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# **Performance of Diesel Engine Using Jatropha and Karanja Biodiesel**

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**Abstract**— Biodiesel is an alternative fuel of diesel, is described as fatty acid methyl ester from vegetable oils or animal fats. The main objectives of the present work is to reduce higher viscosity of Pongamia Pinnata (Karanja), Jatropha curcas(Jatropha) oil using Esterification followed by Transesterification and to assess the performance and emission characteristics of diesel engine. Engine parameters such as brake specific fuel consumption, brake thermal efficiency were calculated .Performance tests were conducted on a multi cylinder diesel engine. From the test results it has been established that blends of Jatropha and Karanja on preheating gives same or better results as that Diesel on same engine.

**Keywords**— Jatropha ,Karanja ,Transesterification ,Diesel Engine.

## **I. INTRODUCTION**

The constant increase in the rate of consumption of the fossil fuels, consequent upon the ever increasing population and the urbanization in the present day world, has made the depletion of these conventional fuel resources in the near future a quite inevitable fact. Also, the Greenhouse Gas emissions from these fossil fuels are constantly degrading the planet and causing global warming and other pollutant emission related problem. As such, the situation demands for an alternate source of energy that can be used to overcome the forecasted future energy crisis. Unlike rest of the world, India's demand for diesel fuels is roughly six times that of gasoline hence seeking alternative to mineral diesel is a natural choice. Biodiesel production is undergoing rapid technological reforms in industries and academia. This has become more obvious and relevant since the recent increase in the petroleum prices and the growing awareness relating to the environmental consequences of the fuel over dependency.

In recent years several researches have been made to use vegetable oil, animal fats as a source of Renewable energy known as bio diesel that can be used as fuel in CI engines. Vegetable oils are Alternative fuels for CI engines as they are renewable, biodegradable, non toxic, lower emission compared to diesel fuel. Even though "diesel" is part of its name there is no petroleum in bio-diesel. It is 100% vegetable oil based, that can be blended at any level with petroleum diesel to create a bio diesel blend.

## **II. PROBLEMS WITH BIODIESEL**

Major problems encountered with vegetable oil as bio diesel used in CI engine are its low volatility and high viscosity due to long chain structure. The common problems faced are excessive pumping power, improper combustion and poor atomization of fuel particles. The conversion of the vegetable oil as a CI engine fuel can be done by Transesterification

### **A. Transesterification process**

Transesterification is a chemical process where an ester is reacted with an alcohol to form another ester and another alcohol. For the creation of biodiesel, triglyceride oils (esters) are reacted with methanol (alcohol) to produce biodiesel (fatty acid alkyl esters) and glycerin (alcohol). The triglyceride contains three separate ester functional groups and can react with three molecules of methanol to form three methyl esters (fatty esters) and glycerol (glyceride). The catalyst for this reaction is sodium hydroxide or another strong base such as potassium hydroxide. These hydroxides cause the methanol to dissociate and produce the methoxide ion, which is the actual catalytic agent that drives the reaction forward to create biodiesel.

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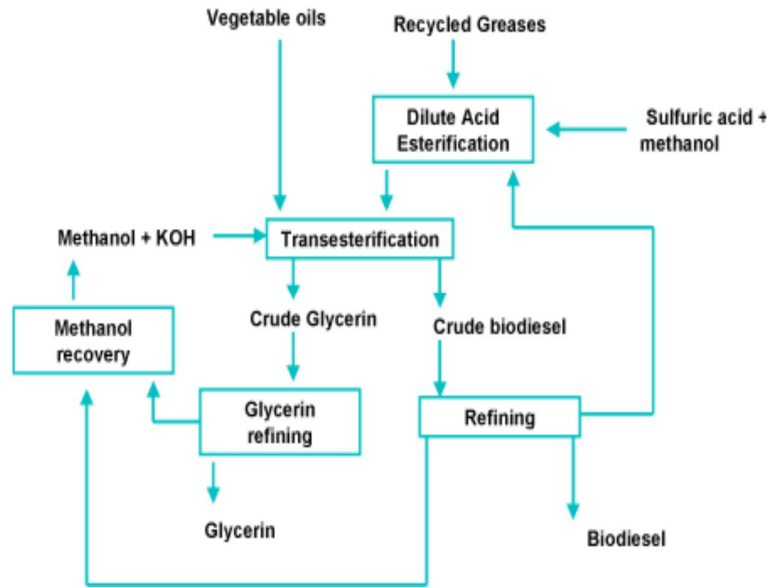


