بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

Preparation and Characterization of Glucuronic Acid and Magnesium Glucuronate(anti acid) from *Acacia polyacantha* Gum

تحضير وتوصيف حمض الجلوكيرونيك وجلوكيورنات الماغنسيوم(مضاد الحموضه) من صمغ الكاكاموت

A Dissertation Submitted in Partial Fulfillment of the Requirements for M.Sc. Degree in Chemistry

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إستهلال

قَالَ تَعَالَىٰ:

﴿ وَيَسْـَٔلُونَكَ عَنِ ٱلرُّوحِۖ قُلِ ٱلرُّوحُ مِنْ أَمْرِ رَبِّى وَمَآ أُوتِيتُم مِّنَ ٱلْعِلْمِ إِلَّا قَلِيلًا ٨٥ ﴾

صدق الله العظيم

سورة الإسراء

Dedication

I dedicate this work to :

My Parents.

My Husband.

My Children.

My Sisters.

Acknowledgement

All praise is raised to Allah; the merciful, who gave me the strength and determination to complete this work.

My deepest gratitude goes to prof: Mohammed Elmubark Osman my supervisor, for his encouragement and supervision over the course of this study.

My thanks are also expressed to all those who helped me in collection of information and the process of this study.

Abstract

In this study anti acid tablet was prepared from *Acacia polyacantha* gum. Glucuronic acid was prepared by ion exchange technique and magnesium glucurnate was prepared by adding magnesium bicarbonate to eluate.

Physicochemical characterization of *Acacia polyacantha* and magnesium glucuronate shows the moisture content of gum sample was 11.94% and for magnesium glucuronate was 12.90%, the total ash and inorganic content of magnesium glucuronate 1.83% is less than in gum sample, the gum sample and magnesium glucuronate is levorotatory, the viscosity of magnesium glucuronate is slightly lower than gum sample.

The gum sample is acidic, when the magnesium glucuronate neutral, and mineral composition shows the all cations values decreased in magnesium glucuronate compared with gum sample except Ca and Mg are increased.

المستخلص

في هذه الدراسة تم تحضير جلوكورنات الماغنيسيوم من صمغ الكاكاموت .

تم تحضير حمض الجلوكرونك باستخدام تقنية التبادل الايوني وتحضير جلوكورنات الماغنيسيوم باضافة بيكربونات الماغنيسيوم.

التشخيص الفيزوكيميائي لصمغ الكاكاموت وجلوكورونات الماغنيسيوم اوضح ان محتوى الرطوبة لعينة الصمغ 11.94% ولجلوكورنات الماغنيسيوم 12.90%، وان محتوي الرماد والمحتوى غير العضوي لجلوكورنات الماغنيسيوم تعادل 1.83% وهو اقل من محتوى عينة الصمغ، عينه الصمغ وجلوكورنات الماغنيسيوم تدير الضوء الى اليسار، لزوجة جلوكورنات الماغنيسيوم منخفضة مقارنة بعينة الصمغ.

عينة الصمغ حمضيه بينما جلوكورنات الماغنيسيوم متعادلة،المحتوي الكتيوني اوضح أن محتوي العناصر انخفض في جلوكورنات الماغنيسيوم مقارنة بعينه الصمغ ماعدا الكالسيوم والماغنيسيوم زاد تركيزهما.

Table of Contents

List of Tables

List of Figures

Chapter One

Introduction and literature Review

Chapter One

Introduction and literature Review

1. Introduction

Although there are more than 1100 species of *Acacias* , distributed throughout the tropical and subtropical areas of the world, most commercial gum Arabic is derived from *Acacia senegal* locally known as hashab gum (in the Sudan) and as Kordofan gum in the world. Gum Arabic has been known for many thousands of years and there are no artificial substitutes that match it for quality or cost of the production (Gabb, 1997). Chemically, gum Arabic consists mainly of high-molecular weight polysaccharides made up of rhamnose, arabinose, and galactose, glucuronic and 4-o-methyl glucuronic acid, and the salts of calcium, magnesium, potassium, and sodium of the two acids (Gabb, 1997). The Sudanese, major gums of economic importance are gum Arabic *Acacia senegal*, gum talha *Acacia seyal* and *Acacia polyacantha* gum. The source of gum Arabic is *Acacia Senegal* var *senegal*. *Acacia polyacantha* exudates are closely related to, and can hardly be distinguished from *Acacia senegal* exudates unless recognized by acknowledged gum expert or by studying the physiochemical characteristics. The two species, *Acacia senegal* and *Acacia polyacantha* belong to the same group known as *Acacia senegal* complex. All gum exudates, from this group of *Acacia* species, have a laevorotatory (-ve) specific rotation in contrast to *Acacia seyal* complex which produce gum exudates, that have a dextrorotary (+ve) specific rotation. Other structural, botanical characteristics are noticeable even with in the same species. Most of the research work is directed towards gum Arabic and to a lesser extent towards gum talha. Regrettably *Acacia polyacantha* gum and all other gum resource from Acacia species received very little attention.

