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STUDY OF SOME HEAVY METALS ANALYSIS IN ALMOND PLANT (*PRUNUS DULCIS*) BARK AND LEAVES

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ABSTRACT

The study of some heavy metals in almond (bark and leaves) were studied using atomic absorption spectrophotometer (AAS) . the metals analyzed and the results obtained include the following; bark, (Pb) = 0.42mg/kg, Hg=0.001mg/kg, (Fe) = 283mg/kg, Ar.= 0.13mg/kg and Zn= 0.033mg/kg, while for leaves Pb =0.47mg/kg, Fe=287mg/kg ,Ar=0.214mg/kg, Zn=0.035mg/kg, Hg= 0.014mg/kg. The result reveals that the concentration of lead (Pb) in both almond bark and leaves are higher when compared to World Health Organization (WHO) standard which is 0.30mg/kg while that of iron for bark and leaves values are within the permissible limits of World Health Organization (WHO). However, increase in the concentration of lead in both bark and leaves can be as a result of processing and other industrial activities associated in the production of almond in a powdery form, the nature of the soil and its processes of cultivation due to the mineral soil content can also be attributed to the concentrations of these mineral elements. The health implications for the consumption of almond may not be hazardous due to the minimal concentrations of most of the mineral elements which are within the permissible limits. However, other heavy metals

can be analyzed to assess its potency, relevance and other uses for both domestic and industrial purposes.

Keyword. Atomic absorption spectrophotometer, mercury, iron, almond etc

INTRODUCTION

Almond is one of the most important and familiar nut tree for global nut production that includes apples pears, prunes and raspberries. Almond seed skin is a prominent source of polyphenolic compounds [3]. The analysis of some heavy metal concentrations in almond plant (*Prunus dulcis)* is important because of the public health and environmental implications. There are recommended standards for heavy metal concentrations in edible and nutritious plants like almond, avocado pear,oranges, apples etc. (WHO/FAO 200 1-1999; Cardoso et al., 2005; CIAT, 2007). High levels of heavy metal in almond are likely to induce a corresponding contamination and health hazards, high accumulation of these metals like lead, mercury, arsenic, manganese etc can exert potential risk in living organisms. It is therefore necessary to compare the values gotten with that of World Health Organization (WHO) and Food and Agricultural Organizations, if the consumption of almond *(Prunis dulcis)* is safer or not. In food processing, it is often necessary to carry out trace elements analysis to ensure that harmful and non- harmful, non-essential elements are kept at low concentrations as much as possible [5]. Most of these, ions which are toxic to human beings by interfering with enzyme functions while some may have stimulatory effects when the metals intake is at low concentration, the body system might not be able to remove it and it will remain in the body as impurities for a short time. The increase in lead, mercury, arsenic and some metal toxicants in almond can cause toxic effects for consumers. The gravity of toxic effects depends on the nature, quality of chemical and body resistance and on synergetic or anta gonistic effects of other chemical contaminations. [7] Almond (*Prunus dulcis)* is one of the most important and familiar nut trees for global nut production that includes apples, pears, prunes and raspberries (9). Almond seed skin is a prominent source of polyphenolic compounds, mainly phenolic acids. Almond is a popular nut rich in minerals, vitamins, proteins, fibres, essential elemnts and other substances which promote a healthy life. The review aims to renew the interest in this promising plant, thus stimulating researchers to go further with the study for discovering novel medicinal and nutritional benefits (5). The kernels of the seeds are a major source of vitamin E and B, dietary fiber, essential elements calcium and magnesium, monounsaturated fatty acids, and phytosterols with significant cholesterol-lowering effects. It is the most popular in nutritive food that can relieve different kinds of ailments (2 and 3). This review summarizes

recent advances in the studies regarding *Prunus dulcis* and its potential significance. Further, there is a need to isolate and evaluate the active chemical constituents of Prunus amygdalus having significant pharmacological values (7). Almond plant, (*Prunus dulcis)* is a highly valued plant that is mostly cultivated in the tropics and sub-tropics, it is a multi-purpose tree which originated from Iran, India, Philippines, Sri-lanka, Thailand, Malaysia, Pakistan, Nigeria, Malaysia, etc. It is a perennial softwood tree with timber of low quality, but for centuries has been advocated for traditional, medicinal and industrial uses with various edible parts. (8).. *Prunus dulcis* belongs to the Rosaceae family which has various species of deciduous trees classified in a single genus. (4). *Prunus dulcis* is the most widely known and distributed species. They are majorly used for food, medicinal and industrial purposes. It is cultivated to use as a vegetable (leaves, green pods, flower seeds), for spice (mainly roots) for cooking and cosmetic oil (seeds) and as a medicinal plant (all plant organs). Medicinally, *moringa* parts are used for treatment of anaemia, anxiety, asthma, fever, semen deficiency (10). Nutritionally, *almond* trees have been used to combat malnutrition, especially among infants and nursing mothers. *Prunus dulcis* (1). contain more vitamin A than carrots, more calcium than milk, more iron than spinach, more vitamin c than milk, more potassium than bananas and that the protein quality of *moringa* leaves rival that of milk and eggs. (4).. It has high anti-oxidant properties making it a valuable source of vitamins A, C and E. it is one of the highest naturally occurring sources of anti-oxidants. (8). The phytochemicals studied such as saponins, cyanogenic glycosides, flavonoids, and alkaloids are natural products which exist in plants and are very significant in the nutritional, medicinal and health benefits of almond plants.(5,6)

