

إستهلال

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(اللَّهُ لَا إِلَهَ إِلَّا هُوَ الْحَيُّ الْقَيُّومُ لَا تَأْخُذُهُ سِنَّةٌ وَلَا نَوْمٌ لَهُ مَا فِي السَّمَاوَاتِ وَمَا فِي الْأَرْضِ مَنْ ذَا الَّذِي يَشْفَعُ عِنْدَهُ إِلَّا بِإِذْنِهِ يَعْلَمُ مَا بَيْنَ أَيْدِيهِمْ وَمَا خَلْفَهُمْ وَلَا يُحِيطُونَ بِشَيْءٍ مِّنْ عِلْمِهِ إِلَّا بِمَا شَاءَ وَسِعَ كُرْسِيُّهُ السَّمَاوَاتِ وَالْأَرْضَ وَلَا يَئُودُهُ حِفْظُهُمَا وَهُوَ الْعَلِيُّ الْعَظِيمُ)

سورة البقرة (٢٥٥)

صدق الله العظيم

Dedication

I dedicate this work to my:

parents,

husband,

daughter

brothers and sisters

Acknowledgment

Praise to Allah Almighty for giving me health and desire to successfully complete this work.

I cannot express enough thanks to my supervisor, Professor. Mohammed Elmubark Osman, not only for offering me the opportunity to work with him but also for his endless patience, support and guidance. It has been an honor and a privilege to work with him, and above all I am deeply indebted to him for his kind character. I hope that one day I will become as good an advisor to my students as Professor. Mohammed Elmubark has been to me.

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Publications from this Thesis

1- Hiam, M. M., Elfatah, A. H. and Mohammed, E. O. (2018). Effect of diesel-biodiesel and diesel-biodiesel-ethanol blends on physicochemical properties and gases emission of Baobab biodiesel. *International Journal of Multidisciplinary Research and Development*, **5**(10): 9-13.

2- Hiam, M. M., Elfatah, A. H. and Mohammed, E. O. (2018). Chemical composition of Baobab (*Adansonia digitata* L.) seed and physicochemical properties of it is oil. *International Journal of Multidisciplinary Research and Development*, **5**(8): 33-35.

Abstract

The seeds from *Adansonia digitata* (Baobab) were subjected to standard chemical analysis to evaluate their properties. The physicochemically properties of Hexane extracted oil and its biodiesel were also characterized. Proximate analysis of the seeds show moisture content ($3.5 \pm 0.1\%$), ash content ($4.49 \pm 0.05\%$), crude lipids ($14.3 \pm 0.05\%$), crude fiber ($20.42 \pm 0.04\%$), crude protein ($12.97 \pm 0.015\%$), carbohydrate ($44.32 \pm 0.25\%$) and total energy (363.024 ± 0.51 K Cal/100g). Mineral compositions was K (90.29ppm), Ca (9.61ppm), P (7.00ppm), Zn (0.268ppm), and Fe (0.227ppm).

The yield of oil extract was 21.5%. Results of Physicochemical analysis of oil show free fatty acid content (3.8%), Acid value (1.7 mg KOH/g), Iodine value (54 mg/g), Peroxide value (7.6 mEq/kg), Saponification value (275.05 mg KOH/g), Density at 15C (0.9154 g/cm^3), Specific gravity (0.9163%), Kinematic viscosity at 40C (33.69 cSt), Calorific value (43.797 MJ/kg), Cloud point (9C) and Pour point (-3C). After the crude oil extract was transesterified, Biodiesel produced from the baobab (*Adansonia digitata*) seed oil blended with conventional diesel and ethanol in different ratio as: B20 (biodiesel 20%, diesel 80%), B20E20 (Biodiesel 20%, ethanol 20%, diesel 60%) and B20E30 (Biodiesel 20%, ethanol 30%, diesel 50%). Physicochemical properties of biodiesel, B20, B20E20 and B20E30 revealed the following results; density at 15C (0.8866, 0.8519, 0.8403, 0.8864 g/cm^3), kinematic viscosity at 40C (5.8, 3.6, 3.4, 2.7 cSt), calorific value (44.051, 44.354, 44.456, 44.5 MJ kg^{-1}), cloud point (7, 12, 8, 8C) and pour point (-6, -6, -8, -12C), the flash point of biodiesel and B20 was (80, 76.0C) respectively. Gases emission CO_2 , NO_2 and NO_x of baobab biodiesel and blends was tested and compared with diesel, engine was set at a different speeds 1000, 1500 and 2000 rpm. The blend B20 showed the lowest gases emission.