Literature Review

1.1 Gums

Gums are high molecular weight polymeric compound composed of carbon, hydrogen, oxygen and nitrogen (Somaya*et.al.*, 2010), gums in the natural form are often polysaccharides or modified polysaccharides. Gums usually have colloidal properties and may produce gels when dissolved in suitable solvents. Commonly, the term gum was applied to the polysaccharide exudates from various plants, which produce viscous mixtures when dissolved in cold or hot water . Plant gums are organic substance obtained as an exudation from fruit, trunk or branches of the trees spontaneously or after mechanical injury of the plant by incision of the bark, or after the removal of the branch, or after invasion by bacteria (Somaya *et.al*, 2010).

1.2 Acacia gums

Gum arabic is an exudate natural gum. It is an important commercial polysaccharide which was used at least 4000 years ago. The term gum was applied because the material has gummy characteristics and the name "Gum arabic" because the origin of export was an Arab area and the Arabs in early history were the important traders and vendors of this material. More than 80 names have been used for the material, depending on the local area where it was collected and on its colour and grade (Blunt, 1926).

The term Gum arabic is used with varying degrees of precision by different groups of people. In the context of its use as a food additive the most recent international specification, published by FAO (FAO, 1990), defines Gum arabic as the dried exudation obtained from the stems and branches of *Acacia senegal*(L) Willdenow or closely related species. The specification then proceeds to give limits for certain parameters which have been selected to try and ensure that only gum from *A. senegal* and closely related species satisfies the specification. In Sudan, the term Gum arabic is used in a wider context to include two types of gum which are produced and marketed, but which are, nevertheless, clearly separated in both national statistics and trade, (Hashab) from *A. senegal* and (Talha) from *A. seyal*. In a still wider sense,gum arabic is often taken to mean the gum from any *Acacia* species, and is sometimes referred to as *Acacia* gum. Gum arabic from Zimbabwe, for example, is derived from *A. karroo.*

In practice, therefore, and although most internationally traded gum arabic comes from *A. senegal,* the term gum arabic cannot be taken as implying a particular botanical source. In a few cases, so-called gum arabic may not even have been collected from *Acacia* species, but may originate from *Combretum*, *Albizia* or some other genus.
Generally the term gum arabic was used in the generic sense as any *Acacia* gum unless it is qualified by some other statement or the botanical source is specified (FAO, 1990).

1.3 Chemical structure of gums Arabic

Gum nodules contain polysaccharide material of complex nature usually contaminated with impurities such as bark fragments, entrapped dust and insects. Inert pertinacious material and a few amounts of terpenoid resins can also be present. Gums are polyuronides; the uronic acid residues may carry acetyl or methyl groups and, generally, occur at least in part as methyl groups and generally occur, at least in part, as metallic salts. The hexose residues are present in the pyranose configuration, while the pentose residues occur in the furanose (Stephen *et al.,* 1955 and 1957) Beside the foregoing gums, others have been studied; *khayasenegalese* gum contains galactose, rhaminose and probably 4-O-methyl, D-glucuronic acid and galactouronic acid (Aspinal*et al.*, 1956). *Sterculiatermentosa* gum contains rhminose, galactose and probably galacturonic acid, Olibanum gum (*Boswelliacarterii*) was found to be of an arabino-galactan and a polysaccharide containing galactose and galactouronic acid . It was noted that the gum was very heterogeneous and it has been described as heteropolymolecular, i.e. having either a variation in monomer composition and/or a variation in the mode of linking and branching of the monomer unites, in addition to distribution in molecular weight (Lewis and Smith, 1957; Dermyn, 1962 and Stoddart, 1966). According to Philips (1989) and Williams (1989), Figure (1.3) shows the carbohydrates monemoers in gum Arabic.(street et al., 1983), fractionation by hydrophilic affinity chromatography revealed that *Acacia Senegal* gum consists of at least three distinct components. Fraction 1 AG (arabinogalactan), fraction 2 AGP (arabinogalactan-protein) and fraction 3 GP (galactoprotein). But even those contain a range of different molecular weight components revealing the polydiverse nature of the gum (Osman, 1994). Fraction 1 containing 88% of the total has only small amount of protein content. Fraction 2 represents 10% of the total and had 12% protein content. Fraction 3 resembles 1.24% of the total but contains almost 50% of protein AGP is responsible for the emulsifying properties of gum Arabic Williams, (1989), and Phillips, (1989). No mention has been made to detailed comparison between the structures of gums from different species of trees, but is believed that D-galactose and uronic acid residues generally constitute the backbone of gum polysaccharide with 1,3 and 1,6 linkages Figure(1.4) predominating side chain are characterized by the presence of D-xylopyranose, L-arabinose, and L-arabinofuranoselinkage (Elnour, 2007).

