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Performance Characteristics of Mixed Biofuels in Single Cylinder In C.I Engine

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Abstract- Now a day's world, better technologies to harvest energy efficiently are of extreme importance, because any country's economic development is decided by electrical energy generation and the sources. The energy security is a major concern of worldwide. The gap between the energy demand and supply increases unpredictably every year, as a result of continuous growth in industrialization and improvement in lifestyle. Owing to the fossil fuel constraints and the intensifying pollution, various nations around the globe has put their limits on exhausted missions from the vehicles. These concerns led to research on alternative renewable fuels. Biofuels was the key, but a consistent scientific framework is needed to ensure policies thatmaximize the positive and minimize the negative aspects of biofuels. Theincreased move towards biofuels is instigated by global political, economic, and environmentalevents, especially rising crude oil prices. To over come these circumstances, many researchers turn their observations towardsnon-edible oil fuels. Researchers have tested edible oils like soya bean oil, palm oil,cottonseed oil, sunflower oil, peanutoil as the feedstockfor biodiesel. In that respect there are a vast number of trees,bushes, and herbs availablein Indiathat can be practiced to create alternative fuel to diesel.Experiments wereconducted in acomputerized single-cylinder, four-stroke, directinjection diesel engineusing mixed biodiesel. To determine the fuel consumption, optical sensor wasused. The air flow rate is measured by a differential pressure transducer.

Keywords- fossil, exhausted missions, biodiesel , single-cylinder etc.

I. INTRODUCTION

As everyone knows fossil fuels produced by underground heat and pressure are being consumed more rapidly than being created. Insufficient quantities or unreasonable price of petroleum fuels deeply concerns everybody. The renewable resource is a promising alternative solution because it is clean and environment- friendly. The drive towards low carbon emissions, and the recognition that current fossil fuel supplies are predicted to last possible only 40 years, has focused the attention of the automotive industry towards alternative fuel supplies. Fossil fuels produced by underground heat and pressure are consumed more quickly than being created. Adequate quantities or unreasonable price of petroleum fuels greatly concerns us, whereas renewable energy is a promising optional solution because it is clean and environmentally safe. Due to pollution, petroleum fuel and accelerating energy consumption have already affected equilibrium of the earth's landmasses and biodiversity. A produced the fuel or sulfur oxides, and particulates that are generally produced during combustion are other specific emissions of concern. So, it is time to search for its alternative fuels.

1.Definition of Biodiesel

Biodiesel is a renewable, biodegradable fuel process domesticallyfrom vegetable oils, animal fats, or recycled restaurant grease. Biodiesel gathers either the biomass-based diesel and overall advanced biofuel requirement of the Renewable Fuel Standard. Biodiesel is a domestic, renewable fuel for diesel engines derived from natural oils like soybean oil, and which meets the specifications of ASTM D6751. Research and development activities were carried out in various parts of the world to investigate how thermal efficiency affects the engine performance, combustion, and exhaust gas emissions [12–14,16– 18,20–36] characteristics when various types of biofuels (and their blends) were used in the engine instead of fossil fuel. Until now, application of TBC is so far limited to some race engines [37] and gas turbines [38] using standard fuels (A. K. Hossain etal. 2018). It is a domestic, clean-burning, renewable liquid fuel that can be used in compression ignition engines instead of petroleum-based diesel with little or no modifications. Blending the two different diesel fuels allows the fuel to have the benefits of the lower emissions present in bio-diesel, while allowing for a lower concentration of alcohol which allows for the engine to run without any changes.

Draw backs of Biodiesel

- Not suitable for use in low temperature.
- Use of Petroleum Diesel to Produce Biodiesel.
- Increase in N Ox emission.
- Thickens more than diesel fuelin cold weather.
- Decrease in afueleconomy on energy basis.
- Higher viscosity
- More expensive, it can be reduced only when entered mass production.

II. PROPERTIES OF BIODIESEL

- Low content of free glycerin
- Reduced Foreign Oil Dependence
- Low acid number
- High degree of Transesterification
- Comparable density with diesel
- No polymers, very clean
- Comparable CV with diesel
- Oxygencontentpresenceupto11%
- Higher flash and fire point

Benefits of Biodiesel

Biodiesel has some benefits over vegetable oil: it performs in any diesel engine, without any moderation to the engine efficiency or the fuel system (Can Hasimoglu et al. 2008). It also has better winter weather properties than vegetable oil, but as compare do not as good as diesel. It has as well many benefits over diesel. Characterization of Biodiesel The following are the important characteristics of good vegetable oil required to alternative diesel fuel.

