USE OF SARGUIA OIL BIODIESEL IN DI ENGINES

M.Saravana Kumar, S.Prabhakar, S.Prakash.
Department of Mechanical Engineering, Aarupadai Veedu Institute of technology Chennai
***Corresponding author: Email:sarov003@gmail.com**

ABSTRACT

In the present experimental research work, methyl ester of Sarguia oil is derived through transesterification of rice-bran oil using methanol in the presence of sodium hydroxide (NaOH) catalyst. Experimental investigations have been carried out to examine the combustion characteristics in a direct injection diesel engine running with diesel, biodiesel (Sarguia methyl ester), and its blends with diesel. Engine tests were performed at different engine loads ranging from no load to rated (100 per cent) load at constant engine speed (1500 rpm). A careful analysis of the cylinder pressure rise, heat release, and other combustion parameters such as the cylinder peak combustion pressure, rate of pressure rise, crank angle at which peak pressure occurs, and rate of pressure rise, were carried out. Higher engine loads; however, combustion duration was higher for biodiesel blends.

Keywords: sarguia oil, direct injection, methyl ester, performance.

INTRODUCTION

Vegetable oils are considered as good alternative to diesel fuel due to their properties which are much closer to that of diesel. Thus, they offer the advantage of being readily used in existing diesel engines without much modification. They have a reasonably high cetane number. Vegetable oils have a structure similar to that of diesel fuel, but differ in the type of linkage of the chains and have a higher molecular mass and viscosity. The heating value is approximately 90% of diesel fuel. A limitation on the utilization of vegetable oil is its cost. In the present market the price of vegetable oil is higher than that of diesel. However, it is anticipated that in future the cost of vegetable oil will get reduced as a result of developments in agricultural methods and oil extraction techniques. Viscosities of vegetable oil derived diesel fuels as are higher and their energy contents about 10% lower than that of their crude oil based equivalents, but their auto ignition properties are much the same. Problems commonly experienced are carbonaceous and gummy deposits in combustion chambers, lower smoke limits and filter blockage in cold weather. Incidentally, a recent discovery by the Scottish is that, by adding alcohol to rapeseed oil, glycerol is made to separate out, thus reducing the tendency to gum deposits in the engine.

With Vegetable oils, emissions of HC and NOx could be higher too. However, these might be overcome by injectors designed specifically for the fuel or the use of antioxidant, detergent and other additives. To economies in the consumption of products derived from crude oil, a 20% blend of vegetable oil with diesel fuel could be practicable. Blending in this way emissions tends reduces the emissions and smoke levels, though the power output will still tend to be lower and separation of the blended constituents could occur in cold weather. Again, ways might be found of avoiding them. Indeed, most of the problems no doubt could be overcome with further development. For example, additives might be used to combat deposit and the gum formation and cold weather, as well as the problems already commercially available for other purposes have been used, so it is oils already mentioned. Moreover so far only oils already commercially available for other purposes have been used, so it is not beyond the bounds of possibility that some more suitable vegetable, currently growing unnoticed yet plentifully in the world, might be discovered.

TRANSESTERIFICATION

To reduce the viscosity of the vegetable oil, transesterification method is adopted for the preparation of biodiesel. The procedure involved in this method is as follows: 1000 ml of vegetable oil is taken in a three way flask. 12-15 grams of Potassium hydroxide (KOH) and 200 ml of corresponding alcohol (Ethanol, Methanol, Butanol) are taken in a beaker. The Potassium hydroxide and the alcohol are thoroughly mixed until it is properly dissolved. The solution obtained is mixed with vegetable oil in three way flask and it is stirred properly. The corresponding alcohols oxide solution with vegetable oil is heated to 78ºC, 65ºC, 117ºC respectively for ethanol, methanol and butanol and it is continuously stirred at constant rate for 90 minutes, 60 minutes,80 minutes by stirrer correspondingly for ethanol, methanol and butanol. The solution is poured down to the separating beaker and is allowed to settle for 4-6 hours. The glycerine settles at the bottom and the ester floats at the top. Corresponding alcohol ester is separated from the glycerine. Then it is heated above 1000ºC and maintained for 10-15 minutes to remove the untreated alcohol. Certain impurities like sodium hydroxide (KOH) etc are still dissolved in the obtained biodiesel. These impurities are cleaned up by washing with 350 ml of water for 1000 ml of coarse biodiesel. This cleaned biodiesel is the corresponding ester of Vegetable oil. This bio-diesel of *Pongamia pinnata* oil and Linseed oil is being used for the performance and emission analysis in a diesel engine.