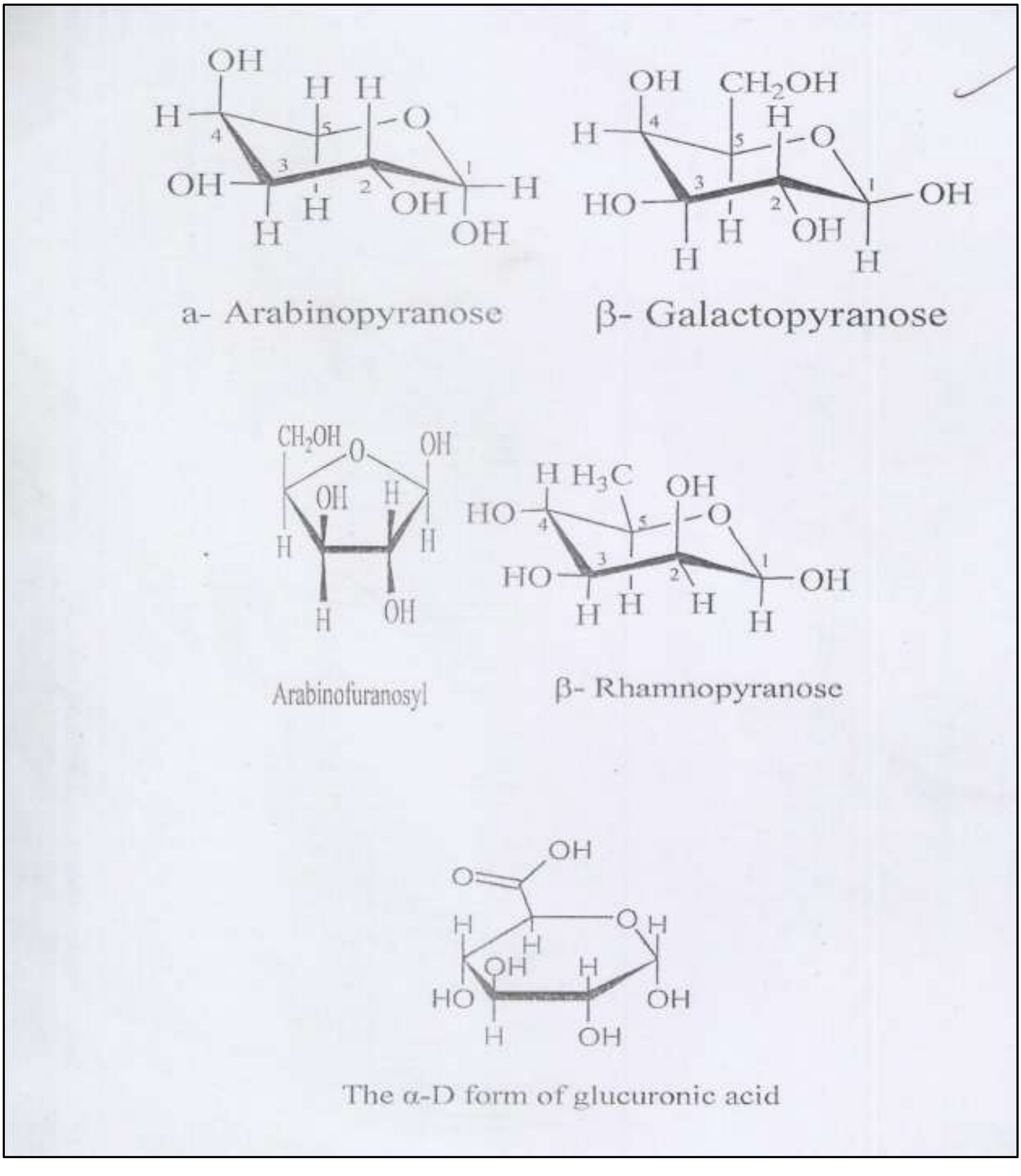
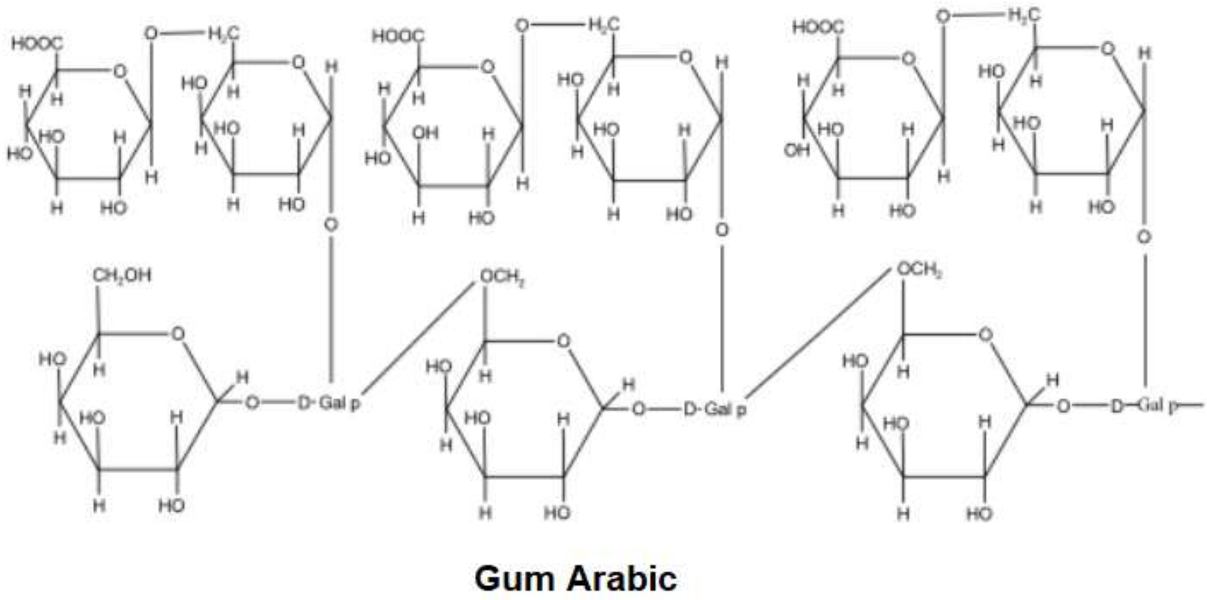


