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Performance and Emission Characteristics of CI Engine Operating on Diesel Fuel and Palm Stearin Biodiesel

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Abstract: ***The world's fuel reserves are depleting rapidly. Developing countries like India, invests heavily on imports of fossil fuels. Due to the increase day by day in demand of fuel and raise of fuel rates, even a small increase in performance of engine is greatly required. This experimental work is carried out on single cylinder, 4-stroke water cooled diesel engine without modifications. Many Investigations are carried out by several researchers with different Biodiesels. In this work, it is planned to conduct experiment with different blends of Palm Stearin biodiesel like B10%, B20% and B30% to verify the performance and emission on a conventional diesel engine. And those results compare with diesel fuel.***
Keywords: Biodiesel, Palm Stearin, biodiesel, transesterification, Performance and emission. IC engine

I. INTRODUCTION

In the course of the last decades, Research and development accomplishments in this important energetic issue permitted the development of several alternative and sustainable ways of producing biodiesel away from the controversial food crops-derived diesel. The production of biofuels in general and biodiesel in particular is gradually becoming a vital issue due to the rarefaction of the fossil fuels and the urgent need to decrease the amounts of greenhouse gas emissions. Thus, the energy concerns, the growing environmental awareness and the economic considerations are the major driving forces behind the worldwide direction towards producing biofuel from bio-resources. Palm-biodiesel seems to be prospering, with enormous interest in other countries. Ashnani et al. and Johansson found that palm-biodiesel can secure the energy supply, preserve the environment, and develop the rural regions particularly the palm oil producers such as Malaysia, Indonesia, Colombia, and Thailand by not relying on petro- diesel. Besides, producing palm-biodiesel can give social advantages that include creating new job opportunities, accelerating social development, and improving living standards for the community that work in palm tree farms.

II. MATERIALS AND METHOD

The properties of Simarouba glauca biodiesel is fund as per Indian standards (IS) method in fuel testing laboratory. Determination of Viscosity, Density, fire point, flash point, Calorific value is carried out using redwood viscometer, pensky apparatus and Bomb calorimeter respectively.

Comparison with properties of Palm Stearin biodiesel with diesel

PROPERTIES	**DIESEL**	**B100**	**B10**	**B20**	**B30**
DENSITY(Kg/m^3)	830	874.6	839.4	848.8	858.2
ABSOLUTE VISCOSITY AT 60^0 C(Poise)	0.0481	0.0266	0.0031	0.0078	0.0108
KINEMATICVISCOSITY At 60^0 C (Cst)	2.95	3.10	0.4018	0.8931	1.365

FLASH POINT (^{0}C)	48	173	54	56	60
FIRE POINT (^{0} C)	58	191	62	66	73
CALORIFIC VALUE	45500	36576	45470	44840	44210

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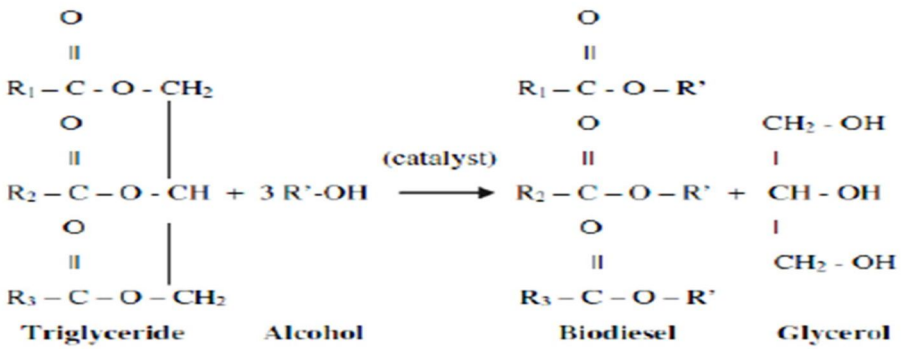

III. EXPERIMENTAL SETUP

The experiment is conducted on single cylinder four stroke diesel engine with water cooling arrangement.

