

Original Research Article

HEAVY METAL PROFILES OF MEDICINAL PLANTS FOUND WITHIN THE VICINITY OF QUARRY SITE IN DEMSA, ADAMAWA STATE, NIGERIA.

ABSTRACT

Heavy metals profile of ethanolic leaves extracts of some medicinal plants was carried out so as to ascertain the level of these metals in the plants because leaves of these plants are used for treatment of some ailments by the people residing in that community where quarry factory was situated. The plants include *Anogeissus leiocarpus*, *Bauhinia reticulata*, *Prosopis oblonga*, *Sterculia tomentosa* and *Tamarindus indica*. The digests were analyzed for the trace metals using Atomic Absorption Spectrophotometer (AAS) model 210VGP. The highest value for Manganese (Mn) was obtained from *Anogeissus leiocarpus* sample with 5.31mg/l from the Quarry site, 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. Chromium (Cr) has value of <0.04, Cadmium (Cd) with <0.01 and Nickel (Ni) having <0.05 in all the samples. 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) was detected in only one of the control sample site with value of 0.08mg/l in *Bauhinia reticulata* and in three plant samples from the Quarry site which include *Anogeissus leiocarpus* with 0.06mg/l and 0.07mg/l for *Bauhinia reticulata* and 0.07mg/l for *Prosopis oblonga* respectively. Other trace metals results obtained away from the quarry site include (Cr) with value of <0.04, (Cd) with <0.01 and (Ni) with <0.05 in all the samples. Some plants in the quarry site contain Mn and Pb above their threshold levels, therefore these plants are not recommended for consumption by animals to avoid bioaccumulation which will in further bring about health hazard.

27 **Keywords:** Heavy metals, *Sterculia tomentosa*, sample, manganese, quarry

28 INTRODUCTION

29 Any toxic metal may be called heavy metal, irrespective of their atomic mass or density [1].

30 Heavy metals are a member of an ill-defined subset of elements that exhibit metallic
31 properties. These include the transition metals, some metalloids, lanthanides, and actinides.
32 One source defines heavy metal as one of the common transition metals, such as copper, lead,
33 and zinc. These metals are a cause of environmental pollution from sources such as leaded
34 petrol, industrial effluents, and leaching of metal ions from the soil into lakes and rivers by
35 acid rain [2].

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

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

50 Metal concentration in soil typically ranges from less than one to as high as 100,000 mg/kg
51 [6]. Heavy metals are the main group of inorganic contaminants and a considerable large

52 area on land it contaminated with them due to use of sludge or municipal compost, pesticides,
53 fertilizers, and emissions from municipal wastes incinerates, exudates, residues from
54 metalliferous mines and smelting industries. Irrespective of the origin of the metals in the
55 soil, excessive levels of many metals can result in soil quality degradation, crop yield
56 reduction, and poor quality of agricultural products, posing significant hazards to human,
57 animal, and ecosystem health [7].

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

68 Human health has become threatened due to exposure to hazardous and toxic substances,
69 such as industrial effluents and emissions, sewage sludge, fertilizers and agrochemicals [9].

70 The possibility of their movement along the food chain cannot be over ruled out, Cd, Pb and
71 Hg are major contaminants of food and may be considered an important problem to our
72 environment while others like Fe, Zn and Cu are essential for biochemical reactions in the
73 body [10].

74 Medicinal plants represent a rich source from which powerful drugs are produced [11].

75 Herbal medicine has shown to be effective and about 60percent of the rural population
76 depends on it for their primary health care [12, 13]. The interest in the scientific

77 investigation of medicinal plants from Nigeria is based on the claims of their effective use for
78 the treatment of many diseases, therefore research into the effects of these local medicinal
79 plants is expected to enhance the use of these plants against diseases caused by the test
80 pathogens, however **most** of these plants used in herbal medicine have not been screened for
81 their toxicity effects. Traditional medical herbs **are** used for strengthening the body immune
82 system and nutritional elements. According to Sofowora [14], many plants have been
83 documented to have the efficacy to treat many diseases in Nigeria. In order to control **and**
84 prevent the inevitable progression of the immune system destruction that these stresses
85 causes, therapy must be diverse, involving all levels of health, diet, use of mineral
86 supplements and life style. It has been revealed that, elements in biological sources are more
87 efficient than pure elemental status, because of presence of element as well as presence of
88 vitamins and other physiological active compounds [15]. A research report by Rajurkar and
89 Damame[16] shows correlation between elemental content of medicinal plants and their
90 curative ability, so the quantitative estimation of various micro element concentrations is
91 important for determining the effectiveness of the medicinal plants **in** treating various
92 disease, as sources of supplement and also to understand their pharmacological action.
93 Moreover macro and micro elemental analysis of medicinal plants can be used to decide the
94 dosage the herbal drugs prepared from these plant materials and also the concentration of
95 toxic element like Pb, Cd and Hg [16]. **Studies conducted by [17, 18] have demonstrated that**
96 **the relative high levels of essential elements such as Fe, Mn, Zn and Ca influence the**
97 **retention of toxic elements in animals and human beings.**
98 Therefore, the main aim of the research is to carry out the heavy metal analysis of some
99 medicinal plants found in the vicinity of quarry site.