Figure: (1.1) structural of carbohydrates units of gum molecule



Figure(1.2):The backbone of gum polysaccharide

1.4 Applications of plant gums

The solubility and viscosity of gum are the most fundamental properties, which make it unique among polysaccharides, the majority of gums dissolve in water at different concentrations, and such properties are exploited in many applications.

1.4.1 Food Applications

Gums for their high viscosity in solutions and inability to crystallize, are particularly suited to serve in foodstuff such as: thickeners for beverages, stabilizers for oil and water emulsions and as wider application where function is to prevent agglomeration and setting of minute particles. They are also used to incorporate flavors in confectionery such as pastilles and gum drops, and the preparation of lozenges. The role of gum Arabic in confectionary products is usually either to prevent crystallization of sugar or to act as an emulsifier (Glicksman*et al.*, 1973).

1.4.2 Pharmaceutical and cosmetic applications

Gums are used as a suspending and emulsifying or binding agents in pharmaceutical industries, it has been used in tablet manufacturing, where it functions as a binding agent or as a coating prior to sugar coating, some times in combination with other gums .*Acacia polyacantha* gum used to act as general health tonic as antidote for snake bite, and cure for venereal diseases. A preparation from the bark is used for general stomach disorders (Voget, 1995).

1.4.3 Paints and coating applications

The hydrophilic colloids and modified cellulose find application in paint industry because of their stabilizing effect on paint emulsions, waxes and numerous others products. (Gamble and Grady 1938) treated pigments with water soluble hydrocolloids such as gum Arabic to add controllable chemotropic properties to paints. The gum also finds application in coating composition Horne *et al*. (1953) developed non glare coating based on a water soluble dye dissolved in gum Arabic solutions.

1.4.4 Other industrial uses

Due to its adhesive properties gum have been used in the manufacturing of adhesives for postage stamps and also in the formulations of paints and inks. Gum may serve as a source of monosaccharide, as e.g. mesquite gum (family *prosopis*) serve as a source of L-arabinose (51%) because of its easier hydrolysis, and availability of the gum in large quantities. The mesquite gum can be dialyzed by addition of ethanol (White, 1947 and Hudson, 1951), or alternatively, isolated by crystallization from methanol after removal of acidic oligosaccharides on ion exchange resin or precipitated by barium salts. Gums are widely used in textile industries to impart luster to certain materials (silk), as thickeners for colors and mordant in calico printing (Omer, 2004).

proteins and enzymes causes some denaturation, but the degree of denaturation depends on the particular molecule that is adsorbing(Paul Stevenson and Xueliang Li ,2014) .

1.5 Physical properties of gums

The solubility, color, taste, odor and viscosity are important parameters in determining the uses and commercial values of gums.

1.5.1 Solubility

Gums can be classified into three categories with regard to their solubilities:

i. Entirely soluble gums: e.g. *A. senegal*, *A. seyal*.

ii. Partially soluble gums: e.g. *Gatti gum*.

iii. Insoluble gums: e.g. *Tragacanth gum* (Omer, 2004).

1.5.2 Colour

The color of the gums varies from almost colorless through various shades of yellow, orange to dark brown, some of the best gum Arabic "*Acacia senegal*" is almost colorless. On the other hand, dark or even black gums sometimes occur, e.g. *Mesquite* gum. The color of *Anogeissusleiocarpus* gum maybe yellow or light brown .

