

**An Experimental Study on High FFA Kusum (Schleichera
Oleosa) Oil Biodiesel Production and its Performance Testing**

Major Dissertation submitted

in partial fulfillment of the requirements for the award of the degree of

Master of Technology

In
Thermal Engineering

By

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Roll No. 2K11/THE/25

Session 2011-14



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STUDENT'S DECLARATION

I hereby declare that the major dissertation entitled “**An Experimental Study on High FFA Kusum (Schleichera Oleosa) Oil Biodiesel Production and its Performance Testing**”, submitted to the Department of Mechanical Engineering, Delhi Technological University, Delhi, in partial fulfillment of the requirements for the award of the degree of Master of Technology in Mechanical Engineering (Thermal Engineering), is an authentic record of my own work, under the supervision of Dr. Amit Pal, Associate Professor, Mechanical Engineering Department, Delhi Technological University, Delhi.

It is also declared that I have not submitted the matter embodied in this major dissertation as whole or in part, to any other Institute / University for the award of any degree.

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CERTIFICATE

This is to certify that the major dissertation entitled “**An Experimental Study on High FFA Kusum (Schleichera Oleosa) Oil Biodiesel Production and its Performance Testing**”, submitted by Mr. Naveen Kumar Garg, bearing roll no. 2K11 / THE /25 in partial fulfillment of the requirement for the award of the Degree of Master of Technology in Thermal Engineering, during session 2011-2014 to the department of Mechanical Engineering, Delhi Technological University, Delhi, is an authentic work carried out by him under my guidance and supervision.

To the best of my knowledge, the matter embodied in this major dissertation has not been submitted to any other Institute / University for the award of any degree.

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ABSTRACT

Diesel is being used as a main fuel in the field of transportation and power generation in industries, agriculture etc. throughout the world. It is one of the highest consumable among petroleum products in India. In India almost 70% to 80% of the crude oil is being imported from different countries. It is expected that the remaining 20% of crude oil available in India will cease to exist within 30 to 40 years. Thus, there is an urgent need to expand the supply of alternative fuels, including bio-diesel to reduce the dependency on imported oil. Biodiesel is produced from vegetable oil (edible & non edible) and animal fats. The methylester of vegetable oil, known as biodiesel are becoming increasingly popular because of their low environmental impact and its potential as a green alternative fuel. They would not require any significant modification of existing diesel engine design. At present, biodiesel is commercially produced from the seeds of nonedible vegetables such as Thumba, Jatropa, Karanja etc.. The biodiesel is produced by esterification process either by adding acidic or alkaline or both (acidic & alkaline) catalysts.

The kusum seed oil is a nonedible feed stock, with high FFA content. In present experimental study biodiesel is produced from kusum seed oil, using two step esterification process which involves addition of acidic and alkaline catalysts. Further the present work investigates the performance of kusum biodiesel blends with petrodiesel in a four stroke, four cylinder, compression ignition (CI) engine.

The biodiesel blends showed higher brake specific fuel consumption, lower brake thermal efficiency and slightly lower brake power. Using kusum biodiesel blends with diesel or other conventional fossil fuels, reduces exhaust emissions such as carbon dioxide (CO₂), particulate matter (PM), carbon monoxide (CO), sulphur oxides (SO_x), and unburnt hydrocarbons (UHC).

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LIST OF ABBREVIATIONS

S.No.	Abbreviations	Description
1.	\$	US Dollars
2.	%	Percent
3.	°C	Degree Celcius/ degree centigrade
4.	ASTM	American Society for Testing of Materials
5.	bbl	Barrels
6.	BIS	Bureau of Indian Standards
7.	BSEC	Brake Specific Energy Consumption
8.	Bsfc	Brake Specific Fuel Consumption
9.	CAGR	Compound Annual Growth Rate
10.	CI	Compression Ignition
11.	CN	Cetane number
12.	CO	Carbon Monoxide
13.	CO ₂	Carbon Di-oxide
14.	CSTR	Continuous Stirred-Tank Reactors
15.	CY	Calendar Year
16.	DEE	Diethyl ether
17.	DI	Direct Injection
18.	EN	European Nations
19.	FFA	Free Fatty Acid
20.	g/gm	Grams
21.	g/kWh	Gram per kilo Watt hour
22.	H ₂ SO ₄	Sulphuric Acid
23.	HC	Hydro carbon
24.	HSD	High Speed Diesel
25.	IV	Iodine Value
26.	JBD	Jatropha Bio Diesel
27.	KBD	Karanja Bio Diesel
28.	KOH	Potassium Hydroxide
29.	KOME	Kusum Oil Methyl Ester
30.	kW	Kilowatt

31.	LPG	Liquefied Petroleum Gas
32.	MJ/kWh	Mega Joule per kilo Watt hour
33.	MMT	Million Metric Tonnes
34.	MT	Metric Tonnes
35.	NaOH	Sodium Hydroxide
36.	NO _x	Oxides of Nitrogen
37.	PM	Particulate Matter
38.	ppm	Parts per million
39.	RPM	Revolutions per Minutes
40.	SO _x	Oxides of Sulphur
41.	TBOs	Tree-Borne Oilseeds
42.	TDC	Top Dead Centre
43.	TMT	Trillion Metric Tonnes
44.	UHC	Unburnt Hydrocarbons
45.	Vol	Volume
46.	wt%	Weight Percent