Fig. No.1. Process Flowchart for biodiesel Production

### B. Preparation of Blends of Biodiesel

At present the amount of biodiesel available is less than that of diesel. The biodiesel blended with diesel by volume as B10 (10% karanja biodiesel & 90% diesel fuel), B20 (20% karanja biodiesel & 80% diesel fuel), B30 (30% karanja biodiesel & 70% diesel fuel), B40 (40% karanja biodiesel & 60% diesel fuel), B50 (50% karanja biodiesel & 50% diesel fuel), B100 (100% karanja biodiesel & 00% diesel fuel).



Fig. No.2. Blends of Biodiesel

### III. EXPERIMENTAL SETUP

Study of Engine Performance has been an important process since the evolution of the engines. In the very early stages, only the external performance was studied with help of loading with a Dynamometer and measuring the parameters like Torque, Output power, Specific Fuel Consumption. For this, in the earlier research, Mechanical Spring and piston type recorders were used. Computerized IC engine Test Rigs with an intent not only to give the students how the testing is done and data is acquired, but to give them a more clear idea about the real time combustion by developing the combustion analysis system. Along with that, one can get all other data like Heat Balance Sheet, Thermal efficiencies, BSFC, Mechanical Efficiency, Air-fuel ratio etc.

#### A. Main components of system

- 1) Dynamometer :Eddy Current type with computerized torque measuring
- 2) Burette: For measuring the fuel consumption per unit time.
- 3) Manometer: For measuring the air consumption.
- 4) Temperature Indicator: For measuring the temperature at various locations.
- 5) Potentiometer: For loading the dynamometer.
- 6) Engine fitted with a Piezo sensor for Pressure measurement

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- 7) Computerized Fuel Flow measurement system
- 8) Computerized Water Flow measurement system

### B. Engine Specifications

Make	BAJAJ( TEMPO TRAX)
Speed	1500 r.p.m
KW Rating	26 KW
Horsepower	35 H. P. AT 3000 r.p.m
Bore	0.11 m
Stroke	0.12m
Max. Output	20 H. P. AT 3000 r.p.m
Min. Output	5 H.P. AT 800 r.p.m



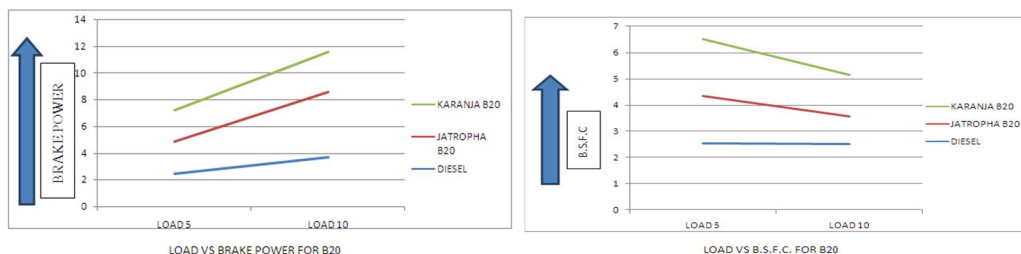
Fig. No.3.Experimental Setup

### IV. PERFORMANCE ANALYSIS OF JATROPHA AND KARANJA BIODIESEL

Performance tests were conducted on stationary cylinders, diesel engine, by using Jatropa and Karanja Biodiesel and its various blends with diesel from no load to full load condition i.e. at 5kg and 10 kg. The tests were also conducted with conventional diesel fuel for comparison; Biodiesel is blended with diesel in proportion like 20%, 40%, 60%, 100% These blends are termed as B20 (20% Biodiesel + 80% diesel), B40 (40% Biodiesel + 60% diesel), B60 (60%Karanja Biodiesel + 40% diesel), B100(100% Biodiesel). Petro diesel is used before and after the Jatropa and Karanja Biodiesel and their blends for verifying the engine performances because biodiesel and blends.