1.5.3 Shape

Gums collected in natural states are represented by a variety of shape and form. Usually the augments are irregularly globular or tear shaped. The grading of gum is based on shape, size and color of gum nodules.

1.5.4 Viscosity

The viscosity of a liquid is its resistance to shear, to stir or to flow through a capillary tube. Since viscosity involves the size and the shape of the macromolecule it was seen as the one of the most important analytical and commercial parameter. The viscosity of the solution may be having a complicated variation with composition due to the possibility of hydrogen bonding among the solute and solvent molecules(Omer, 2004).Although gum Arabic is a high molecular weight it is a highly soluble gum, it makes a rather low viscosity, higher viscosity is not obtained with gum until the concentration of about (40-50%) (Glicksman, 1973). The intrinsic viscosity of fresh collected gum varies from 14 to 60cm^3/ g and the mean viscosity changes with the age of the crop, season and samples picked from one tree . Viscosity plays a role involving the size and the shape of the macro-molecule. It can be presented in various terms such as relative viscosity, specific viscosity, reduced viscosity, inherent viscosity, kinematic or dynamic viscosity and intrinsic viscosity. in an early investigation for electrodailized fractions of *Acacia.senegal* gum showed that the intrinsic viscosity for this gum was 20cm^{-3}g^{-1}. Anderson (1983) reported 13.4cm^{-3}g^{-1} intrinsic viscosity for authenticated specimens and 17cm^{-3}g^{-1} for commercial samples of *A.senegal* gums .Vandevelde et al.,(1985) found that the intrinsic viscosity for *A.senegal* gum originated from Sudan was in the range of 15.5 to 40cm^{-3} g^{-1}. Idris (1989) measured the intrinsic viscosity of samples obtained from *A.senegal* trees of different ages and concluded that it ranged from 7.2 to 14.2 cm^{-3} g^{-1} and that of stored samples to be 17.8 to 18.6 cm^{-3}g^{-1}. Anderson et al.(1991b) reported 16 cm^{-3}g^{-1} for Sudanese samples Jurasek et al.(1993) surveyed the analysis of 18 specimens of *A.senegal* and found their values range from 13.4 to 23cm^{-3}g^{-1}. For *A.seyal* Anderson and Weiping(1991c) reported the values of 12, 14,15,17,19and21cm^{-3}g^{1}intrinsic viscosity for samples from Niger, Uganda and Sudan. Hassan 2000 reported the range of 11-17cm^{-3}g^{-1}.The values of15.8cm^{-3}g^{-1}, was reported for *Acacia polyacantha* (Anderson,1978 and Karamalla,1965).

1.5.5 Specific optical rotation

The optical activity of organic molecules (saccharide and carbohydrates) is related to their structure and its characteristic property of the substance.

The gum is of natural Origen, e.g. *A. Senegal* gum has the property of rotating the polarized plane of light. The direction of the rotation, as well as the magnitude is regarded as a diagnostic parameter to establish that gum used to conform to current regulatory position. *Acacia Senegal* gum gives a negative optical rotation ranging between -27 to -34 the optical rotation is used to differentiate between A. *Senegal* gum and other botanically related *Acacia* gum.(Anderson and Stoddard, 1966) reported that the specific rotation for electrostatics *Acacia Senegal* gum as -31.5. Pure gum from *Acacia Senegal* has specific rotation of -27 to -30 certain variation in the degree of the optical rotation (-27 to -32) has been noticed by Anderson1968, karamalla 1998 found that the mean of the specific optical rotation of commercial *Senegal* gum was(-30.54). The optical rotation is not affected by both auto hydrolysis and variation, while mild acidic hydrolysis has a significant effect on optical rotation (Barron, 1991). Omer(2004) reported that the mean of the specific rotation of authenticated samples of A*cacia polyacantha* gum was(-16.6)(Elnour, 2007).

1.6 Chemical properties of gums

1.6.1 Moisture content

`The hardness of gum would be determined by moisture content. The moisture content of a good gum quality is in between 10 - 15% for granular and spray dried material respectively (FAO, 1999). The moisture content is weight lost due to the evaporation of water (Person, 1970). It shows the hardness of the gum and hence variability of densities, the amount of densities, and the amount of the air entrapped during formation. Omer (2004), reported that the moisture content of *Acacia polyacantha* gum to be around 8.2%.

1.6.2 Total ash content

Ash content is a measure of inorganic residue remaining after organic mater has been burnt. The inorganic residues exist as elements. Siddig (1996) explained that the type of the soil (clay or sand) affected the ash content significantly; the ash content for *Acacia polyacantha* gum was determined as 2.929 ash% (Anderson *et.al.*, 1985).