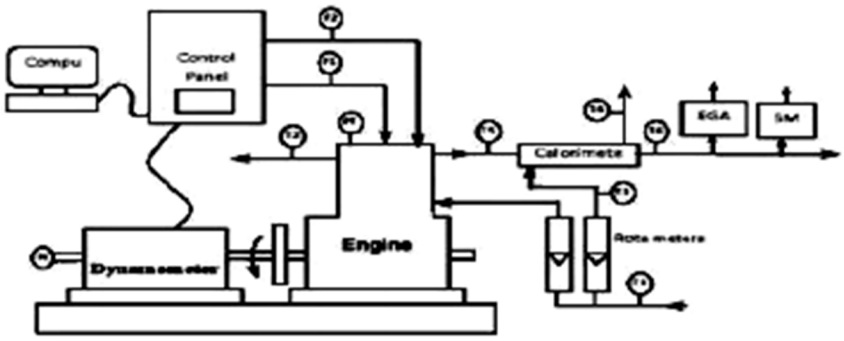

Fig 1: Line diagram of Experimental setup Engine Specification

IV. RESULTS AND DISCUSSION

The Performance and Emission Characteristics by using Palm sterian biodiesel with various blends with diesel

A. Brake Thermal Efficiency(BTE)

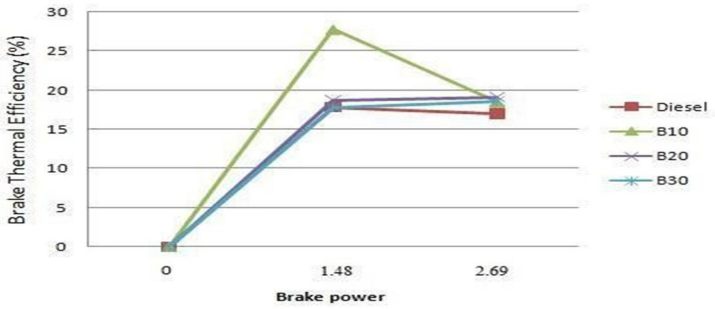

Fig 2: Brake thermal efficiency versus Load

The Graph Represents the variation of brakes thermal efficiency with variations in load of different fuels i.e., Diesel, B10%, B20%, B30%. It is seen that Brake thermal efficiency is high for B10 at 1.48 KW load. Ii is followed by B20 at 2.69 KW load. The brake thermal efficiency is high for B30% blend.

B. Specific Fuel Consumption (SFC)

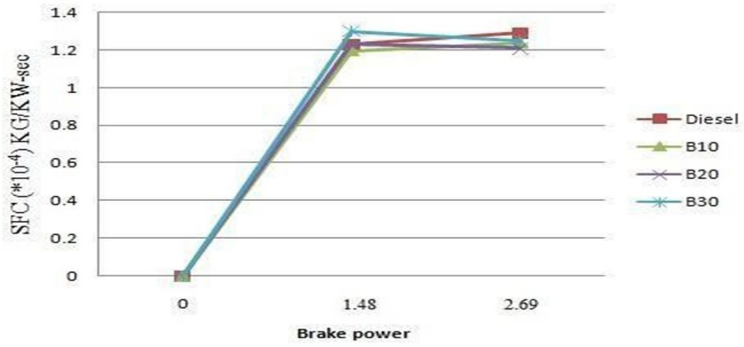

Fig 3: Specific Fuel Consumption versus Brake Power

The Graph Represents the variation Specific fuel consumption with variations in load of different fuels i.e., Diesel, B1%0, B20%, B30%. It is seen that Specific fuel consumption is high for B30 at 1.48 KW load. Ii is followed by B20 at 2.69 KW load. The specific fuel consumption is high for Diesel blend.

