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Experimental Investigation of Performance of C.I. Engine by using Simarouba Biodiesel

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Abstract

The simarouba biodiesel is considered as one of the alternative fuels to diesel. This has been taken up to identify the performance characteristics by using Simarouba biodiesel. The depletion of world petroleum reserves and increased environmental concern have stimulated the search of alternative fuel which is to be environment friendly. Bio-fuels have the potential to become alternative fuel for fossil fuels. Biodiesel is renewable, reliable, biodegradable and regarded as a clean alternative fuel to reduce exhaust emissions. The simarouba biodiesel is considered as alternative fuels to diesel. The mainly is observed on the same factors which are critical to the potential profitable use of these blends. This paper investigates the performance using simarouba biodiesel on C.I.Engine.
Keywords: Alcohol, Biofuels, Simarouba glauca seeds, Brake power, Mechanical Efficiency

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I. Introduction

A. *An Overview of Diesel Engine*

The diesel engine (also known as a compression-ignition or CI engine), named after Rudolf Diesel, is an internal combustion engine in which ignition of the fuel is caused by the elevated temperature of the air in the cylinder due to the mechanical compression (adiabatic compression).

B. *Combustion in C.I. Engine*

CI refers to compression ignition engines. This means that combustion process is ignited due to compression of air, inside the cylinder, rather than spark ignition of air-fuel mixture in the case of Spark Ignition engines. So, during the suction stroke, only air is sent inside the cylinder of the engine.

C. *Simarouba (Simarouba Glauca) as Biodiesel*

Simarouba is a genus of trees and shrubs in the family Simatoubaceae, native to the neotropics. They have compunf leaves with between 1 and 12 pairs of alternate pinnate leaflets. In 1713, the genus was discovered by French explorers. Between 1718 and 1725, the bark was exported to France where it was used to treat an epidemic of dysentery. The bark of Simaroubaspecies has been used by indigenous tribes as a tea to treat many diseases.The seeds of Simarouba glauca have been proposed as suitable for producing edible oils in India. Simarouba amara is harvested for timber, with its bright and lightweight timber being highly sought after in European markets to use in making fine furniture and veneers. Simarouba glauca, also known as Lakshmi Taru in India, is also valued for its wood. It bears yellow and oval elongated purple colored fleshy. It can be propagated from seeds, grafting and technology. Fruits are collected in the month of April / May, when they are ripe and then dried in sun for about a week. Skin is separated and seeds are grown in to produce saplings. Saplings 2 to 3 months old can be transplanted to a plantation.

The tree forms a well-developed and dense evergreen canopy that efficiently checks, supports soil microbial life, and improves groundwater position. Besides converting into biochemical energy all round the year, it checks overheating of the soil surface all through the year and particularly during summer. Large scale planting in wastelands facilitates wasteland reclamation, converts the accumulated atmospheric into oxygen and contributes to the reduction of or. It is believed that the leaves and roots of this plant have an ability to fight against cancer cells. Simarouba glauca trees must be regarded as a sure source of 2nd Generation Biodiesel and the foundation around which a profitable business plan can be build for its ability to provide large amount of oil and its pure hardiness and stress handling ability. The Simarouba biodiesel meets all the three criteria any environmentally sustainable fuel must meet. These are social, technical and commercial.

In 1986, when the Karnataka government handed a husband-and-wife team of botanists four seeds from the Simarouba glauca tree – also known as the paradise tree – they were told to research its ability to produce biofuel and edible oil, and how it might reclaim wasteland in the Indian state. Three decades on, the paradise tree is providing all that and more – including bringing comfort to cancer patients battling the side effects of chemotherapy. As the biodiesel industry grows, honing a cost-effective and diverse feedstock supply out as a top challenge. There is a need to diversify the sources and methods used to generate biofuel products to achieve food security, energy security and sustainable development and carbon savings. Biodiesel producers are looking for alternative feedstocks which are non-agricultural and non-food crops. And Simarouba glauca has the ability to substitute the requirement of low cost feedstock with the potential for high oil seed production and the added benefit of an ability to grow on marginal land. These properties support the suitability of this plant for large scale vegetable oil production needed for a sustainable biodiesel industry.