1.7 Acacia polyacantha

Kakamut gum is the dry exudate obtained from the stems and branches of *Acac a polyacantha* var. *campyl acanthi* (L.) Willdenow (fam.*Leguminosae*). It consists, mainly, of salts of an acidic arabino-galactan protein complex, which on hydrolysis yields galactose, arabinose, rhamnose, glucuronic acid and 4-O-methyl glucuronic acid

Botonical classification of *Acacia polyacantha* gum

Family *Leguminosae*

Subfamily *Mimosaceae*

Genus *Acacia*

Species *Polyacantha*

English name *Flacons claw Acacia*

Arabic name

Kakamut

Order

Fabales

Class *Magnoliopsida – Dicotyledons* (El Amin, 1977 and Voget, 1995)

1.8 Description

The tree, Figure(1.1) occasionally, reaches 20 m in height and the trunk can be 70 cm in diameter. A knobbly bark and paired thorns are it's most conspicuous features. The bark is yellowish with brown scale and thorn. Thorns occur in pairs and are sharply curved; they are brown with black tips. Leaves may reach 25 cm in length, biparipinnate with 10-40 pairs of pinnate and 35-60 of leaflets each. A prominent gland is present at the leave base. Flowers occur in pairs or 3 spicate racemes from the leaf axial and are cream colored and strongly scented. Fruits consist of pods up to 15 cm long, which each contain 5-9 seeds (Voget, 1995).

Flowering August – September; fruiting December – March.

1.9 Habitat

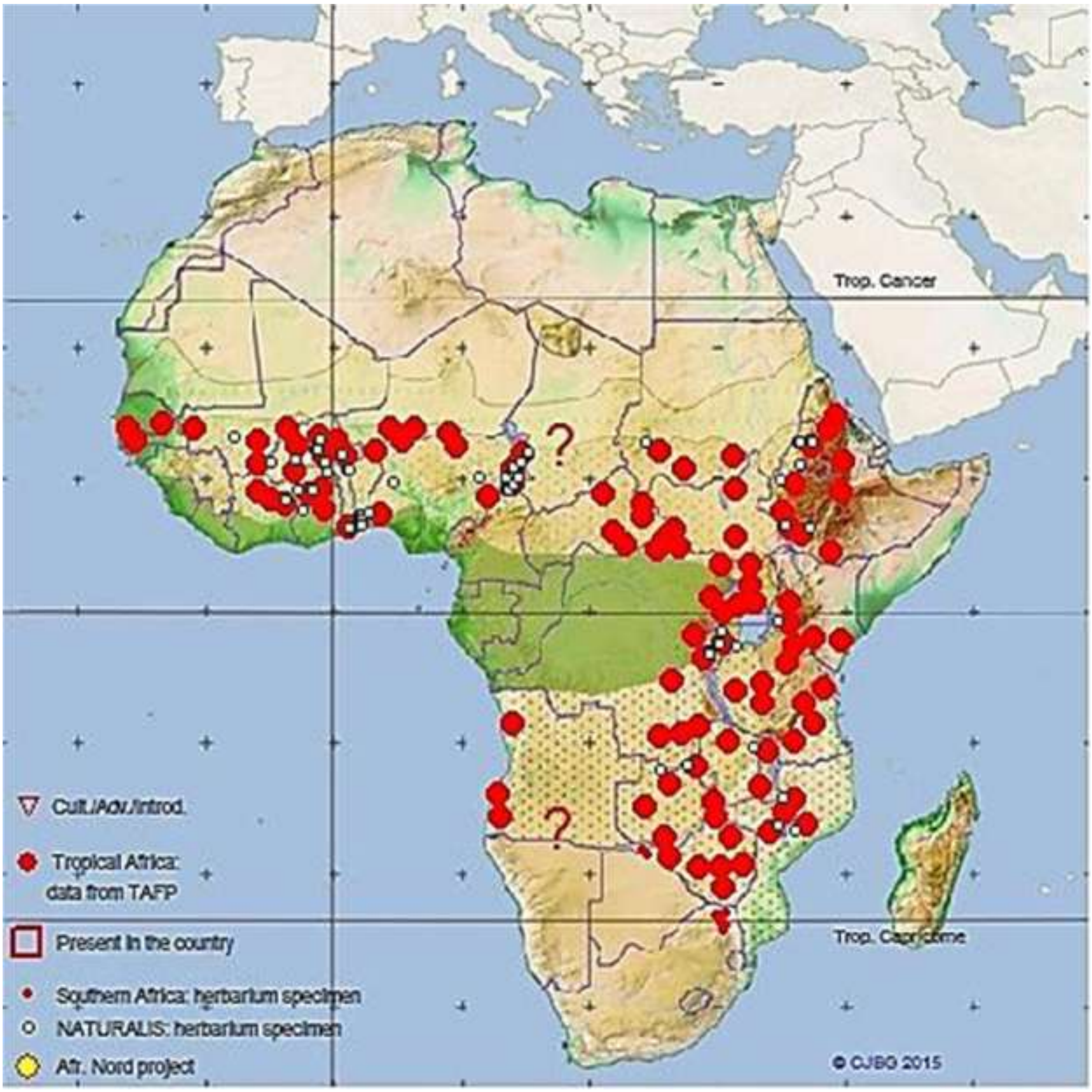
Deciduous woodlands, riverine and groundwater forests. Usually gregarious along rivers and in rich alluvial valleys (Elamin, 1973).

