

Approval Page

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أَلَمْ تَرَ أَنَّ اللَّهَ يَسْجُدُ لَهُ مَن فِي السَّمَوَاتِ وَمَن فِي الْأَرْضِ
وَالشَّمْسُ وَالْقَمَرُ وَالنُّجُومُ وَالْجِبَالُ وَالشَّجَرُ وَالدَّوَابُّ وَكَثِيرٌ
مِّنَ النَّاسِ ۗ وَكَثِيرٌ حَقَّ عَلَيْهِ الْعَذَابُ ۗ وَمَن يُهِنِ اللَّهُ فَمَا لَهُ
مِن مُّكْرِمٍ ۗ إِنَّ اللَّهَ يَفْعَلُ مَا يَشَاءُ

سورة الحج - آية رقم ١٨

Dedication

I dedicate this work, to my Parents, Wife, Children, Brother and Sisters

...

Acknowledgement

First of all praise to Allah, the Most Gracious, the Most Merciful for giving me the health and patience to complete this work.

My best regards go to Professor. *Mohammed El-Mubarak Osman*, my supervisor, for his encouragement and supervision over the course of this study, for his keenness to follow this study.

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ABSTRACT

Twenty nine samples of authentic *A.nilotica* var. *tomentosa* gum were collected from Sinnar and Blue Nile states of Sudan. Representative composite sample were prepared from all collected samples.

Physicochemical methods were undertaken to characterize the gum from Sinnar and Blue Nile states of Sudan. Results obtained for all parameters show insignificant differences within samples collected from different locations.

Mean values obtained for the studied properties were: moisture content 12.6%; and 11.95%; ash content 2.17%; and 1.94%; pH value 5.25; and 5.13; specific optical rotation +97.67; and +91.8, calorific value 4.04 $Kcal\ mol^{-1}$; and 4.03 $Kcal\ mol^{-1}$, intrinsic viscosity 10.16 $cm^3\ g^{-1}$; and 11.47 $cm^3\ g^{-1}$, nitrogen content 0.08%; and 0.05%, protein content 0.51%; and 0.28%, acid equivalent weight 2182.87; and 2187.73, total uronic acid 8.90% ;and 8.88%, respectively. The relationship between tannin content and Colour Gardner were also studied for all samples. Studied cationic composition showed that calcium has the highest value among the studied cations, followed by potassium, iron and strontium.

Rheological study of *A.nilotica* var. *tomentosa* gum showed identical behaviour compared to *A.nilotica* var. *nilotica* gum, The flow behaviour is shear thinning under low shear rate and behaves as a Newtonian fluid at high shear rate and high concentrations. The results of oscillatory test of gum solutions revealed a typical liquid-like behaviour.

Molecular weight distribution was determined using gel permeation chromatography. The chromatogram showed three main components designated as arabinogalactan protein (AGP), arabinogalactan (AG) and glycoprotein (GP). Average molecular weight of the samples was estimated from light scattering measurement using GPC-MALLS technique. The values of M_w , was found to be 5.3×10^6 Da. for each. The radius of gyration was found to has an average of 43.5 nm.

Emulsification studies of *A.nilotica* var. *tomentosa* gum showed that the gum has the same emulsifying stability compared to *A.nilotica* var. *nilotica*, and has a very good emulsifying stability compared to *A. senegal* var. *senegal*

المستخلص

جمعت تسعة وعشرون عينة من صمغ السنط (أكيشيا نابلوتيكا صنف تمتوزا) من ولايتي سنار والنيل الازرق في السودان. أُخذت عينة ممثلة مكونة من جميع العينات التي جُمعت من أماكن مختلفة داخل كل ولاية. تم توصيف و تقييم صمغ السنط (أكيشيا نابلوتيكا صنف تمتوزا) باستخدام الطرق الفيزيوكيميائية.

