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Effect of Biodiesel Blends and Back Pressure on Exhaust Temperature (Silencer) and Pollution of Engine

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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 Etherification 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. Biofuel blends produced from Jatropha (Jatropha curcas) and Karanja (Pongamia pinnata) oil were evaluated for their combustion properties. Two kinds of blends (regular diesel with Jatropha and Karanja oil) were prepared at 20% volume to the diesel and tested as alternative fuels in single cylinder (vertical), water-cooled, direct injection diesel engine at the rated speed of 1500 rpm.*

The performance of the engine in terms of thermal efficiency at full load for diesel was 30%. For Jatropha and Karanja biodiesel blends, the thermal efficiencies were 29.0% and 28.6%, respectively. The maximum cylinder pressure and ignition delay for biodiesel fuel blends are very close to that of regular diesel. This paper presents a comparative analysis of the diesel engine performance and emission characteristics, when operating on diesel fuel and various diesel-biodiesel (B5, B10, B20) blends, at various loads and engine speeds. The experimental tests were performed on a four-stroke, single cylinder, direct injection, naturally aspirated, 60 kW diesel engine

Key Words: (**Jatropha biodiesel, Karanja; water-cooled diesel engine, performance, emission characteristics**.

1. 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. The advantage of using biodiesel to diesel engines is the higher content of oxygen in its fatty acid composition compared with diesel fuels (Torres-Jimenez et al. 2011). Being an oxygenated fuel, it is environmentally cleaner than petrol diesel with respect to hydrocarbon and particulate matter emissions**.**

1.1 Problem statement

1. After devices such as mufflers, catalytic converters, waste heat recovery devices create exhaust back pressure on the engine.
2. Increasing exhaust back pressure can reduce the fuel economy and performance and increase the emission of the engine.
3. In these instance, we need to measure exhaust back pressure of the CI engine. By using jatropha and diesel blends.

1.2 Objective of the project

1. To find out relation between exhaust back pressure and performance of the engine in terms of brake power, brake thermal efficiency, specific fuel consumption, volumetric efficiency etc.
2. To find out relation between exhaust back pressure and emission of the engine such as CO , CO_2 and HC

2. 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

- Dynamometer :Eddy Current type with computerized torque measuring
- Burette: For measuring the fuel consumption per unit time.
- Manometer: For measuring the air consumption.
- Temperature Indicator: For measuring the temperature at various locations.
- Potentiometer: For loading the dynamometer.
- Engine fitted with a Piezo sensor for Pressure measurement
- Computerized Fuel Flow measurement system
- Computerized Water Flow measurement system

Table -1: Input Table

Sr. No	Parameters	Range value
1)	X1	40 % , 60 % , 100 %
2)	X2	14 , 16 ,18
3)	X3	P1 P2 P3
4)	X4	1500

X1 - LOAD (value)

X2 - Compression Ratio (CR)

X3 - Injection pressure

X4 – Speed

For B20 blend, graphs show that Brake power of Karanja and Jatropha 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 Jatropha Decreases gradually but B.S.F.C of diesel deceases slightly. When the load increases, thermal efficiency of Karanja and Jatropha increases rapidly but thermal efficiency of diesel slightly increases. Volumetric efficiency of Karanja, Jatropha and Diesel increases with increase in load

