# ELEMENTAL ANALYSIS ON PTEROCARPUS MILDBREADII (OHA)SEED

**PRESENTED**

# BY

**EGECHI AMARACHI FRANCA BC/2009/252**

# BEING A PROJECT RESEARCH WORK SUBMITTED TO THE DEPARTMENT OF BIOCHEMISTRY,CARITAS UNIVERSITY IN

**AUGUST,2013**

# TITLE PAGE

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# EGECHI AMARACHI FRANCA BC/2009/252

**BEING A PROJECT RESEARCH WORK SUBMITTED TO THE DEPARTMENT OF BIOCHEMISTRY,CARITAS UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE(B.Sc.)IN BIOCHEMISTRY**

# SUPERVISOR: MR. UGWUDIKE

**AUGUST,2013**

# APPROVAL PAGE

THIS PROJECT WORK HAS BEEN APPROVED AS MEETING THE REQUIREMENT OF THE DEPARTMENT OF BIOCHEMISTRY, CARITAS UNIVERSITY,AMORJI-NIKE,EMENE-ENUGU FOR THE AWARD OF DEGREE(B.Sc.)

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HEAD OF DEPARTMENT

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# DEDICATION

This project is dedicated to God, Almighty, who continues to provide new ideas in improving human health, to Blessed Virgin Mary, who continues to intercede for her children, and to the researchers who have made themselves available to save humanity.

# ACKNOWLEDGEMENT

First and foremost, I will like to ascribe all glory and honor to God, the beginning and the end, who began this work with me, strengthened and finished well with me. He made it all possible. Thank you Jesus.

And with sincere appreciation, I thank my Project Supervisor , Mr Ugwudike, P.O; who with wisdom attended to the success of this project. Sir, God will favor you above all things. Thank you sir.

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labour daddy and mummy. Also, to my siblings, Chibuzo, Chizoba, Obinna, Echee and Mr. Ogechi,I love you all.

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A million thanks to you Chigozie Anosike,Wisdom,other friends,uncles, and

numerous friends,I really appreciate your aid and pray IRU \*RG¶V EOHVVL upon you. Amen.

And to all I cannot mention and did not remember, God will never forget you. Thanks.

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# ABSTRACT

Elemental analysis is the qualitative detection and quantitative determination of chemical elements(atoms,ions)in a sample(Fritz Pregl 1923). To detect an

element, one should fix an appearance of an analytical signal. The formation of precipitate or characteristic crystals, colour change, an isolation of gaseous products, an appearance of a definite lines in spectrum, luminescence, etc. To determine elements quantity, it is necessary to measure a value of an analytical signal; a precipitate mass, intensity of a current, solution absorption, spectrum line, luminescence or radioactivity, a reaction rate and so on.([www.intechopen.com](http://www.intechopen.com/)).

This study was undertaken to analse the elements present in grounded Pterocarpus mildbreadii (Oha seed) using Atomic Absorption Spectrometer(AAS MODEL- AA320N).The seed was found to contain these essential macro minerals/elements sodium(Na),Potassium(K),calcium(Ca),magnesium(Mg),and the trace elements iron(Fe),copper(Cu),zinc(Zn), and selenium(Se)(Duffus,2002).

The study established that Pterocarpus mildbreadii(oha seed) does not contain manganese and has high content of potassium which is necessary for good health.

# CHAPTER ONE

* 1. **INTRODUCTION, AIMS AND OBJECTIVES**

A seed or mature ovule is a miniature plant with a protective cover in a suspended state of development. Most seeds contain a built-in food supply called endosperm, orchid is an exception. The endosperm can be made up of proteins, carbohydrates and fats.

Seed can also be defined as a small embryonic plant enclosed in a covering called the seed coat, usually with some stored food. It is the product of the ripened ovule of gymnosperm and angiosperm plants which occurs after fertilization and some growth within the mother plant(Wikipedia).Seed protects a plant embryo so that it can grow into a new plant. Many seeds are edible, such as sunflower seeds, tomato seeds, corn and peas.

Seeds contain three distinct structures. The inside of a seed contains an embryo, which is a baby plant with a shoot and a tiny root. The two halves of a seed are stored food that provides the nourishment necessary for seeds to germinate, or begin growing. Surrounding the seed is a hard, tough seed coat, which protects the seed during dormancy(Anville 2007).