المستخلص

خضعت بذور التبلى (ادونسونيا ديقيتاتا) لتحليل كيميائي معياري لتقييم خواصها، الخصائص الفيزيائية الكيميائية للزيت المستخلص بواسطة الهكسين المستخرج ووقود الديزل الحيوي.

أظهر التحليل التقريبي للبذور محتوى الرطوبة ($3.5 \pm 0.1\%$)، محتوى الرماد ($4.49 \pm 0.05\%$)، الدهون الخام ($14.3 \pm 0.05\%$)، الألياف الخام ($20.4 \pm 0.04\%$)، البروتين الخام ($12.97 \pm 0.01\%$)، الكربوهيدرات ($44.32 \pm 0.25\%$) والطاقة الكلية (363.024 ± 0.51 كيلو سعر \100جم) على التوالي. التركيبات المعدنية كانت في تظهر البوتاسيوم (90.29 جزء من المليون)، الكالسيوم (9.61 جزء من المليون)، الفوسفور (7.00 جزء من المليون)، الزنك (0.268 جزء من المليون)، والحديد (0.227 جزء من المليون). كان العائد من استخراج الزيت 21.5%. أظهرت نتائج التحليل الفيزيائي الكيميائي للزيت محتوى الأحماض الدهنية الحرة (3.8%)، قيمة الحمض (1.7 مجم هيدروكسيد البوتاسيوم/جم)، قيمة اليود (54 مجم / جم)، قيمة بيروكسيد (7.6 مللى مكافئ/كجم)، قيمة التصبين (275.05 مجم هيدروكسيد البوتاسيوم/جم)، الكثافة عند 15 درجة مئوية (0.9154 جم / سم³)، الثقل النوعي (0.9163%)، اللزوجة الحركية عند 40 درجة مئوية (33.69 درجة مئوية)، القيمة الحرارية (43.797 ميغا جول / كجم)، النقطة الغائمة (9 درجة مئوية) ونقطة الانسكاب (-3 درجة مئوية). تم إنتاج الوقود الحيوي من الزيت المستخلص وتم مزج الوقود الحيوي المنتج من زيت بذور التبلى (ادونسونيا ديقيتاتا) مع الإيثانول و الديزل بنسب مختلفة مثل: B20 (وقود الديزل الحيوي 20%)، ووقود الديزل (80%)، B20E20 (وقود الديزل الحيوي 20%)، والإيثانول (20%)، والديزل (60%)، و B20E30 (وقود الديزل الحيوي 20%)، والإيثانول (30%)، والديزل (50%). بعد تحويل مستخلص الزيت الخام، كشفت الخصائص الفيزيائية الكيميائية لوقود الديزل الحيوي، B20، B20E20 و B20E30 النتائج التالية؛ الكثافة عند 15 درجة مئوية (0.8519، 0.8866)، 0.8403، 0.8864 جم / سم³)، اللزوجة الحركية في 40 درجة مئوية (5.8، 3.6، 3.4، 2.7 سنتى ستوك)، القيمة الحرارية (44.051، 44.354، 44.456، 44.5 ميغا جول/كجم)، نقطة السحاب (7)، 12، 8، 8 درجة مئوية) ونقطة صب (-6، -6، -8، -12 درجة مئوية)، كانت نقطة الوميض من وقود الديزل الحيوي و B20 (80، 76.0 درجة مئوية). تم اختبار انبعاث غاز ثاني أكسيد الكربون و أكسيد النيتروجين من وقود الديزل الحيوي ومخاليطه ومقارنتها مع الديزل، تم ضبط المحرك بسرعات مختلفة 1000 و 1500 و 2000 دورة في الدقيقة. أظهر خليط B20 أقل انبعاث للغازات.

List of Abbreviation

PV	Photovoltaic
GHG	Greenhouse gas
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
EU	European Union
FAEE	Fatty acid ethyl ester
FAME	Fatty acid methyl ester
IPCC	Intergovernmental Panel on Climate Change
LTFT	Low temperature flow test
CFPP	Cold filter plugging point
GC	Gas chromatography
TLC	Thin layer chromatography
HPLC	High performance liquid chromatography
VPC	Vapor-phase chromatography
GLPC	Gas-liquid partition chromatography
AAS	Atomic absorption spectroscopy
CSIRO	Commonwealth Scientific and Industrial Research Organization
HCL	Hollow cathode lamps
MAPTMRI	Medicinal and Aromatic Plant and Traditional Medicine Research Institute
ATR	Attenuated total reflectance
FTIR	Fourier transform infrared spectroscopy
ASTM	American Standard for Testing and Materials
EN	European Standard
AOAC	Association of Official Analytical Chemists
FFA	Free Fatty Acid
CP	Cloud Point
PP	Pour Point
TGA	Thermal gravimetric analysis

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