1.Heating Value

Even though the diesel burning chamber system can accept fuels with great variation in heating value, the one with a greater calorific value is better suited. Its helps to reduce the quality of biofuel handled and maximizes the equipment operating range.

2. Ignition Quality

Adequate combustion demands self-ignition of the biofuel as it is sprayed near Top Dead Center into the hot spiraling compressed cylinder gas. long-delayed ignition is not acceptable as it leads to knocking. Therefore, the cetane number of the exchange fuel should be high enough, which is a measure of the knocking tendency of the fuel. Adequate fuel must have a cetane number between 40 and 60. Viscosity Fuel viscosity plays an important role of combustion. The direct injection in the open combustion chamber through the nozzle and pattern of fuel spray decides the ease of combustion and thermal efficiency of the engine. Too low a viscosity can lead to immoderate internal pump leakage and the system pressure will high an unacceptable level and will affect Ignition during the spray atomization. The effect of viscosity is critical at low RPM.

3.Temperature

PP (Pour point) and CP (cloud point) are important for winter weather operations of the Internal Combustion engine. For adequately working, the values of both should be well below the frigid point of the oil used. The Flash point is a temperature from a refuge point of view. Its temperature should be the highest attainable standard. Typical values of commercial vegetable oils range between 50 and 110oC.

4.Other Properties

The S (Sulphur) content, C (carbon) residue and ash are responsible for the scaling and erodea residuum on the engine parts which will affect the engine life. These values should be lowest attainable standard. Practical values are 0.5% S (sculpture), 0.27% C (carbon) residuum and 0.01% ash.

Vegetable Oil And Biodiesel

Vegetable Oil and Its Blends

Vegetable fats and oils are fat materials acquired from plants. objectively, oils are liquid at atmospheric temperature, and fats are solid. Chemically, both fats and oils are composed of triacylglycerols, as contrasted with waxes which lack glycerin in their structure. Vegetable oils from crops such as peanut, soybean, sunflower, rape, coconut, karanja, neem, cotton, mustard, jatropha, linseed and castor have been in many parts of the world, which lack petroleum accumulation as fuels for compression ignition engines. Vegetable oils consist mostly of saturated hydrocarbons. It is nothing but triacylglycerol's consisting of glycerol esters of fatty acids. Long term storage problem (Mittelbach& Gangl 2001). Reduction in carbon deposit buildup and piston ring sticking.

When the engine is operated for extended periods with vegetable oils there is a severe carbon deposit buildup and sticking of the piston rings. The large droplet size, low volatility, the long perforation distance as well as the chemical properties of vegetable oils seems to cause such problems.

Properties of Vegetable Oil

- Cetane numbers are range same or close to that of diesel fuel.
- Heat contents of various vegetable oils are nearly 90% that of diesel fuel (Kalam& Masuka 2002).
- Long chain saturated, un-branched hydrocarbons are extremely satisfactory for diesel engines.
- The long un-branched hydrocarbon chains in the greasy acids meet this demand.
- The diesel fuel has a chain of 11-14 carbons and fresh vegetable oil has a chain of 18. To combustion in an engine, the chain needs to be run-down to the one similar in length to diesel.
- The high viscosity of the mono-unsaturated nature of the oils.
- Ingenious vegetable oils reported to cause engine settle.
- Severe carbon settle build up and sticking of the piston rings.
- Long term storage problem (Mittelbach& Gangl 2001).
- Reduction in carbon settle buildup and piston ring sticking.
- When the engine is operated for extended periods with vegetable oils there is a severe carbon settle buildup and sticking of the piston rings.
- The large a tiny drop size, low volatility, the long cleverness distance as well as the chemical properties of vegetable oils pretend to source such trouble.

III.EXPERIMENTAL INVESTIGATION ON A DIESEL ENGINE FUELED WITH BLEND SAND NEAT MIXED BIODIESEL

1. Brake Thermal Efficiency (BTE) The variation of Brake thermal efficiency with brake power for different merge of mixed biodiesel is shown in Figure [A]. The Brake thermal efficiency rises with all burdens for all merges of biodiesel. From the graph, it is noticed that MB20 has maximum Brake thermal efficiency when compared to other merges and minimum for MB100.