Chart -1: Brake power Vs Load

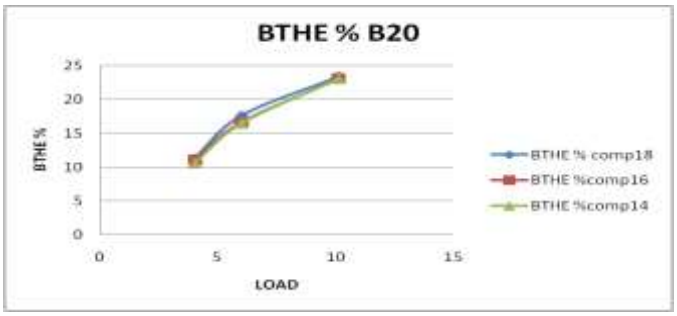

Chart -2: Brake Thermal Efficiency Vs Load

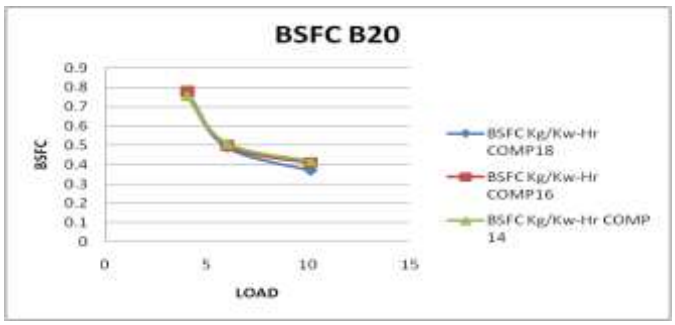

Chart -3: Brake Specific Fuel Consumption Vs Load

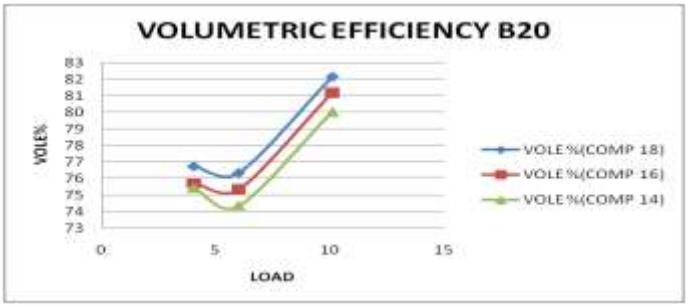

Chart -4: Volumetric Efficiency Vs Load

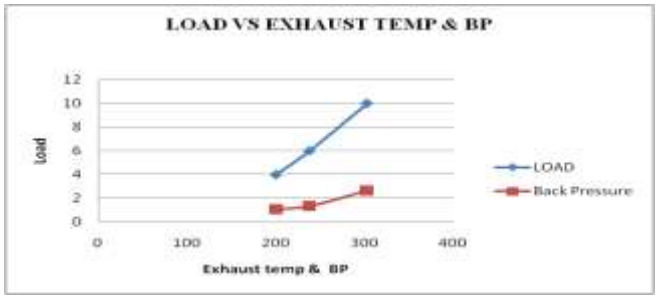

Chart -5: Exhaust Temperature & BP Vs Load

Biodiesel Blends

Biodiesel is a domestically produced, renewable fuel that can be manufactured from new and used vegetable oils, animal fats, and recycled restaurant grease. Biodiesel's physical properties are similar to those of petroleum diesel, but the fuel significantly reduces greenhouse gas emissions and toxic air pollutants. It is a biodegradable and cleaner-burning alternative to petroleum diesel Biodiesel can be blended and used in many different concentrations. They include B100 (pure biodiesel), B5 (5% biodiesel, 95% petroleum diesel), B10 (10% biodiesel, 90% petroleum diesel), and B20 (20% biodiesel, 80% petroleum diesel).The most common biodiesel blend is B20, which qualifies for fleet compliance under the Energy Policy Act (Epact) of 1992

Blends	Jatropha %	Karanja %	Diesel%
B5	2.5	2.5	95
B10	5	5	90
B20	10	10	80

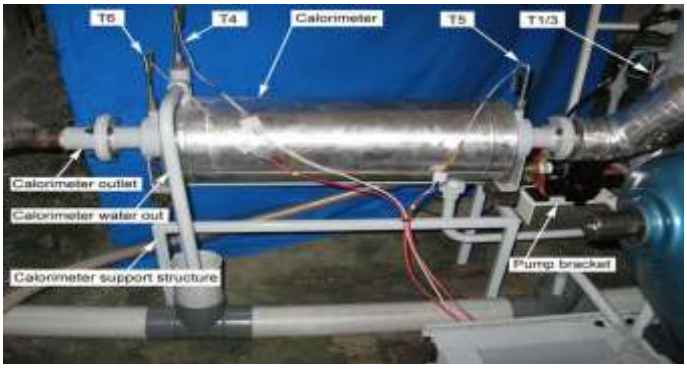

Fig -1: Calorimeter Details

Fig -2: Biodiesel & diesel blends

. **Fig -3** Image Dynamometer

Fig -4 Engine Specification image

Fig -5 Comp. Ratio Image

3. CONCLUSIONS

The experiment was done by blending biodiesel (jatropha & karanja) in different volumes with diesel. The engine performance indicating parameters like brake power, indicated power, brake thermal efficiency, mechanical efficiency, Volumetric efficieny , brake specific fuel consumption etc., have been observed for various blends at different loads.

1. From the experiments conducted, it is concluded that
2. biodiesel and its blends as a fuel for diesel engine have better emission characteristics compared with diesel as follows:
    - CO emissions are less compared with diesel
    - NOx emissions for biodiesel and blended fuel are slightly higher than that of diesel
    - From the study it can be concluded that 20% blends of karanja & jatropha gives better performance with reduced pollution.
    - Tests has been conducted using the biodiesel blends of 40% and 60% ,100 % biodiesel with standard diesel, with fixed compression ratio 14 ,16 ,18 and an engine speed of 1500 rpm at different loading conditions
    - Performance of C.I. Engine using Jatropha and karanja Biodiesel shows that Biodiesel is more efficient than diesel**.** 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 increases when load increases
    - The Brake power of Jatropha and karanja increases with increase in load but when load increase, Brake power of dieseldecreases. B. S. F. C. of karanja and Jatropha drastically decrease but for diesel decreases gradually.

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