Most seeds contain a built-in food supply called endosperm. The endosperm can be made up of proteins, carbohydrates and fats. Seeds also contain anti-nutrients in

their seed coat. These anti-nutrients includes phytin, lectin, trypsin inhibitor activity, tannin and cyanide. In addition, they also contain minerals such as sodium, potassium,calcium,magnesium,phosphorus,zinc,manganese,iron,selenium and copper.(Balogun 2000)

Oilseeds are energy dense foods; for example, sesame seeds provide 600kcal or 2470kj/1000g.Although oilseeds contain protein(|14-32g/100g)and carbohydrate(ranging from less than 1g/100g to more than 34g/100g),most of the food energy they provide is as fat(which provides 9kcal or 37kj/g).Oilseeds vary widely in their fatty acid composition but tend to be rich in MUFA(e.g peanut)r PUFA(e.g sunflower seeds).Some seed oils contain significant amounts of EFA, ALNA, an n-3 fatty acid, and linoleic acid(LA),an n-6 fatty acid. from these two fatty acids, the body can make all the fatty acids it needs. From LA, arachidonic acid can be produced, and from ALNA the long chain n-3 eicosapentaenoic acid(EPA)and docosahexanoic acid(DHA)can be made.(BNF 1999).

Generally, whole oilseeds are a source of fibre, phosphorus, iron and magnesium; many oilseeds are a source of vitamin E(an antioxidant),niacin and folate. Whole oilseeds also contain phytoestrogens, a group of substances including lignans and isoflavones. Phytoestrogens have a structure similar to the oestrogen hormone oestradiol and can bind to oestrogen receptors.Phytoestrogens may provide a protective effect against coronary heart disease as they have been shown to have a

lowering effect on blood cholesterol.Additionally,some phytoestrogens may have antioxidant properties(Goldberg 2003).

In Britain, oilseeds are usually consumed, following processing,as oils and margarines. The fatty acid composition of oils produced from oilseeds varies widely. Vegetable oils do not contain the same levels of macronutrients, vitamins and minerals as whole oilseeds. In fact, apart from fat itself, vitamin E is the only nutrient present in appreciable amounts. Vegetable oils do, however, contain a range of phytochemicals, e.g they are the main source of natural plant sterols in the diet. Plant sterols have a structure similar to cholesterol and hence reduce cholesterol absorption, therefore reducing the circulating levels of total and low density lipoprotein(LDL)cholesterol. Plant sterols can be present as free or esterified forms and the proportions vary, e.g free sterols dominate in soybean,olive and sunflower oil,while in rapeseed and corn oil, free sterols account for only 30% of the plant sterols.Refining vegetable oils decreases the content of sterols(from 10-70% depending on the oil and processing conditions used),thus decreasing their potential to lower serum cholesterol(Goldberg 2003).

# AIM OF STUDY

To determine the elements present in grinded oha seed(Pterocarpus mildbreadii)

# RESEARCH OBJECTIVE;

This study was primarily designed to use grinded oha seed(Pterocarpus mildbreadii) extract for elemental analysis.

# CHAPTER TWO LITERATURE REVIEW

# 2.1 ELEMENTAL ANALYSIS

Elemental analysis is the qualitative detection and quantitative determination of chemical elements(atoms, ions)in a sample(Fritz Pregl 1923).To detect an element, one should fix an appearance of an analytical signal, the formation of precipitate or characteristic crystals, color change, an isolation of gaseous products, an appearance of a definite lines in spectrum, luminescence ,etc. To determine elements quantity, it is necessary to measure a value of an analytical signal: a precipitate mass, intensity of a current, solution absorption, spectrum line, luminescence or radioactivity, a reaction rate and so on. The content of an element is calculated on the base of a functional dependence of the analytical signal value(AS)on a mass or concentration of this element(AS=F©),which is established by calculations or experiments(Mazor L 1986).To obtain the analytical signal, chemical reactions of different types(acid- base, oxidation-reduction, complex formation),various processes(eg. precipitation)as well as different chemical, physical, biological properties of elements themselves or product of their reactions, are used. Methods for the detection and determination of elements are divided into chemical, physical, biological. The most important characteristics of these methods are the detection limit, sensitivity, selectivity,

precision, rapidity and price of analysis. At present, elements are mostly detected with the help of physical methods, which are based on physical phenomena or processes eg. an interaction of elements with an energetic current. Among such methods is the method of atomic emission spectroscopy(AES),based on a thermal excitation of atoms of free elements and registration of the optic spectrum of excited atoms emission (Kellner R.et al. 1998).

