SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY COLLEGE OF GRADUATE STUDIES

Characterization and Thermodynamic Studies of *Acacia Nilotica* Gum of Sudanese Origin

دراســة توصيــفيــة ثــيرموديــناميكــية لصمــغ السنـــط مــن أصــل ســــوداني

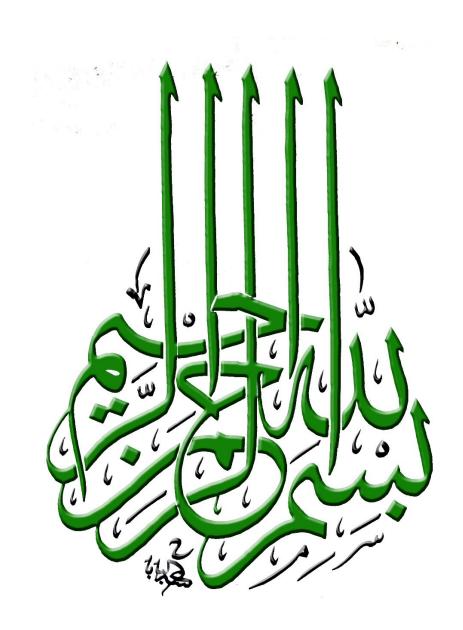
A thesis Submitted in Partial Requirement of the Degree of Master of Science (Chemistry)

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يقول جل وعلا شأنه في محكم تنزيله



ا وَظَلَّلْنَا عَلَيْكُمُ الْغَمَامَ وَأَنزَلْنَا عَلَيْكُمُ الْمَنَّ وَالسَّلْوَى كُلُواْ مِن طَيِّبَاتِ مَا رَزَقْنَاكُمْ وَمَا ظَلَمُونَا وَلَـكِن كَانُواْ أَنفُسَهُمْ يَظْلِمُونَ اللَّ



قرآن كريم ،الجزء الأول سورة البقرة ، الآية (57)

DEDICATION

To My Parents ,,,,,

To My Family ,,,,,

To My Friends ,,,,,

ACKNOWLEGEMENT

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

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ABSTRACT

A number of physicochemical properties (moisture, ash, pH, nitrogen and protein content, specific rotation, intrinsic viscosity) and total sugars content were used to characterize *Acacia nilotica* gum of Sudanese origin.

The general characteristic of *A. nilotica* gum and the mean values of all properties studied are as follows: moisture content 9.3%, ash content 1.7 %, nitrogen 0.1%, protein 0.6 %, specific rotation +107, intrinsic viscosity 8.117cm³g⁻¹ and pH 5.05. Cationic composition of gum samples was also determined and results show that calcium has the highest value followed by magnesium, sodium, potassium, iron and zinc.

Sugar composition was estimated using HPLC technique where galactose and arabinose content were found to be 15.5% and 81.9% respectively.

Molecular weight of *A. nilotica* gum was determined using osmometric technique and was found to be 2.3*10⁶ Dalton.

Thermodynamic parameters including the density, the partial specific volume of *A. nilotica* gum and solvent (water) and the volume fraction were estimated and found to be 2.32 gcm⁻³ and 0.99 gcm⁻³, 0.0003cm³g and 0.0005 cm⁻³g, 0.625 and 0.375 respectively. Chemical potential range have been calculated from osmotic pressure measurement for

different concentration of gum solutions and was found to be $1.16~erg~g^{-1}$. Second virial coefficient and free energy of mixing were found to be $0.64cm^2.mole/g^2$ and $1.78~erg~g^{-1}$ respectively.

الخــلاصـــــة

لقد تم توصيف صمغ السنط (اكشيا نيلوتيكا) باستخدام العديد من الطرق الفيزوكيميائية (نسبة الرطوبة والرماد والنتروجين والبروتين، الدوران الضوئى، اللزوجة الضمنية، المعادن الرئيسية وتم تقدير السكريات.

الصفات العامة لصمغ السنط وجدت كالآتي (الرطوبة 9.3 %، الرماد 107 %، النتروجين 0.1 ، البروتين 0.6 %، الدوران الضوئى النوعي $0.1\,$ الأس الهيدروجيني 5.05، اللزوجة الضمنية $0.1\,$ $0.1\,$

المعادن الرئيسية بالترتيب كانت كالآتي الكالسيوم> المغنسيوم> الصوديوم> البوتاسيوم> الحديد> الزنك.

تم تقدير محتوى السكريات باستخدام تقنية HPLC وأظهرت النتائج أن محتوى سكر الجلاكتوز يبلغ 15.5%.

تم قياس الوزن الجزيئي (M_n) للصمغ باستخدام تقنية الضغط الاسموزى ووجد أنه يساوى 2.3^{*0} دالتون.

تم إجراء دراسة ثرموديناميكية شملت حساب الكثافة، الحجم النوعي الجزيئي، والكسر الحجمى للصمغ والمذيب التي وجدت كالآتي 0.3253 و 0.0003 و 0.375 و 0.0003 و 0.0003 و 0.0003 بالترتيب.

تم إيجاد الجهد الكيميائى من قياسات الضغط الاسموزى لتراكيز مختلفة للمحاليل المائية للصمغ وقد وجد أنه g^{-1} 1.16 erg معامل معدل طاقة الحركة الثاني وجد أنه يبلغ cm^2 .mole/ g^2 0.64 وطاقة جبس الحرة $ergg^{-1}$ 1.78.

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