1.10 Distribution

Acacia polycantha (Kakamut) is widespread in the Tropical Africa from Gambia to Ethiopia in the north and the Transvaal in the south. Also in Uganda, Kenya, Tanganyika and with – wards to Ghana, Nigeria, Dahomy, Ivory Coast Togo Figure(1.2) (Elamin, 1973). In Sudan there are several regional locations, which usually occur along rivers and valleys where the water table is fairly high, and soils are good (Voget, 1995).

Figure (1.3): ***Acacia polyacantha*****tree**

((https://en.wikipedia.org/wiki/Senegalia_polyacantha))



Figure(1.4) Distribution of *Acacia polyacantha* tree in the African gum belt *http://www.ville-ge.ch/musinfo/bd/cjb/africa/details.php?langue=an&id=67253*

© 2012 Conservatoire etJardinbotaniques& South African National Biodiversity Institute

1.11 Uses

The woods is used mainly in fuel and charcoal of good quality, fence posts, farm implements, railway; sleeper, beams and rafters. The gum is edible and uses as adhesive in the treatment of textile fibers. The roots is said to act as a general health tonic as and antidote for snake bite, and cure for venereal diseases, preparation from the bark is used for general stomach disorders. (Omer,2004)

1.12 Trade

The export of *Acacia polyacantha* started actively in 2003 with around 200 metric Tons annually. Prices are always around 50% lower than that of *Acacia Senegal* var. *Senegal* gum. Potential production is more than 10 thousand metric Tons/ annum.

The objectives of this study

preparation of anti acid tablets from magnesium glucuronate.

Specific objectives

i. To authenticate the sample of Acacia *polayacantha* gum by studying the physicochemical properties.

ii. To prepare glucuronic acid from Acacia polyacantha gum using ion exchange technique.

iii. To prepare magnesium glucuronates from glucuronic acid .

iv. To compare the physicochemical properties of *Acacia polyacantha* gum and physicochemical properties of prepared glucuronic acid and magnesium glucuronates

Chapter two

Materials and Methods

Chapter two

Materials and Methods

2. Chemicals and Materials

Samples of *Acacia polyacantha* gum nodules were collected from Eldamazine area in Sudan.

-sulphuric (2M).

-Barium chloride.

-Magnesium bicarbonate.

-Amberlitecation exchange resin(IR-120H+).

-Distilled water.

-Starch.

-Suger.

- micro crystalline cellulose .

2.1 Apparatus and Instruments

-Beakers.

-Measuring cylinder.

-Mortar and pestle.

-Sensitive balance.

-Blender.

2.2 Pretreatment of gum sample

Gum nodules were dried at room temperature, and then hand cleaned by hand to insure freedom from sand, dust and bark impurities.

2.3 Preparation of uronic acid

Action exchange colnmn packed with Amberlite (IR-120H+)resin was thoroughly washed with 2.0 mol dm2 H_2SO_4 by distilled water until the column was sulphate free .Gum Arabic samples (27.98g in 500 ml) were slowly passed down the column.

2.4 Moisture content

10g of sample were weighed using halogen moisture analyzer,METTLERTOLEDO,Type HB43 then the device was measured moisture.

2.5 Total ash

Total ash was determined according to AOAC (1990). Crucibles were heated in an oven for 30 minutes cooled in a desiccator and then weighed (W1). About two grams of sample were placed in the crucible and accurately weighed (W2), then ignited at 550°C in a Heracus electronic muffle furnace for 6 hours, cooled in a desiccater and weighed (W3).

Total ash% was calculated as follows:

$$= \frac{w3 - w1}{w2 - w1} \times 100$$

Where:

W1: Weight of the empty crucible

W2: Weight of crucible +sample

W3: Weight of crucible +sample after drying

2.6 Specific optical rotation

1 g/100cm-3 aqueous solution of the gum was prepared, the solution was filtered to be highly pure. Optical rotation was measured using (1dm=10cm) tube filled

with the test solution, at room temperature specific optical rotation was calculated(Omer et al., 2015).

Specific rotation = $\alpha \times 100C \times L =\cdots...dm-1\ mL\ g-1$

Where:

α = observed optical rotation

C = concentration of the solution (g/ml)

L = length of the Polari meter tube(dm)

2.7 pH measurement

pH was determined in 25% aqueous solution using pH meter, HANNA Type H12210. Two standard buffer solutions of pH 4.00 and 7.00 were used for the calibration of the pH meter. The temperature was kept at 25°C and the pH was let to stabilize for one minute and then the pH of gum formulations were read directly.

2.8 Viscosity measurement

25% aqueoues solution was prepared and the viscosity was measured using DV-1 viscometer,BROOKFIELD, AMETEK.