100

101

MATERIALS AND METHODS

Study Area

The study area is quarry site situated in Demsa Local Government Area of Adamawa State, Nigeria. Fig 1 shows the map of the study area. Demsa is a Local Government Area of Adamawa State, Nigeria. Demsa lies on the Benue River. Coordinates: 9°25'N 12°8'E with population of 180,251. The state spans two vegetation zones namely Sudan and Sahel savannah. Effective rains start in late June and end in late October. They dry seasons start in October and end in June. The occupation of the rural community of Demsa LGA has always been agrarian. The local government communities of these areas have been using these medicinal plants under investigation to cure various diseases for a long time.

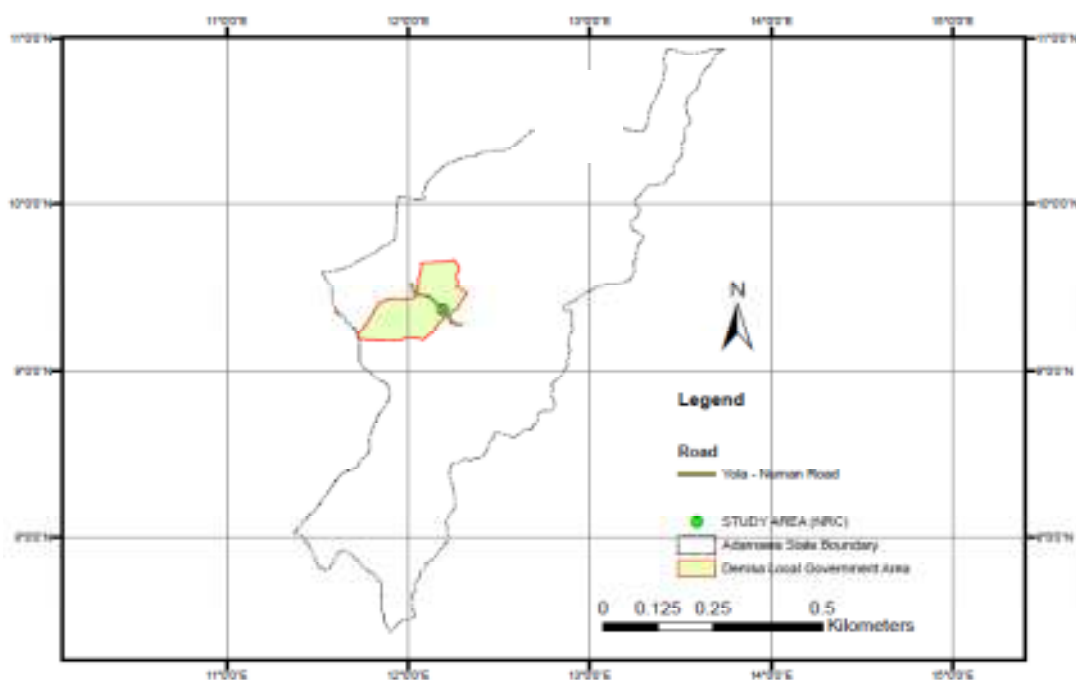


Fig. 1: Map of Adamawa State Showing Demsa LGA and the Study Area

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118 **Sample Collection**

119 Leave samples of *Bauhinia reticulata*, *Prosopis oblonga*, *Sterculia tomentosa*, *Tamarindus*
120 *indica* and *Anogeissus leiocarpus* were collected from the Quarry site (N R C) along Numan
121 road in Demsa L.G.A and transported to Modibbo Adama University of Technology, Yola,
122 where they were identified and authenticated by Dr A. Jauro from forestry department.
123 Voucher specimens of these plants were deposited at the University Herbarium.

124

125 **Sample Preparation**

126 The plant samples were washed thoroughly with tap water to remove the soil particles from
127 the leaves. The samples were then cut into smaller pieces and air dried for some days. The
128 dried samples were ground into powder and stored in labeled polythene bags. Each powdered
129 sample was digested as reported by Barminas et al. [19]. 2gm of each sample was weighed
130 into separate beakers and treated with 20cm³ of HNO₃ acid. It was then digested on an
131 electric hot plate at 70°-90° for 60minutes. Blank was prepared similarly by digesting 20cm³
132 of HNO₃ acid in an empty beaker. It was cooled and the content filtered through Whatman
133 No. 42 filter paper into a volumetric flask and made up to 100cm³ with deionised water. The
134 digests were analyzed for the trace metal contents using Buck scientific model 210VGP
135 Atomic Absorption Spectrophotometer. A calibration curve was constructed using standard
136 stock solution for each element. The unknown sample absorbance is read off on the
137 spectrophotometer and the concentration in ppm is obtained by extrapolation on the curve.

138

139 **Determination of essential and heavy elements in the sample**

140 This was achieved by means of absorbance measurements of the dilute solutions using the
141 advantage of the sensitivity of the AAS spectrophotometer. The instrument was calibrated by