and actinides. One source defines heavy metal as one of the common transition metals, such as copper, lead, and zinc. These metals are a cause of environmental pollution from sources such as leaded

26 petrol, industrial effluents, and leaching of metal ions from the soil into lakes and rivers by
27 acid rain [2].

28 Any metal (or metalloid) species may be considered a “contaminant” if it occurs where it is
29 unwanted, or in a form or concentration that causes a detrimental human or environmental
30 effect. Metals/metalloids include lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As),
31 chromium (Cr), copper (Cu), selenium (Se), nickel (Ni), silver (Ag), and zinc (Zn). Other less
32 common metallic contaminants include aluminium (Al), cesium (Cs), cobalt (Co), manganese
33 (Mn), molybdenum (Mo), strontium (Sr), and uranium (U) [3].

34 Living organisms require varying amounts of heavy metals. Iron, cobalt, copper, manganese,
35 molybdenum, and zinc are required by humans [4]. All metals are toxic at higher
36 concentrations [5]. Excessive levels can be damaging to the organism. Other heavy metals
37 such as mercury, plutonium, and lead are toxic metals that have no known vital or beneficial
38 effect on living organisms, and their accumulation over time in the bodies of animals can
39 cause serious illness. Certain elements that are normally toxic are for certain organisms or
40 under certain conditions, beneficial. Examples include vanadium, tungsten, and even
41 cadmium [1].

42 Metal concentration in soil typically ranges from less than one to as high as 100,000 mg/kg
43 [6]. Heavy metals are the main group of inorganic contaminants and a considerable large
44 area on land is contaminated with them due to use of sludge or municipal compost, pesticides,
45 fertilizers, and emissions from municipal wastes incinerates, exudates, residues from
46 metalliferous mines and smelting industries. Irrespective of the origin of the metals in the
47 soil, excessive levels of many metals can result in soil quality degradation, crop yield
48 reduction, and poor quality of agricultural products, posing significant hazards to human,
49 animal, and ecosystem health [7].

Heavy metal contaminations of land resources continue to be the focus of numerous environmental studies and attract a great deal of attention worldwide. This is attributed to non--biodegradability and persistence of heavy metals in soils. In order to identify spatial relationship of heavy metals in soil-rice system at a regional scale, 96 pairs of rice and soil samples were collected from Wenling in Zhejiang province, China, which is one of the well-known electronic and electric waste recycling centers. The results indicated some studied areas had potential contaminations by heavy metals, especially by Cd. The spatial distribution of Cd, Cu, Pb, and Zn illustrated that the highest concentrations were located in the northwest areas and the accumulation of these metals may be due to the industrialization, agricultural chemicals and other human activities [8].

Human health has become threatened due to exposure to hazardous and toxic substances', industrial effluents and emissions [9]. Sewage sludge, fertilizers and agrochemicals. The possibility of their movement along the food chain cannot be over ruled out, Cd, Pb and Hg are major contaminants of food and may be considered an important problem to our environment while others like Fe, Zn and Cu are essential for biochemical reactions in the body [10].

Therefore, the main aim of the research is to carry out the heavy metal analysis of some medicinal plants found in the vicinity of quarry site.

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69 **MATERIALS AND METHODS**

70 **Materials**

The laboratory equipment's and apparatus used for this purpose include :Atomic Absorption Spectrophotometer (AAS), Beakers (250ml), Volumetric flasks (100mL, 500ml, 1000ml), Measuring cylinders (10ml, 50ml, 100ml), Conical flasks (250ml), funnel, Glass rod, Spatula,

74 Evaporating dish, Pipette. Polythene bags, Mortar and Pestle, Sieve or mechanical shaker,
75 Oven, Plastic stoppers, Analytical balance, Hot plate etc.