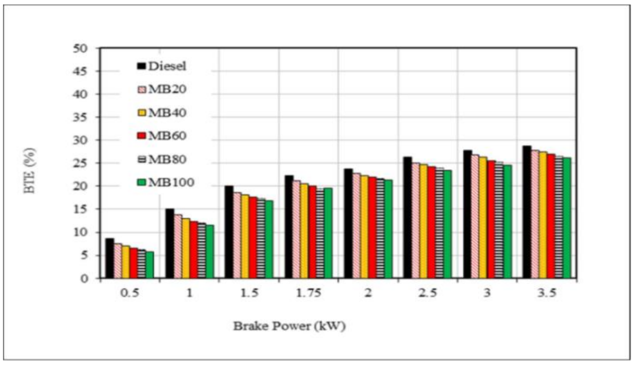

Figure 1 Variation of BTE with brake power

The Brake thermal efficiency values for Mixed biofuel-20%,40%,60%,80%,100% (MB20, MB40, MB60, MB80, MB100) are 27.8%, 27.4%, 26.9%, 26.43% and 26.13% respectively, whereas 28.8% for diesel at full load. At full load, the brake thermal efficiency of MB100 is found to be lower by 8.95% balanced to that of diesel. For MB20, the Brake thermal efficiency is lesser by 3.13% than that of diesel fuel. This is due to reduced CV and low viscosity of the fuel merges.

2.Brake Specific Fuel Consumption (BSFC)

At the max burden, the Brake specific fuel consumption for MB20 and MB100 is found to be extremer by 5.08% and11.86% correspondingly when correlated to diesel. It is noticed that BSFC values for blends such as MB20, MB40, MB60, MB80, and MB100 are 0.307 kg/kWh, 0.317 kg/kWh, 0.322 kg/kWh, 0.324 kg/kWh and 0.327 kg/kWh respectively, whereas 0.296kg/kWh for diesel.

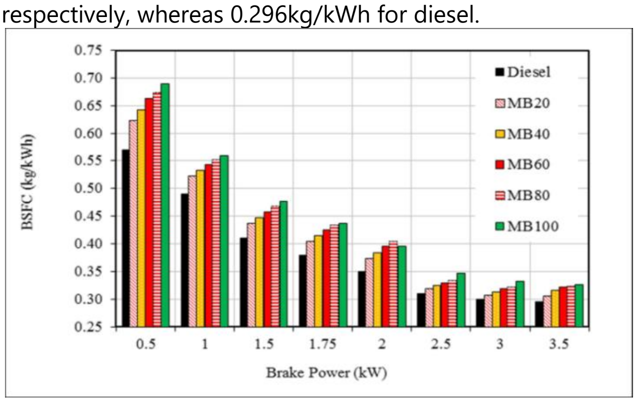

Figure 2 Variation of BSFC with Brake Power

This is due to high viscosity and specific gravity and lesser heating value of MB20 correlated to diesel and the equal results were acquired for the others merges also.

IV.PERFORMANCE CHARACTERISTICS

The variation of Brake thermal efficiency with BP for different injecting pressure is offered in Figure [C]. From this figure, it is achieved that the Brake thermal efficiency rises with rise in brake power and also rises with injection pressure. The Brake thermal efficiency for mixed biodiesel is lesser than diesel for all injection pressures. Max brake thermal efficiency is achieved for 230 bar injection pressure, but it is less than that of diesel. The lower brake thermal efficiency is acquired for 200 bar injection pressure.

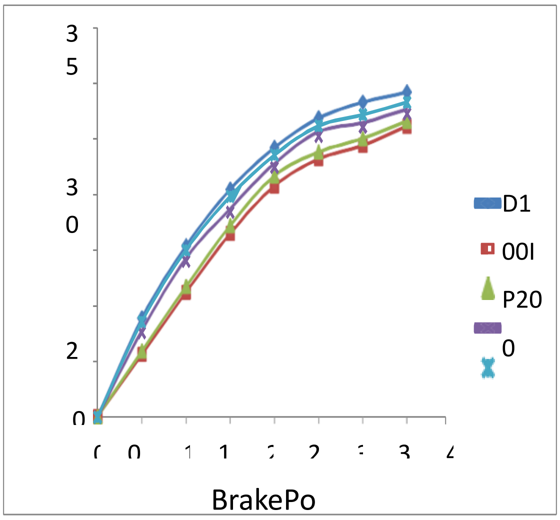

Figure 3 Variation of Brake Thermal Efficiency with Brake Power

When the injection pressure rises from 200 bar to 230 bar, the brake thermal efficiency is raised from 25.7% to 28.1% at full load. It is lesser by 6.27%, 3.83%, 2.79%, 2.09% for 200 bar, 210 bar, 220 bar, 230 bar correspondingly when correlated to diesel. At full burden the efficiency is closer to diesel for mixed biodiesel for different injection pressure.