أظهرت النتائج المُتحصل عليها للمعايير المدروسة اختلافات ضئيلة بين العينات التي تم جمعها من ولايتي سنار والنيل الازرق. متوسط القيم المُتحصل عليها للخصائص التي تم دراستها باستخدام العينة الممثلة هي كالآتي: محتوى الرطوبة %12.6 و 11.95% محتوى الرماد %2.17 و 1.94% ، قيمة الأس الهيدروجيني 5.25 و 5.13، الدوران الضوئي النوعي +97.67 و +91.8، السرعات الحرارية 4.04 ك/كال / مول و 4.03 ك/كال / مول، الزوجة الضمنية 10.16 سم³ سم³ ، 11.47 سم³ ، محتوى النيتروجين 0.05% ، 0.08% ، محتوى البروتين 0.51% ، 0.28% ، الوزن المكافئ الحمضي 2182.87 ، 2187.73 ، حمض اليورونيك الكلي 8.90% ، 8.88% على التوالي. محتوى التانين لجمع العينات يتناسب طرديا مع حدة اللون. أظهرت دراسة الأيونات الموجبة للفلزات ان الكالسيوم لديه أعلى قيمة بين الأيونات الموجبة التي دُرست يليه البوتاسيوم، الحديد، الاسترانسيوم على الترتيب.

أظهرت الدراسة الريولوجية لصمغ السنط (أكيشيا نابلوتيكا صنف تمتوزا) أن سلوك الانسياب له قص استراقي تحت تأثير معدل القص المنخفض ويسلك سلوك الموائع النيوتونية تحت تأثير معدل القص المرتفع و التراكيز المرتفعة. كشفت نتائج الاختبار التذبذبي لمحايل الصمغ ان سلوكه يطابق سلوك السوائل النيوتونية.

تم قياس توزيع الوزن الجزيئي عن طريق تجزئة الصمغ باستخدام نظام نفاذية الهلام المدمج. أظهر الكروماتوغرام ثلاثة مكونات رئيسية، اراينوجلاكتان بروتين، اراينوجلاكتان و جلايكوبروتين. تم حساب الوزن الجزيئي من نتائج قياسات التشتت الضوئي باستخدام تقنية نفاذية الهلام المدمج-تشتت ضوء الليزر متعدد الزوايا. وقد وُجدت قيمة الوزن الجزيئي 5.3×10^6 دالتون لكلا الولايتين. نصف قطر التدويم وُجد في المتوسط 43.5 نانومتر.

تمت تجزئة الصمغ باستخدام كروماتوغرافيا التفاعل الهيدروفوبي. تم الحصول على جزئين، جزء هيدروفيلي (جزء 1) يحتوي على الاراينوجلاكتان كمكون رئيسي وهذا مشابه للصمغ قبل التجزئة و جزءاً هيدروفوبياً (جزء 2) و هو بالأساس جلايكوبروتين.

أظهرت دراسة الاستحلاب لصمغ السنط (أكيشيا نابلوتيكا صنف تمتوزا) ثباتية استحلابية ممتازة وقرية جدا من أكيشيا نابلوتيكا صنف نابلوتيكا وفضل من صمغ السنغال على الرغم من أن مستحلبات صمغ السنط تمتلك قطرات أكبر حجماً مقارنة بمستحلبات صمغ السنغال.

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List of Abbreviation

Abbreviation	Name
FRP	Forest Research Programmed
ODA	Overseas Development Administration
LSP	limestone powder
FA	Fly ash
VAM	Vesicular Arbuscular Mycorrhizae
JECFA	Joint Expert Committee for Food Additives
FAO	Food Additives Organization
HIC	hydrophobic interaction chromatography
SEC	Size Exclusion Chromatography
AGP	Arabinogalactan-protein
GP	Glycoprotein
AG	Arabinogalactan
AUC-SV	Sedimentation velocity in the analytical Ultracentrifuge
MALS	Multi Angle Light Scattering
MNP	Magnetic iron oxide nano-particles
TEM	Transmission Electron Microscopy
DLS	Dynamic Light Scattering
QELS	Quasi- Elastic Light Scattering
DRI	Differential Refractive Index
SDS	Sodium Dodecyl Sulfate
PSD	Particle Size Distribution
EC	Emulsifying Capacity
ESI	Emulsion Stability Index
VDM	Volume Median Diameter
PP	Parallel Plate
CP	Cone-Plate
RGD	Rayleigh-Gans-Debye
RMS	Root Mean Square

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