# MACRO ELEMENTS

POTASSIUM

Potassium is a soft, silvery alkali metal. Atomic number: 19

Potassium symbol: K

Potassium atomic weight: 39.0983

Discovery: Sir Humphrey Davy 1807(England)

Potassium word Origin: English potash pot ashes; Latin kalium, Arabic qali: alkali

Isotopes: There are 17 isotopes of potassium. Natural potassium is composed of three isotopes, including potassium-40(0.0118%),a radioactive isotope with a half life of 1.28 \* 109years.

Potassium properties: Melting point is 63.250c, bioling point is 7600c,specific gravity is 0.862(200c),with a valence of 1.Potassium is one of the most reactive and electropositive of metals. The only metal that is lighter than potassium is lithium. The silvery white metal is soft(easily cut with a knife).The metal must be stored in a mineral oil, such as kerosene, as it oxidizes rapidly in air and catches fire spontaneously when exposed to water. Its decomposition in water evolves

hydrogen. Potassium and its salts will color flames voilet. /DQJH¶V +DQGE Chemistry 1952).

Uses: Potash is in high demand as a fertilizer. Potassium, found in most soils, is an element that is essential for plant growth. An alloy of potassium is used as a heat transfer medium. Potassium salts have many commercial uses.

Sources: Potassium is the 7th most abundant element on earth, making up 2.4% of WKH HDUWbyKw¶eigVht . PFotaUssXiumViWs n ot found free in nature. Potassium was the first metal isolated by electrolysis(Davy,1807,from caustic potash KOH).Thermal methods(reduction of potassium compounds with

C,Si,Na,CaC2)are also used to produce potassium. /DQJH¶V +DQGER

Chemistry 1952). Potassium in the body

Potassium is important for membrane function, nerve impulses, and muscle contractions. Potassium cations are found in cellular cytoplasm. The electrolyte helps to attract oxygen and remove toxins from the tissues. Potassium is found in muscles and nerves as ions. It makes up about 0.4% of body fluid. It is the principal cation of intracellular fluid(ICF).(Crescent Chemical Company(2001).

Bodily function facilitated:

-heartbeat

-muscle contraction

-proteosynthesis

-osmotic equilibrium

-utilization of sacharides. SODIUM

Sodium atomic number: 11 Sodium symbol: Na

Sodium atomic weight: 22.989768

Sodium word origin: English soda and Medieval Latin sodanium: headache remedy; Latin natrium: sodium carbonate

Isotopes: Eighteen isotopes of sodium are known. Only one isotope is stable:Na- 23.

Properties: Sodium has a melting point of 97.81+/-0.030c,boiling point of 882.90c, specific gravity of 0.971(200c), and a valence of 1.Sodium is a bright, silvery metal, it is soft and highly reactive. Sodium floats in water, which decomposes it to evolve hydrogen and form the hydroxide. Sodium may ignite spontaneously on water. It does not usually ignite in air at temperatures below 1150c.(International Atomic Energy Agency ENSDF database Oct.2010).

Uses: Sodium chloride is important for animal nutrition. Sodium compounds are used in the glass, soap, paper, textile, chemical, petroleum, and metal industries. Metallic sodium is used in manufacturing of sodium peroxide, sodium cyanide, sodamide, and sodium hydride. Sodium is used in preparing tetraethyl lead. It is used in the reduction of organic esters and preparation of organic compounds. Sodium metal may be used to improve the structure of some alloys, to descale metals, and to purify molten PHW.DSOod¶iumV, as well as NaK, an alloy of sodium

with potassium, are important heat transfer agents.(Los Alamos National Laboratory 2001).

Sources: Sodium is relatively abundant in the sun and other stars. The D lines of sodium are prominent in the solar spectrum. Sodium is the sixth most abundant

HOHPHQW RQ HDUWK FRPSULVLQJ DSSodSiuUm Ris [LPDW

the most abundant of the alkali metals. The most common sodium compound is sodium chloride(salt).Sodium occurs in many minerals, such as cryolite, soda niter, zeolite, amphibole, and sodalite. Sodium is not found free in nature. It is obtained

commercially by the electrolysis of dry fused sodium chloride. /DQJH¶V +DQG of Chemistry 1952).