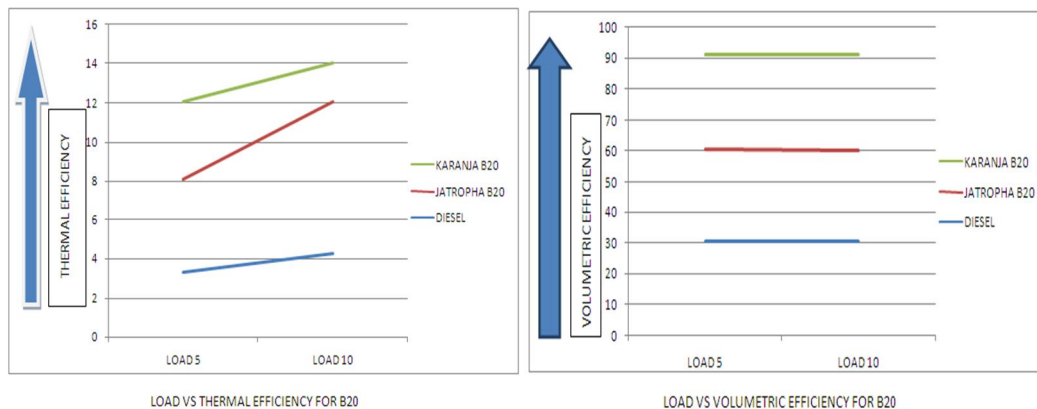
#### A. Engine Performance Analysis

The performance of an internal combustion engine is mainly studied with the help of combustion and operating characteristics. These characteristics obtained by using diesel, Jatropa and Karanja biodiesel in 4 cylinders, 4 strokes diesel engine with eddy current dynamometer. Performance tests were conducted from no load to full load conditions for diesel, B20, B40 and B60 and B100 for Jatropa and Karanja Biodiesel.