Yield is a function of light, water, nutrients and the age of the Plant. Good planning, quality planting material, standardized agronomy practices and good crop management may increase the yield. Simarouba glauce will yield at Maturity as high as +3 tons Biofuel with proper nutrition and irrigation, which is an exceptional amount of oil from as agricultural crop.

Fig. 1: Simarouba glauca seeds, Simarouba glauca Plant

Simarouba biodiesel satisfies the important fuel properties as per ASTM specification of biodiesel. Engine works smoothly on simarouba methyl ester with performance compared to diesel operation. The simarouba biodiesel can be successfully substituted as alternative fuel for CI engine.

II. EXPERIMENTAL INVESTIGATION

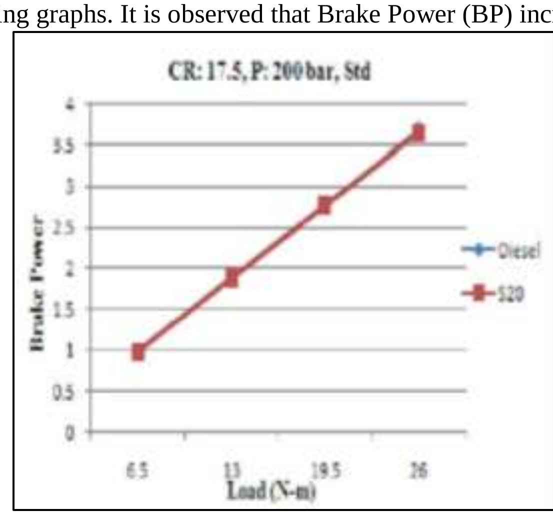
In Investigation it has been observed that the engine has a compression ratio of 17.5 and a normal speed of 1500 rpm. An injection pressure of 200 bar, 250 bar and 300 bar are used for the analysis. The engine is first run with diesel at loading conditions such as 6.5, 13, 19.5 and 26 N-m. Between two load trials the engine is made to become stable by running it for 3 minutes before taking the readings. At each loading condition performance parameters namely speed, exhaust gas temperature, brake power, peak pressure are measured under steady state conditions.

The experiments are conducted on performance and emission characteristics of simarouba biodiesel and its blends on engine. This work includes performance of engine fuelled with blends of simarouba in the proportion of S10, S20, S30 and finally results are compared by the graphs plotted at various load conditions and analysis of combustion characteristics and performance parameters like peak pressure, specific fuel consumption (SFC) and Brake thermal efficiency are evaluated

III. RESULTS AND DISCUSSIONS

A. *Brake Power (BP)*

The variation of Brake Power with various engine load conditions for base and modified piston for diesel and S20 fuels is as shown in the following graphs. It is observed that Brake Power (BP) increases with load.



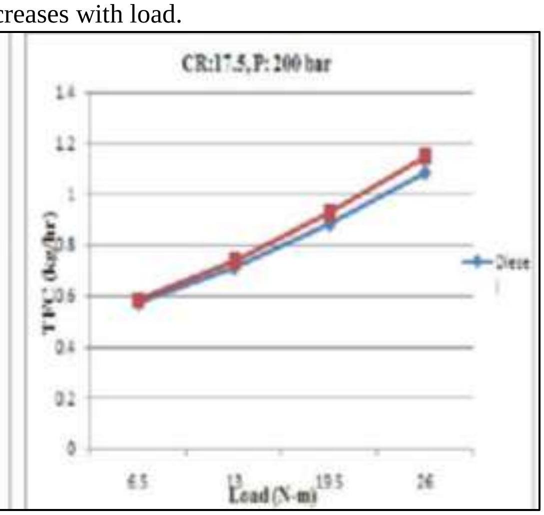


Fig. 2: Variation of BP with Load for diesel and S20 Biodiesel   Fig 3.Variation of TFC with Load for S20 biodiesel normal

B. Total Fuel Consumption (TFC)

The variation of Total Fuel Consumption with various engine load conditions for diesel and H20 fuels is as shown in the following graphs.