Occurrence in human body

Na+ is principle cation of extracellular fluid (ECF) In serum:135-144mmol/1,ICF:37mmol/1.

Bodily function facilitated:

-acid-base equilibrium

-normal cellular fluid level

-proper muscle contraction.

# MAGNESIUM

Magnesium symbol: Mg Atomic number: 12

Atomic weight: 24.3050(6)

Word origin: Magnesia,a district in Thessaly, Greece

Properties: Magnesium has a melting point of 648.80c,boiling point of 10900c,specific gravity of 1.738(200c),and valence of 2.Magnesium metal is light(one-third lighter than aluminium),silvery-white, and relatively tough. The metal tarnishes slightly in air. Finely divided magnesium ignites upon heating in

air, burning with a bright white flame. /DQJH¶V +DQGE1R95R2)N. RI &K

Uses: Magnesium is used in pyrotechnic and incendiary devices. It is alloyed with other metals to make them lighter and more easily welded, with applications in the aerospace industry. Magnesium is added to many propellents. It is used as a reducing agent in the preparation of uranium and other metals that are purified from their salts. Magnesite is used in refactories. Magnesium hydroxide(milk of magnesia),sulfate(epsom salts),chloride and citrate are used in medicine. Magnesium is essential for plant and animal nutrition. Chlorophyll is a magnesium-centered porphyrin.(CRC Handbook of Chemistry &Physics 18th Ed.).

Sources: Magnesium is the 8th PRVW DEXQGDQW HOHPWHhQileWit LQ W

is not found free in nature, it is available in minerals including magnesite and dolomite. The metal may be obtained by electrolysis of fused magnesium chloride

derived from brines and seawater /DQJH¶V +DQG1E95R2)R) N RI &KH Occurrence in human body

Cation of intracellular fluid(99% of Mg is intracellular, one half is binding in proteins and at a crystals of hydroxyapatite in bones. One half is in the muscles, liver and central nervous system).

In plasma:5-60% is ionised,30% is binding to protein, the rest is complex with anions of acids.

Magnesium participates in all biochemical and physiological processes because of their ability to activate(together with zinc)approximately 230 enzymes.

Bodily function facilitated:

-acid/alkaline balance

-blood sugar metabolism(energy)

-calcium metabolism.

# CALCIUM

Atomic number: 20 Symbol: Ca

Atomic weight: 40.078

Calcium word origin: Latin calx, calcis: lime

Calcium properties: The melting point of calcium is 839+/-20c,boiling point is 14840c,specific gravity is 1.55(200c).Calcium is a silvery white, soft alkaline earth metal. Although none of the alkaline earths occur free in nature, calcium

compounds are abundant.(LDQJH¶V +DQGER1R95N2) . RI &KHPLVWU

Uses: Calcium is essential for human nutrition. Animals skeleton get their rigidity normally from calcium phosphate. The eggs of birds and shells of molluscs are comprised of calcium carbonate. Calcium is also necessary for plant growth. Calcium is used as a reducing agent when preparing metals from their halogen and oxygen compounds; as a reagent in purification of inert gases; to fix atmospheric nitrogen; as a scavenger and decarbonizer in metallurgy; and for making alloys. Calcium compounds are used in making lime, bricks, cement, glass, paint, paper, sugar, glazes, as well as for many other purposes.(International Atomic Energy Agency ENSDF database Oct 2010).

Sources: The Romans prepared lime (called calx)in the first century, but the metal was not discovered until 1808.Berzelius and Pointin prepared calcium amalgam by electrolyzing lime in mercury. Davy isolated the impure metal. The metal may be prepared by electrolysis of CaCl2 at a temperature slightly above its melting point.

&DOFLXP LV WKH ILIWK PRVW mDaEkinXg QupG3.D22Q%W HOH

of the earth, air, and oceans. Natural forms of calcium include limestone(CaCO3),gypsum(CaSO4.2H2O),and fluorite(CaF2).Apatite is the fluorophosphates or chlorophosphate of calcium.(Annie Helmenstine 2001).

Occurrence in human body:

Extracellular cation. Almost all of calcium is in the bones and teeth in form of hydroxyapatite ~ Ca10(PO4)6(OH)2.