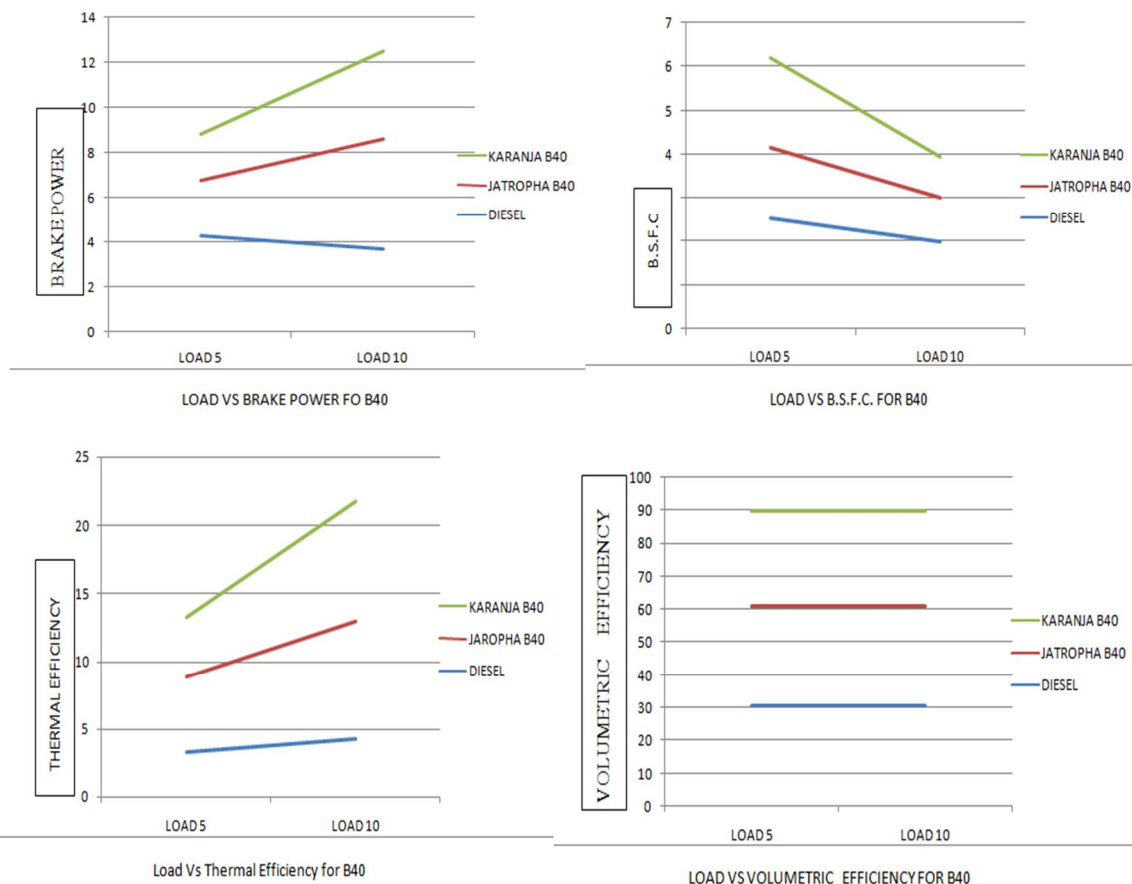




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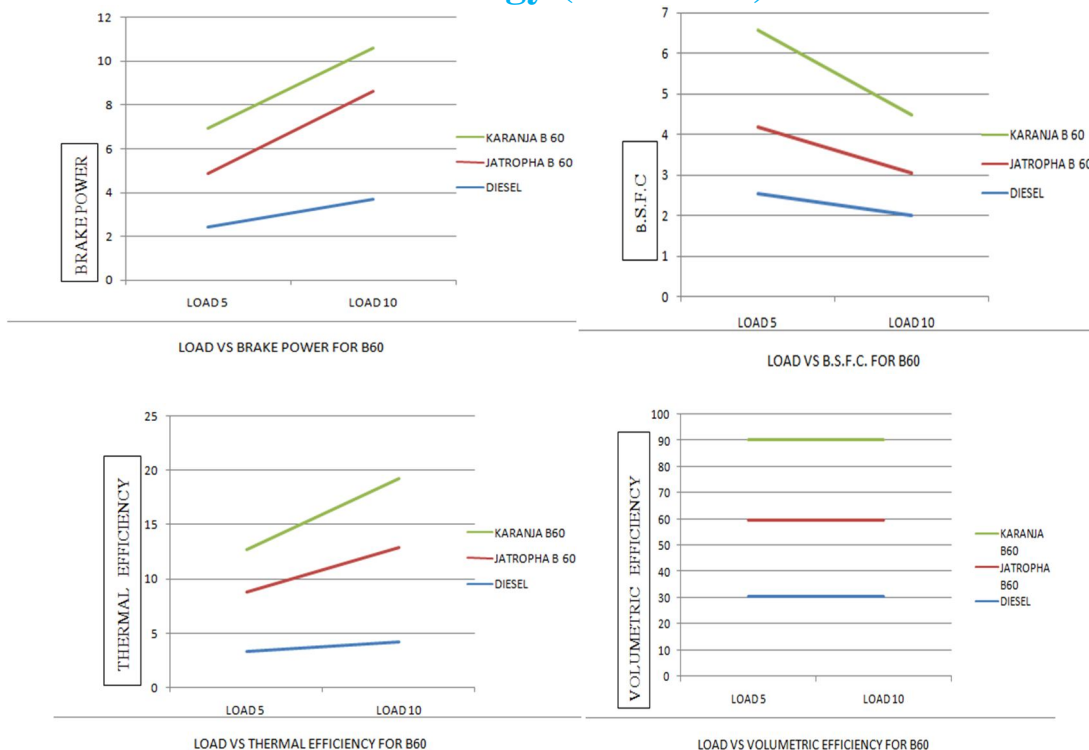


For B20 blend, graphs show that Brake power of Karanja and Jatropa increases when load increases but brake power of diesel slightly increases with load. With increase in load .value of B.S.F.C. of Karanja and Jatropa Decreases gradually but B.S.F.C of diesel deceases slightly. When the load increases, thermal efficiency of Karanja and Jatropa increases rapidly but thermal efficiency of diesel slightly increases. Volumetric efficiency of Karanja, Jatropa and diesel remains constant when load increases.