C. Volumetric Efficiency

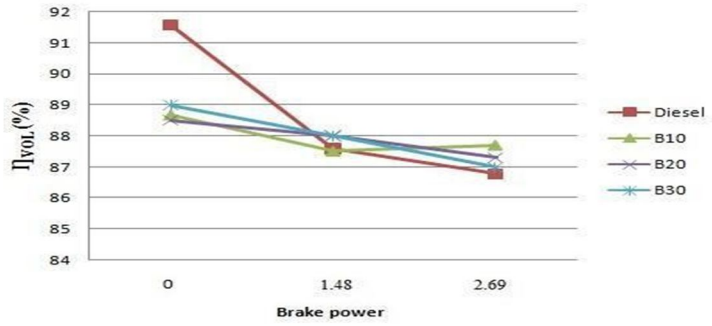

Fig 4: Volumetric efficiency versus Brake Power

The Graph Represents the variation volumetric efficiency with variations in load of different fuels i.e., Diesel, B10%, B20%, B30%. It is seen that volumetric efficiency is high for diesel initially at 0 KW load. Ii is followed by B20 at 2.69 KW load.

D. Mechanical efficiency

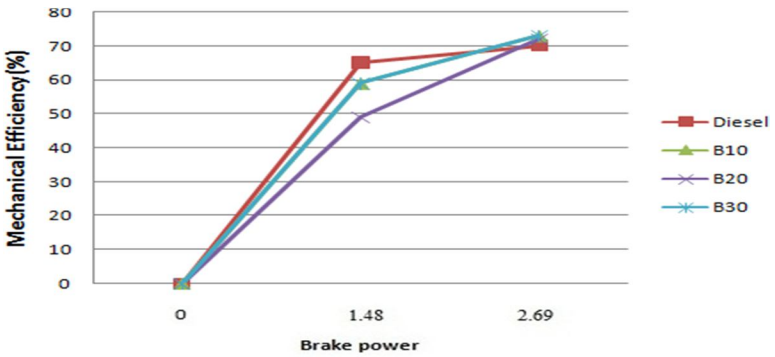

Fig 5: Mechanical efficiency versus brake power

The Graph Represents the variation of mechanical efficiency with variations in load of different fuels i.e., Diesel, B10%, B20%, B30%. It is seen that mechanical efficiency is high for B30 at 2.69 KW load.

E. Co, CO2, O2 Percentage

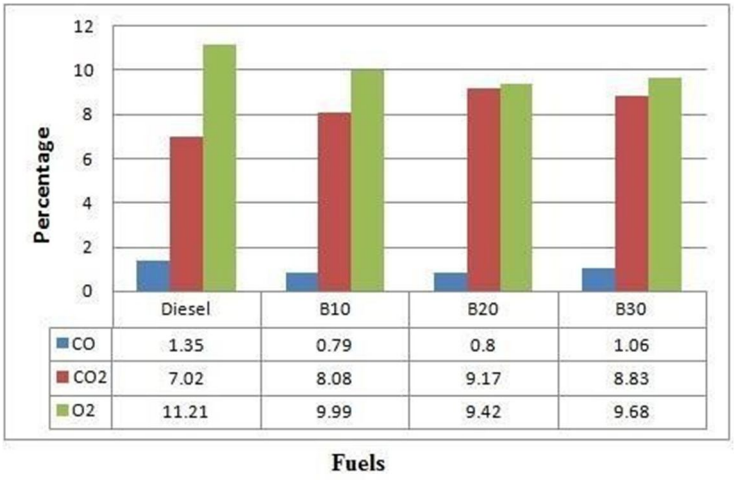

Fig 6: Co,Co2,O2 Percentage versus fuel

The Graph Represents the variation of percentages of CO, CO2 and with variations in different fuels i.e., Diesel, B10%, B20, B30%. It is seen that CO percentage is high for Diesel at 1.35% and low for B10 at 0.79%. And CO2 percentage is high for B20 at 9.17 % and low for diesel at 7.02 %.O2 percentage is high for diesel at 11.21% and low for B20% at 9.42 %.

V. CONCLUSION

Palm Stearin biodiesel fuel was successfully operated single cylinder four stroke CI engine. The accompanying conclusions are made in view of the test results.

A. Thermal efficiency of palm biodiesel and oil blends with diesel fuel was lower compared to diesel fuel and specific fuel consumptions were found to be higher.

B. Higher exhaust gas temperatures are recorded for biodiesel and oil blends compared to diesel fuel for the entire engine load. Exhaust gas temperature values for diesel, B10, B20 and B30 are respectively at full engine load.