Plasma: 2,25 ±2,75 mmol/l

There are three forms of Ca in plasma:

* ionised (cca 50%)
* protein- bond (35 ±40%)
* as complex with anions of acids (5 ±10%) (citrate) Bodily function facilitated:
* bone/tooth formation
* blood clotting
* heart rhythm
* nerve transmission

-muscle growth and contraction.

# TRACE ELEMENTS ZINC

Atomic number: 30 Symbol: Zn

Atomic weight: 65.39

Word origin: German zinke: of obscure origin, probably german for tine. Zinc metal crystals are sharp and pointed. It could also be attributed to the German word µ]LmeQan¶ing tin.

Properties: Zinc has a melting point of 419.580c,boiling point of 9070c,specific gravity of 7.133(250c),with a valence of 2.Zinc is a lustrous blue-white metal. It is brittle at low temperatures, but becomes malleable at 100-1500c.It is a fair electrical conductor. Zinc burns in air at high red heat, evolving white clouds of zinc oxide.(International Atomic Energy Agency ENSDF database Oct.2010).

Uses: Zinc is used to form numerous alloys, including brass, bronze, nickel, silver, soft solder, Geman silver, spring brass and aluminium solder. Zinc is used to make

die castings for use in the electrical, automotive and hardway industries. The alloy prestal, consisting of 78%zinc and 22%aluminium,is nearly as strong as steel yet exhibits superplasticity. Zinc is used to galvanize other metals to prevent corrosion. Zinc oxide is used in paints, rubbers, cosmetics, plastics, inks, soap, batteries, pharmaceuticals, and many other products. Other zinc compounds are also widely used, such as zinc sulfide(luminous dials and fluorescent lights)and ZrZn2(ferromagnetic materials)(CRC Handbook of chemistry and physics 18th Ed.)

Sources:The primary ores of zinc are sphalerite or blende(zinc sulfide), smithsonite(zinc carbonate),calamine(zinc silicate),and franklinite(zinc,iron and manganese oxides).An old method of producing zinc was by reducing calamine with charcoal. More recently, it has been obtained by roasting the ores to form zinc oxide and then reducing the oxide with carbon or coal, followed by distillation of the metal.

Occurrence in human body:

Zinc is namely intracellular element. (60% is in muscles, 30% in bones).

Zinc is component of some enzymes (carbonate anhydrase, lactate dehydrogenase, alcohol dehydrogenase and superoxide dismutase).

Zinc is an activator of about 230 enzymes.

Bodily function facilitated:

* carbohydrate digestion
* prostate gland function
* reproductive organ growth and development

-phosphorus and protein metabolism.

# COPPER

Atomic number: 29 Symbol: Cu

Atomic weight: 63.546

Word origin: Latin cuprum: from the isle of cyprus, which is famed for its copper mines.

Properties: Copper has a melting point of 1083.4=/-0.20c,boiling point of 25670c,specific gravity of 8.96(200c),with a valence of 1 or 2.Copper is reddish colored and takes a bright metallic luster. It is malleable, ductile, and a good conductor of electricity and heat. It is second only to silver as an electrical

conductor. /DQJH¶V +DQGE1R95R2)N. RI &KHPLVWU\

Uses: Copper is widely used in the electrical industry. In addition to many other uses, copper is used in plumbing and for cookware. Brass and bronze are two

important copper alloys. Copper compounds are toxic to invertebrates and are used as algicides and pesticides. Copper compounds are used in analytical chemistry, as

in the use RI )HKOLQJ¶V VROXWAmLeRricQan coWinRs conWtaiHn VW I

copper.(Los Almos National Laboratory 2001). Sources:

Sometimes copper appears in its native state. It is found in many minerals, including malachite, cuprite, bornite, azurite, and chalcopyrite. Copper ore deposits are known in North America, South America, and Africa. Copper is obtained by smelting, leaching, and electrolysis of the copper sulfides, oxides, and carbonates. Copper is commercially available at a purity of 99.999+%.

Occurrence in human body:

It is component of some oxidoreductases (e.g. cytochromoxidase c, lysyloxidase, Superoxide dismutase) and plasmatic protein - ceruloplasmine (oxidase).

Bodily function facilitated:

* synthesis of collagen
* bone formation
* healing processes of body

-hemoglobin and red blood cell formation.

# MANGANESE

Atomic number: 25