Materials and METHODS

Plant materials: Almond (Prunus dulcis) bark were freshly collected from Captain Elechi Amadi Polytechnic. washed with distilled water for serval times and dried in the sun. Air dried bark is grounded into powdery form in the Chemistry Laboratory, Department of Chemistry, Faculty of Natural Science, Ignatius Ajuru University of Education . The grounded powder were extracted with acetone and ethanol extract incubated for 48 hours in shaker, whereas the aqueous extract was prepared by incubating for overnight in shaker and it was boiled for 30 minutes till the volume was reduced to half its original. The solvents was then removed by filtration. The extracts were condensed using rotary vacuum evaporator and stored at 40o C. the aqueous extracts was dissolved in water and used for further purpose whereas concentrated extract of acetone and ethanol was suspended in 0.25% dimethyl formamide (DMF) to the concentration of 100mg/ml and was used for analysis

Reagents

- Hydrogen tetraoxosulphate (vi) acid (H_2S0_4)
- Trioxonitrate (v) acid (HNO_3)
- Distilled water

Standard Preparation

Wet digestion method: A total volume of 40m1 of H_2S0_4 and HNO_3 were used in the ratio of 10%:30%during the experiment.

Procedure

- 2.00g of each sample was weighed and stored in different conical flasks.
- 30ml of trioxonitrate (V) acid (HNO_3) and 1 Oml of tetraoxosulphate (VI) acid (H_2SO_4) were added to each flask.
- Each flask containing each sample was digested in a fume cupboard using a hot plate till white fumes appeared and cleared up.
- The samples were cooled and diluted with 100ml of distilled water.
- Each sample was filtered into a measuring cylinder using a funnel and a filter paper.
- The filtrates were transferred into a sterile sample bottle to avoid interferences.
- 2m1 of each filtrate was collected using a micro pipette and was placed into two different curvets.
- The spectrophotometer was switched on and was set to a zero mark using a curvet filled with distilled water.
- The curvets containing the samples were placed in the chamber of the spectrophotometer one after the other and readings were taken.

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RESULT AND DISCUSSION

DATA PRESENTATION AND ANALYSIS

The result obtained from the study are presented below and analyzed accordingly.

Table1.0: Concentrations of Heavy Metals in almond bark and leaves.

Heavy metals	Almond (mg/kg) concentration		WHO/FAO (2001-1999) (Cardoso et al., 2005; CIAT, 2007), (Wheatley et al., 1993)
	Bark	Leaves	
Lead, Pb	0.42(mg/kg)	0.47(mg/kg)	0.30mg/kg
Iron, Fe	283(mg/kg)	281(mg/kg)	425mg/kg
Mercury Hg	0.001mg/kg	0.004mg/kg	
Arsenic, Ar.	0.13mg/kg	0.24mg/kg	
Zinc Zn	0.033mg/kg	0.035mg/kg	

Table 2.0 : Percentage Composition of The Heavy Metals in almond bark and leaves

Heavy metals	Percentage Composition and Heavy Metals in Almonds			
	Bark (mg/kg)	Percentage (%)	Leaves (mg/kg)	Percentage (%)
Lead, Pb	0.42	0.16	0.47	0.13
Iron, Fe	245	89.74	249	66.85
Mercury Hg	0.001	0.0004	0.004	1.411
Arsenic Ar.	0.13	0.0458	0.24	8.463
Zinc, Zn	0.033	0.116	0.034	0.012

The determination of heavy metal concentrations in almond is important because of the public health implications [9]. There are recommended standards for heavy metal concentrations in foods like almond, (WHO/FAO 200 1-1999; Cardoso et at., 2005; CIAT, 2007; Wheatley et al., 1993). The results of Lead (Pb) in the almond sample from mass spectroscopy determination showed a concentration of 0.42 and 0.47mg/kg for both almond bark and leaves respectively. The value is above the World Health Organization recommended limits of 0.30mg/kg. The concentrations of Iron (Fe) in the samples were found to be 245 and 249mg/kg for both bark and leaves samples, this is below the WHO recommended standard of 425mg/kg. the results shown can be attributed to the nature of the soil and environmental activities. In table 2, the results obtained indicated a higher percentage of Iron among the other heavy metals that were determined. The presence of heavy metals as trace metals are components of

human activities although result reveals that the quantity of lead (Pb) in bark and leaves samples are higher when compared to World Health Organization (WHO) standard as shown in table 2 while. The values of the other mineral elements are within the limits for both bark and leaves when compared to World Health Organization (WHO) standards indicating that consumption may not have a serious risk or health implications [10]. Heavy metals are highly toxic when present in these systems in high concentration and when they accumulate above maximum limit in any physiological system; they tend to be highly injurious to health. The level of arsenic, zinc and mercury are also quite low considering the permissible limits for consumption. The level of arsenic is an indication of its less carcinogenic effect and low level disease effect. Zinc, physiologically can act as a cofactor to enzyme activities for living organisms. Almond species is good for consumption and has a high level of health benefits.

CONCLUSION

From the research carried out, the results showed that the heavy metals found in the samples have a potential risk to human health. Based on the data obtained, it is discovered that lead concentration is above the world health organization (WHO) which is not helpful to human system and can cause neurotoxin that accumulates both in tissues and muscles . While in iron the concentration level is within the permissible limit of world health organization and it's also very useful.

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