2.9 Colour

Aqueoues solution(25%) was prepared and the colour was measured using lovi bondcolomete,TINTOMETER ,COLORMETER,MODEL F.

2.10 preparation of magnesium glucuronate

190g of magnesium bi-carbonate were weighed and then was added to 500 ml of glucuronic acid in 500 ml in beaker and then transferred in a petry dish and was dried for three days at room temperature and ground

$$4RCo2 + 2MgHCo3 \rightarrow 2R\ \frac{coo}{coo}{>}mg + H2o + Co2\uparrow$$

2.11 Preparation of formulation of anti acid tablet by direct method

Active substance magnesium glucuronate and excipients micro crystalline cellulose, starch binder, suger were weighted (0.55g,2.4g,1.6g,0.6), then sifiting through No.15 desh to reject all large particles. Excipient were added to active substance expect lubricant (Mg streate) and mixed by using amixer or blender for 15 minates. Mg streate(lubricant) was added weight(0.2g) and mixed for 5 minutes mixed powder were compressed into tablets by using tableting machine (ERWEKA) Germany.

2.12 Ion exchange

Ion exchangers are ion exchange resins(functionalized porous or gel polymer), zeolites, montmorillonite, clay, and soil humus. Ion exchangers are either cation exchangers that exchange positively charged ions(cations) or anion exchangers that exchange negatively charged ions(anions). There are also amphotric exchangers that are able to exchange both cations and anions simultaneously. Howerver, the simultaneous exchange of cations and anions can be more efficiently performed in mixed beeds that contain a mixture of anion and cation exchange resins, or passing the treated solution through several different ion exchange materials(Dorgner, 1992).

2.13 ICP (OES)

ICP, an abbreviation for Inductively Coupled Plasma, is one method of optical emission spectrometry. When plasma energy is given to an analysis sample from outside, the component elements (atoms) are excited. When the excited atoms return to low energy position, emission rays (spectrum rays) are released and the emission rays that correspond to the photon wavelength are measured. The element type is determined based on the position of the photon rays, and the content of each element is determined based on the rays' intensity.

Equipment for ICP optical emission spectrometry consists of a light source unit, a spectrophotometer, a detector and a data processing unit.

ICP optical emission spectrometry is now highly rated as a multipurpose analysis technique.

Chapter Three

Results and Discussion

Chapter Three

Results and Discussion

Table (3.1) Physiochemical properties of gum sample and magnesium glucurnate

Physiochemical properties	Moisture %	Ash %	PH	Specific rotation	Viscosity
Gum sample	11.94%	2.96%	4.2 %	-15^0	74.50mg/l
Magnesium glucurnate	12.90%	1.83%	2.4%	-6^0	14.75mg/l

Table(3.1) shows the moisture content of *A*cacia *polyacantha* gum was found (11.94%).(However, the mean value reported here were slightly higher than the mean value of (8.2%) indicated by Omer (2004). The value of ash content of commercial gum (2.9%) (Anderson *et al.*, 1983) found that the value of ash content of commercial gum arabic to be 4.4%. Later, (Anderson et al 1991) reported 3.6% Ash content for Sudanese formulations. FAO (1999) reported that the ash content of gum Arabic did not exceed more than 4%.

The mean pH value for sample(4.2) the gum solution is slightly acidic with pH 4.6, as reported by Omer (2004).

Aqueous solutions of sample was found to be optically active (laevorotatory). The specific rotation of sample was found(-15°).The mean value reported here were slightly lower than the mean value of (-16.6°) indicated by Omer (2004).

The viscosity was found (74.50ml/g).The mean value reported here was slightly higher than the mean value of (10.6ml/g) indicated by Omer (2004).

The pH value of the eluate was found to be 2.4 , it slightly acidic .

Table (3.2) Minerals content (mg/l) of gum sample and magnesium glucurnate :

Mineral	Na	Mg	Ca	V	Fe	Ni	Cu	As	AL	Pb
gum sample	877.24	3.05	33.98	1.62	1.91	1.82	0.44	4.37	4.68	4.27
Magnesium glucuronate.	5.28	13.01	60.26	1.65	1.49	1.75	0.51	3.96	1.54	3.81

Table (3.2) shows the cationic analysis study shows that calcium and magnesium has highest value followed by another cations.

Figure(3.1): Anti acid tablet

Conclusion

On the basis of results obtained, it could be concluded that

This work mainly involve the preparation of glucuronic acid and magnesium glucuronates from the *Acacia polyacantha*, From the obtained results the study succeeded in preparing them using ion exchange method.

The results showed that the changes in the physical properties of the sample gum and magnesium glucuronates such as pH , optical rotation and viscosity.

The results showed the similarities between the properties of gum studied and results from previous researches, which indicate that the gum under study is an authentic *Acacia polyacantha* gum.

The cationic analysis study shows that calcium and magnesium has high value, followed other cations.

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