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77 **Reagents**

78 The reagents used for the purpose of these research were of analytical grade, these includes:-

79 NaOH pellets, KOH, HNO₃, HClO₄, HCl, H₂SO₄, Distilled water, Light petroleum, Hexane,

80 Ether, Acetone, Methanol and Ethanol, FeCl₃, Fehling solutions A and B, Pb(NO₃)₂,

81 CuSO₄.5H₂O, CdCl₂, KMnO₄, ZnSO₄, and K₂Cr₂O₇.

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83 **Study Area**

84 The study area is quarry site situated in Demsa Local Government Area of Adamawa State,

85 Nigeria. Fig 1 shows the map of the study area.

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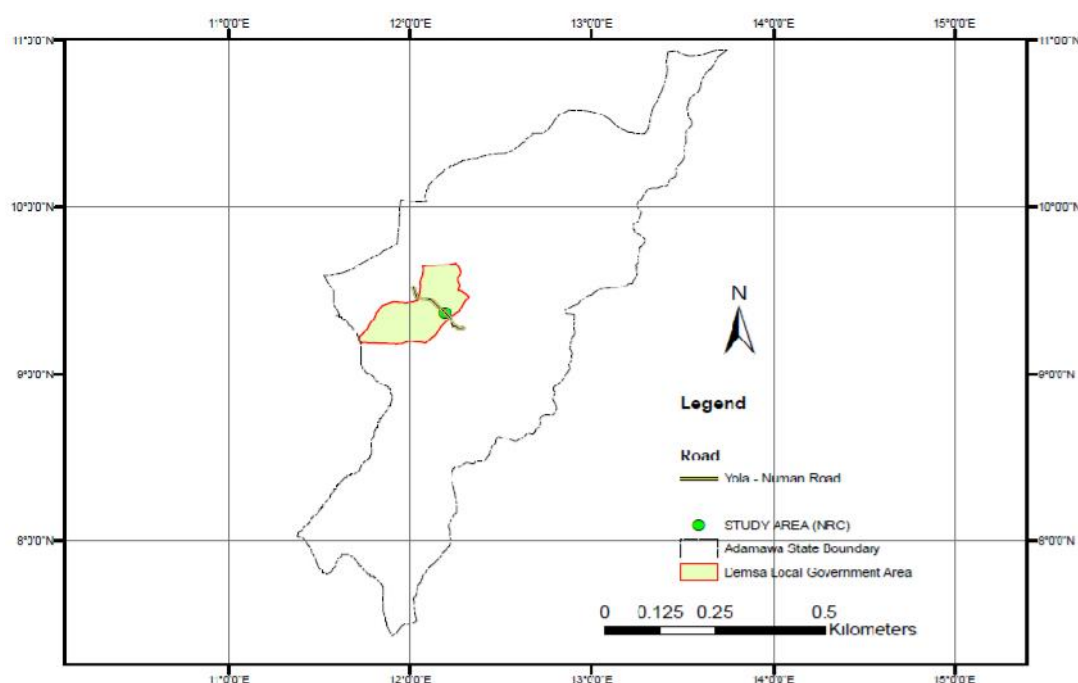


Fig. 1: Map of Adamawa State Showing Demsa LGA and the Study Area

Sample Collection

Leave samples of *Bauhinia reticulate*, *Prosopis oblonga*, *Sterculia tomentosa*, *Tamarindus indica*, *Anogeissus leocarpus* was collected from the Quarry site (N R C) along Numan road in Demsa L.G.A and transport to Modibbo Adama University of Technology, Yola, where it was authenticated by a taxonomist from forestry department.

Sample Preparation

The plant samples were washed thoroughly with tap water to remove the soil particles from the leaves. The samples was then cut into smaller pieces and air dried for some days. The dried samples was ground into powder and stored in labeled polythene bags. Each powdered sample was digested as reported by [11]. 2gm of each sample were weighed into separate beakers and treated with 20cm³ of HNO₃ acid. It was then digested on an electric hot plate at 70°-90° for 60minutes. Blank was prepared similarly by digesting 20cm³ of HNO₃ acid in an

empty beaker. It was cooled and the content filtered through Whatman No. 42 filter paper into a volumetric flask and made up to 100cm³ with deionised water. The digests was analyzed for the trace metal contents using Buck scientific model 210VGP Atomic Absorption Spectrophotometer. Usually a calibration curve is constructed using standard stock solution for each element. The unknown sample absorbance is read off on the spectrophotometer and the concentration in ppm is obtained by extrapolation on the curve. Concentration in milligrams is obtained in mg/l.