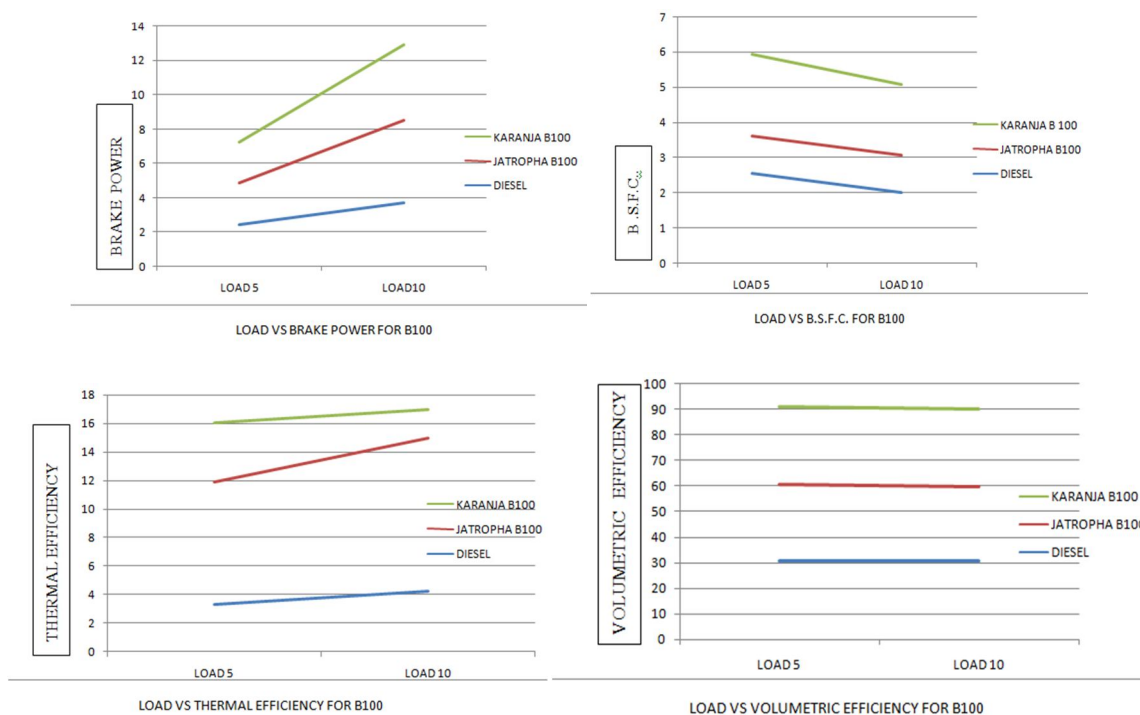


For B40 blend, Graph shows that, brake power of Karanja and Jatropa increases when load increases. But when load increases brake power of diesel decreases. B.S.F.C. of karanja, Jatropa and diesel decreases when load increases. Thermal efficiency of Karanja, Jatropa increases rapidly but diesel's decreases slightly when load increases. Volumetric efficiency of Diesel, Jatropa and karanja remains constant when load increases.

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For B60 blend, Graph shows that, when the load increases brake power of Karanja and Jatropa increases rapidly but B.P of diesel increases slightly increases when load increases. B.S.F.C. of Karanja, Jatropa and diesel decreases when load increases. Thermal efficiency of Karanja, Jatropa and diesel increases when load increases. When load increases volumetric efficiency for Karanja, Jatropa and diesel remains constant.



For B100 blend, Brake power of Jatropa, Karanja and diesel increases when load increases. B.S.F.C. of Jatropa, Karanja and

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diesel decreases when load is increases. Thermal efficiency of Jatropha increases rapidly when load increases but Thermal efficiency of diesel and karanja increases slightly. When load increases, volumetric efficiency of karanja, jatropha and diesel remains constant.