It has been observed that Total Fuel Consumption (TFC) increases with load for diesel and H20 fuels in all the cases. It was further observed that TFC for S20 biodiesel is slightly lesser than normal diesel.

C. Total Energy Content (TEC)

The variation of Total Energy Content (TEC) with various engine load conditions for S20 biodiesel and normal diesel is as shown in the following graphs.

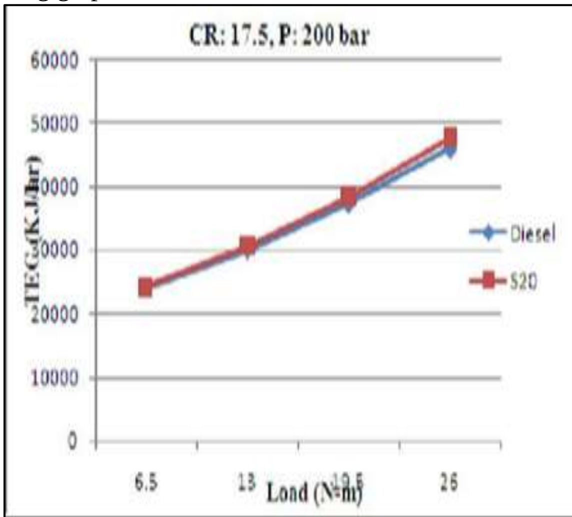


Fig. 4: Variation of TEC with Load for S20 biodiesel and normal

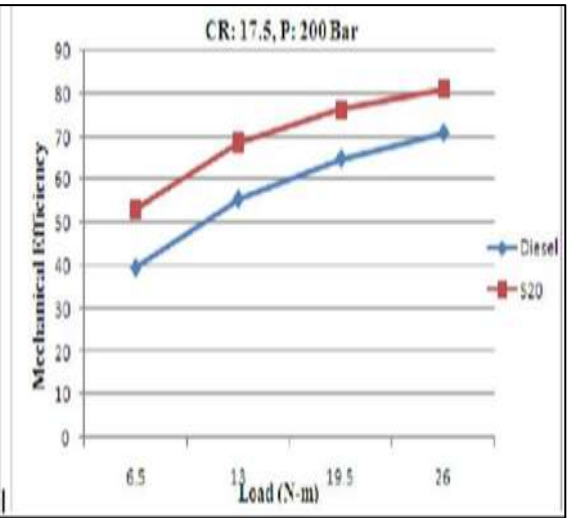


Fig 5. Variation of Mechanical Efficiency with Load for S20 biodiesel & ND

The variation of Mechanical Efficiency of various engine load conditions for diesel and H20 fuels is as shown in the following graphs. The shows the variation of Mechanical Efficiency with load for CR=17.5 and IP=200 bar for diesel and S20 fuels. It is observed that the mechanical efficiency is gradually increasing for both diesel and S20 blends.

Mechanical Efficiency gradually increases in both the cases. And it is observed that, mechanical efficiency is higher in case of S20 biodiesel.

IV. CONCLUSION

1) Brake Thermal Efficiency for modified piston at CR=17.5 for Diesel is increased by 3.25, 2.68 &1.84% at the loads 13, 19.5, 26 N-m respectively. Also brake thermal efficiency CR=17.5 for H20 is increased by 3.54% & 3.55% & 2.61% respectively at load 13,19.5,20 N-m.
2) Brake specific fuel consumption at CR=17.5 for diesel is decreased to around 8.2% at load 6.5N-m.
3) Mechanical efficiency at CR=17.5 for Diesel is increased by 3.98%, 15.66% & 6.60% at the loads 6.5, 13, 19.5 N-m respectively. Also at CR=17.5 for H20 is increased by 17.58%, 17.60%, 11.61% & 9.19% at the loads 6.5,13,19.5 & 26 N-m respectively.

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