C. Air- fuel ratios for diesel-palm biodiesel blends (B10, B20,B30) were lower than diesel fuel.

D. Exhaust emissions of CO and HC were reduced relative to conventional diesel fuel

E. NOx emissions increased relative to conventional diesel. The NOx emission for diesel, B10, B20 and B30 are respectively, at full load operation.

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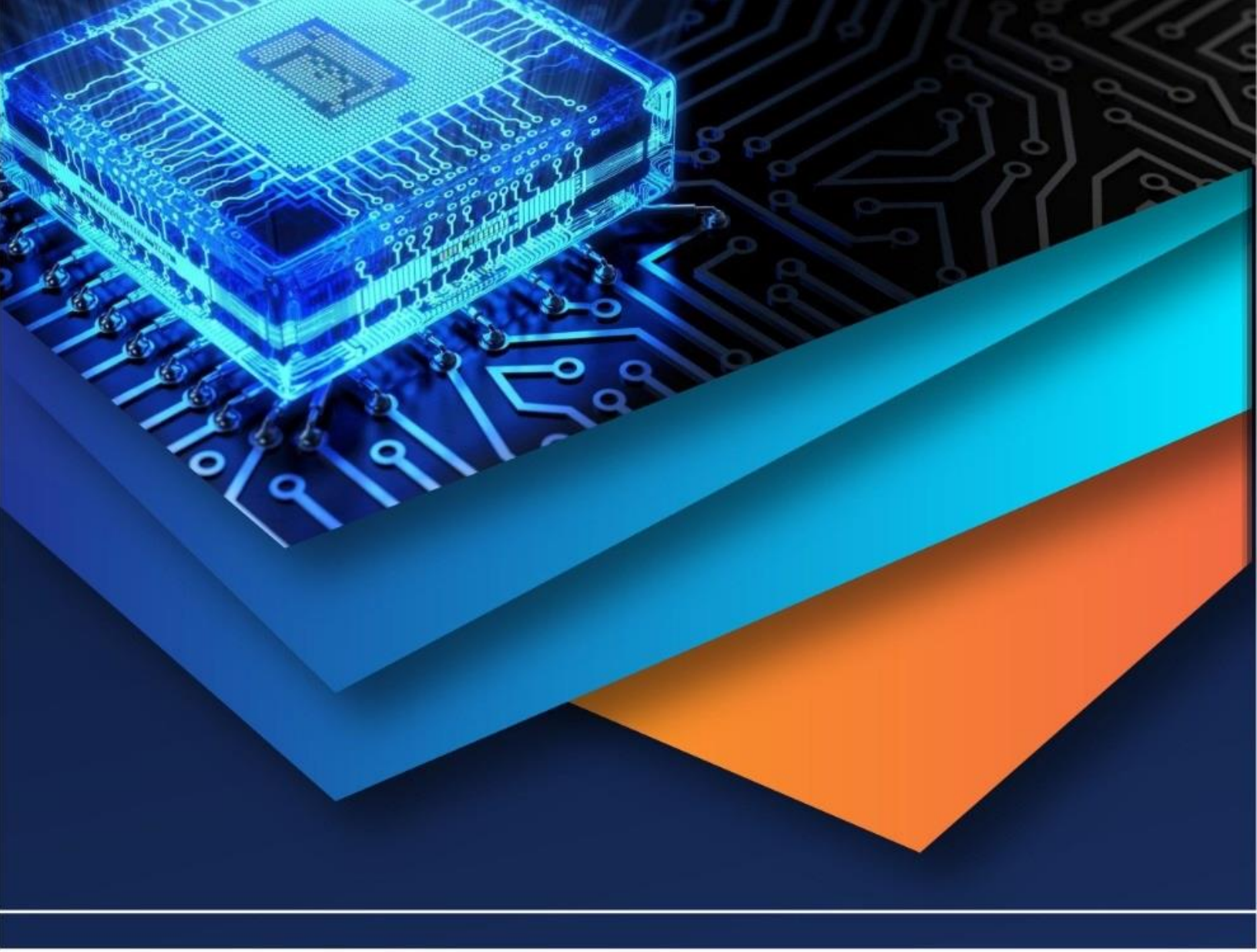

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