Determination of essential and heavy elements in the sample

This was achieved by means of absorbance measurements of the dilute solutions using the advantage of the sensitivity of the AAS spectrophotometer. The instrument was calibrated by allowing some warm up time for the AAS machine and the control knob adjusted until the meter reads 0% transmittance. Three glass cuvettes was obtained and blotted with tissue paper. One of them was used for the solvent blank which is distilled water while the others were used for the analyte samples. The absorbance reading was measured for each metal serial dilution of the various samples. Calibration curves for each metal was prepared from which unknown concentrations in the samples shall be extrapolated. A plot of the absorbance (A) versus concentration gives a straight line graph.

RESULTS AND DISCUSSION.

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Table 1: Mean levels of some heavy metal (mg/l) in the plants in quarry site

Element	<i>Anogeissus</i>	<i>Bauhinia</i>	<i>Prosopis</i>	<i>Sterculia</i>	<i>Tamarindus</i>	WHO
	<i>Leiocarpus</i>	<i>reticulata</i>	<i>oblonga</i>	<i>tomentosa</i>	<i>indica</i>	Standard limit
Cr	<0.04	<0.04	<0.04	<0.04	<0.04	0.05
Cd	<0.01	<0.01	<0.01	<0.01	<0.01	0.005
Pb	0.060±0.01	0.07±0.01	0.07±0.01	<0.04	<0.04	0.05
Mn	5.31±0.01	1.22±0.01	1.46±0.01	1.61±0.01	1.56±0.01	0.1
Ni	<0.005	<0.005	<0.005	<0.005	<0.005	0.02

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Table 2: Mean levels of some heavy metal (mg/l) in the plants away from quarry site

Element	<i>Anogeissus</i>	<i>Bauhinia</i>	<i>Prosopis</i>	<i>Sterculia</i>	<i>Tamarindus</i>	WHO
	<i>leiocarpus</i>	<i>recticulata</i>	<i>oblonga</i>	<i>tomentosa</i>	<i>indica</i>	Standard Limit
Cr	<0.04	<0.04	<0.04	<0.04	<0.04	0.05
Cd	<0.01	<0.01	<0.01	<0.01	<0.01	0.005
Pb	<0.04	0.08±0.01	<0.04	<0.04	<0.04	0.05
Mn	0.03±0.01	0.68±0.01	<0.03	<0.03	<0.03	0.1
Ni	<0.005	<0.005	<0.005	<0.005	<0.005	0.02

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Table 1 and 2 shows the summaries for heavy metals that are found in the plant sample. Most of heavy metal analyzed was below detection limit of Atomic Absorption Spectrophotometer AAS Buck 210VGP used. Except Manganese (Mn) and Lead (Pb) that is significantly present in both samples from Quarry site and away.

Lead (Pb): Lead concentration in the plants species studied was above 0.05mg/l permissible limit given by [11, 12]. Manganese (Mn): Levels for Mn accumulation during the present study are shown in table 1 and 2. The highest content of Mn in the studies is in *Anogeissus leiocarpus* sample from the quarry site with 5.31mg/l and low in sample of *Anogeissus leiocarpus* with 0.03mg/l away from the Quarry site. The permissible limit for Mn set by [12] is 0.01mg/l while by [9] is 0.05mg/l Hence Mn does appear to present a hazard to both Human and animal that ingest the plants extract as medicine.

Most of the heavy metal analyzed was not detected except in few plants where Mn and Pb was noted. Plants that have high values for both Mn and Pb are found in the quarry samples which exceed the permissible limit of [9, 12]. So, therefore, the plants are said to be toxic to be consume as medicine.

CONCLUSION AND RECOMMENDATION

The plants in the quarry site contain some lead and manganese above their threshold level in some plants and therefore the plants are not recommended to be consumed by animals to avoid bioaccumulation in them which will in further bring about health hazards. It is recommended that another study should be carry out on other edible plants that are cultivated around the quarry site in order to know if they are safe to be consumed or not

REFERENCES

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