The variation of EGT with BP for different injection pressure is presented in Figure [D]. Exhaust gas temperature is raised when the load rises. The exhaust gas temperature is lower for diesel and higher for mixed bio fuel. When the injection pressure is raised from 200 bars to 230 bar, the exhaust gas temperature is raised. At IP 200 bar, the exhaust gas temperature is higher than diesel at full load and increases when the injection pressure increases. The EGT is higher than diesel by 13.4%, 16.84%, 35.31% and 42.78% for 200 bars, 210bar, 220 bars and 230 bars respectively at maximum load. This is due to the O2 content present in the mixed biodiesel, which improves the combustion and thus increases in EGT.

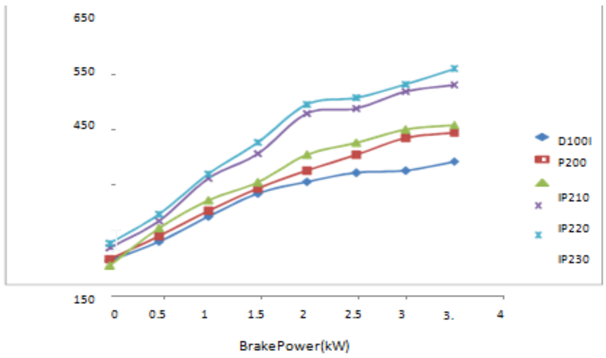

Figure 4 Variation of EGT with Brake Power

The variation of Brake-specific fuel consumption (BSFC) for mixed biodiesel and diesel for various inject pressures with different burdens are given in Figure [E]. It is showing that mixed biodiesel consumes large fuel than that of diesel. This is due to lesser heating value and riser density of mixed biodiesel when correlated with diesel. When the burden and injection pressure rises, Brake-specific fuel consumption less but it is higher than diesel. Max Brake-specific fuel consumption acquired for mixed biodiesel at max burden for IP 200 by 22.03% risers than that of diesel. When the injection pressure rises from 200 bars to 230 bar, the Brake-specific fuel consumption lower from 22.03% to 5.08% at full load.

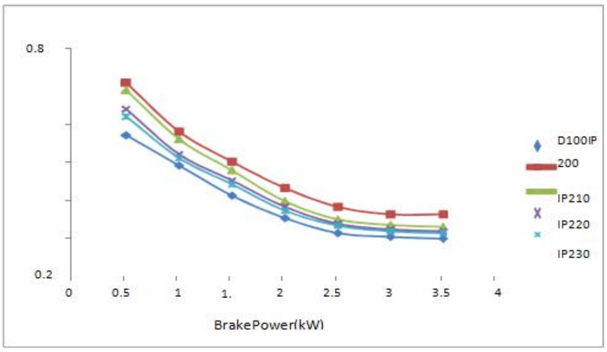

Figure 5 Variation of BSFC with Brake Power

V.CONCLUSION

It was recognized that performance and emission individuals of Combustion ignition engine fuel with mixed biodiesel was refined by raising the inject pressure and inject timing correlated to that of designed inject pressure and timing. The experiment were conducted on direct inject compression ignition engine using mixed biodiesel and the diethyl ether used as an additives are added to mixed biodiesel in 5%,10% and 15% and the following results are obtained at 15% in the max burden. Brake thermal efficiency is increased by 1.87%.

- Brake-specific fuel consumption is decreased by 5.10%.
- Exhaust Gas Temperature is increased by 16.91%.
- Carbon monoxide (CO), Hydrocarbons (HC) and smoke emissions are reduced to 44.44%, 22%, and 16.22%, respectively.
- Carbon dioxide (CO_2) emission is increased from 6.17% to 29.63%.

On the whole, results of above experiments on a diesel engine fuel with mixed biodiesel prove that the performance, combustion, and emission characteristics are comparable to that of diesel. Hence, mixed biodiesel from Thevetia peruviana, Neem, jatropha, pongamia seed oil can be a viable alternate fuel for diesel engine.

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