DECLARATION

I hereby declare that this submission is my own work towards the MSc. and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of university, except where due acknowledgment has been made in the text.

RICHARD OWUSU (PG2849008)	……	……..
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Certified by:

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(Supervisor's Name)	Signature	Date

Certified by:

Dr. J.A.M. Awudza	……	……
(Head of Dept.)	Signature	Date

DEDICATION

This work is dedicated to my mother, Mrs. Dora Apraku and all mothers who are toiling to make their children's dreams come into reality, with love and admiration

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ABSTRACT

The use of biodiesel has grown dramatically during the last few years and is becoming a key component in the motor diesel pool because of its attractive features. In the present thesis, a comparison is made of catalysts (homogeneous basic - sodium hydroxide, potassium hydroxide; homogeneous acidic catalyst – sulphuric acid and heterogeneous catalyst – calcium oxide, magnesium oxide and zeolite) for methanolysis of indigenous *Jatropha curcas* seed oil. The variables studied were temperature, the types and the catalyst concentration by weight of jatropha curcas seed oil, the reaction time and the methanol: vegetable oil molar ratio, while the response was biodiesel yield. In addition, the *Jatropha curcas* seed oil as well as the biodiesels produced were evaluated for quality characteristics. These were conducted using standard analytical methods. The physicochemical properties recorded for the *Jatropha curcas* seed oil were: saponification value 195.3mg/g, iodine value 104.13mg/g, acid value 3.86mgKOH/g, density 918kg/m^3 @ 28^{o}C, kinematic viscosity 42.6mm^2/s, refractive index 1.465 and % free fatty acids 1.92%. Nearly 80% yields were obtained for the basic homogeneous base catalyst – NaOH, KOH and NaOH/KOH mixture (78%) when the reaction was conducted at 60^{o}C, 6:1 methanol-oil molar ratio and 2%w/w catalyst concentration for 30minutes. The maximum biodiesel yield of nearly 30% were achieved for the heterogeneous catalyst – CaO, MgO and zeolite at 60^{o}C, 25: 1 methanol-oil molar ratio and 0.5%w/w catalyst concentration for 48hrs. The homogeneous acidic catalyst produced a 25.2% biodiesel yield at 60^{o}C, 35:1 methanol-oil molar ratio and 1% w/w catalyst concentration for 48hrs. The fuel properties of the biodiesel produced from the indigenous *Jatropha curcas* seed oil were density 881.4 - 886kg/m^3, total sulphur 0.02-0.05ppm, kinematic viscosity 4.2 - 6.5mm^2/s, pour point -3 to 2^{o}C, carbon residue 0.11 - 0.0.2%wt, total acid 0.14 - 0.37mmKOH/g, total ash 0.001 - 0.023%wt, cetane index 54.55 - 56.30, basic water and sediment 0.10%vol and sodium metal content 0.78 – 6.33ppm. From the results it was found that the biodiesel fuel produced, whether by homogeneous basic catalyst or homogeneous acid catalyst, was within the recommended standards of biodiesel fuel except for the kinematic viscosity of 6.5mm^2/s, density of 886kg/m^3 and sodium metal content of 6.33ppm which deviated marginally from the ASTM recommended limits.

ACRONYMS/ABBREVIATIONS

AOAC	American Oil Chemists' Society
ASTM	American Society for Testing Materials
Ave.	Average
CaO	Calcium Oxide
CJP	Centre of Jatropha Promotion
CO	Carbon Monoxide
CO_2	Carbon Dioxide
FAME	Fatty Acid Methyl Ester
FFA	Free Fatty Acid
GDP	Gross Domestic Production
H_2SO_4	Tetraoxosulphate (VI) acid
HC	Hydrocarbon
HCl	Hydrochloric acid
IEA	International Energy Agency
KITE	Kumasi Institute of Technology and Environment
KOH	Potassium Hydroxide
ME	Methyl Ester
MeOH	Methanol
Meth	Methanol
MgO	Magnesium Oxide
N	Normality
NaOH	Sodium Hydroxide
NOx	Nitrogen Oxides
PM	Particulate Matter

RME	Rapeseed oil Methyl Ester
ROH	Alcohol
SO_2	Sulphur Dioxide
TG	Triglyceride
toe	tone of oil equivalent
W	Weight
$	America Dollar
%Y	% Yield

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