### V. CONCLUSION

- A. Performance of C.I. Engine using Jatropha and karanja Biodiesel shows that Biodiesel is more efficient than diesel.
- B. The thermal efficiency of Jatropha and karanja increases with increases in load rapidly but increases slightly for diesel. The volumetric efficiency of karanja, Jatropha and diesel remains constant when load increases.
- C. The Brake power of Jatropha and karanja increases with increase in load but when load increase, Brake power of diesel decreases. B. S. F. C. of karanja and Jatropha drastically decrease but for diesel decreases gradually.
- D. At the speed of 2000 rpm and load of 5 kg, value of B. S. F. C. for Jatropha is 1.6221kJ/k W hr and at the speed of 1970 rpm and load of 5 kg, value of B. S. F. C. for diesel is 2.54KJ/kW hr.

### REFERENCES

- [1] Attempted Cultivation of Jatropha Curcas L. in the Lower Senegal River Valley: Story of a Failure Marieke Terren1,2\*, S. Saverys1, P. Jacquet de Haveskerckel1, S. Winandy2 & G. Mergeai2,3
- [2] Characteristic and Composition of Jatropha Curcas Oil Seed from Malaysia and its Potential as Biodiesel Feedstock Emil Akbar ,Department of Chemical and Process Engineering, Faculty of Engineering, National University of Malaysia (UKM), 43600 Bangi Selangor, Malaysia
- [3] Combustion analysis of Jatropha, Karanja and Polanga based biodiesel as fuel in a diesel engine,P.K. Sahoo, L.M. Das,Centre for Energy Studies, Indian Institute of Technology, Delhi 110016, India
- [4] Effect of biodiesel on engine performances and emissions Jinlin Xuea,b,\*, Tony E. Grift a, Alan C. Hansena.
- [5] Karanja Oil as an Alternative Fuel for Direct Injection CI Engine- A Review Mukesh A. Mane M. Tech. student, Thermal Engineering, Government College of Engineering, Amravati, (M.S.) India
- [6] Performance Analysis of Multi-cylinder C.I. Engine by using Karanja Bio-diesel Dipak Patil1 , Dr. Rachayya.R. Arakerimath, Dr. Babasaheb Ambedkar Technological University, Lonere, Maharashtra, India 2Department of Mechanical Engineering, G H Raisoni College of Engineering and Management, Wagholi, Pune, Maharashtra, India
- [7] Detail study on the Properties of Pongamia Pinnata (Karanja) for the Production of Biofuel ,Bobade S.N.1 and Khyade V.B.2 Indian Biodiesel Corporation, Baramati, above Sh. Malojiraje Co-op. Bank, Tal Baramati, Dist- Pune, MS, India Shardabai Pawar Mahila College, Shardanagar, Tel. Baramati, Dist – Pune, MS, INDIA Research Journal of Chemical Sciences ISSN 2231-606X
- [8] Biodiesel production from Jatropha curcas: A review Wilson Parawira Department of Applied Biology, Kigali Institute of Science and Technology (KIST),Avenue de l' Armee, B. P. 3900
- [9] Internal combustion Engine, Mathur Sharma
- [10] Dipak Patil , Dr. Rachayya. Arakerimath, Performance characteristics and analysis of Jatropha oil in multi-cylinder turbocharge Compression Ignition Engine, International Journal of Engineering Research and Development ISSN: 2278-067X, Volume 1, Issue 10 (June 2012), PP.50-55
- [11] Pankaj B. Gavali and Prashant H. Patil, Performance Evaluation of Diesel Engine Using Jatropha & Karanja Oil and Its Blends, ISSN: 2249 - 6289 Vol. 4 No. 2, 2015, pp. 35-41, ARME Vol.4 No.2 July-December 2015
- [12] Nagarhalli M. V., Nandedkar V. M. and Mohite K.C., EMISSION AND Performance Characteristics Of Karanja Biodiesel And Its Blends In A C.I. Engine And It's Economics, ARPN Journal of Engineering and Applied Sciences, VOL. 5, NO. 2, FEBRUARY 2010- ISSN 1819-6608
- [13] N. Stalin and H. J. Prabhu , performance test of ic engine using karanja biodiesel blending with diesel, RPN Journal of Engineering and Applied Sciences, VOL. 2, NO. 5, OCTOBER 2007- ISSN 1819-6608



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