RESUULTS AND DISCUSSIONS

Performance characteristics:

Specific energy consumption: It can be seen that the Specific Energy Consumption is higher in the case of B100

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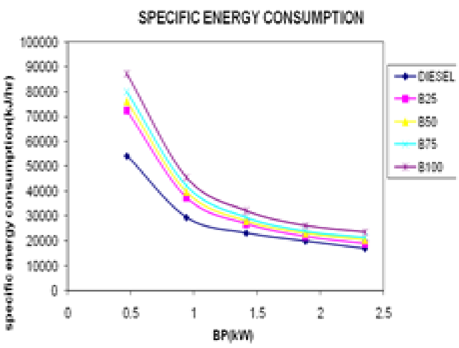
and lower for B25.



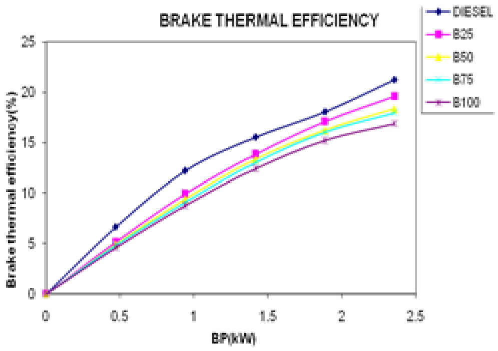
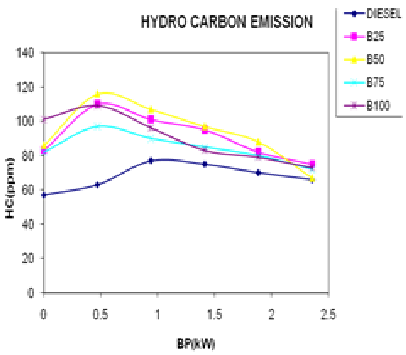


Fig.1 SEC Vs BP **Fig.2 BTE Vs BP**

Brake thermal efficency: It can be seen that Efficiency of the engine with B25 is closer to diesel. The thermal efficiency is lower for B100 and it is 5.54%. This is also due to low heating value of Bio-diesel.

Emission characteristics:

Hydro carbon emission: The emission of UBHC form the engine with B25 is slightly higher than diesel and forB75, HC emission decreasing gradually. Diesel and B100 have higher Hc emission because of incomplete combustion.



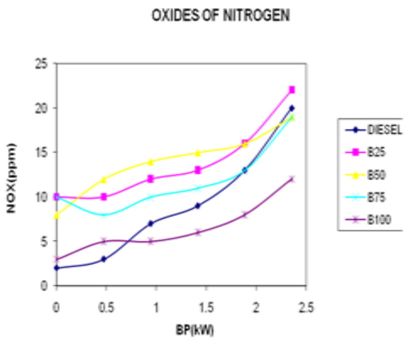


Fig.3.HC Vs BP **Fig.4.Nox Vs BP**

Oxides of nitrogen: Nox content for the B50 is higher than Sarguia oil blends. Diesel and B100 are having minimum Nox content compare to other blends of bio-diesel fuels.

CONCLUSION

A single cylinder four stroke compression ignition engine was operated successfully using 100% pure diesel B25, B50, B75, andB100 as a fuels. A detailed experimental analysis for finding out the combustion characteristics of bio-diesel in comparison with diesel was carried out. Various combustion parameters such as performance and emission were evaluated for different engine loads as a constant engine speed of 1500 RPM in a stationary diesel engine. The experimental investigations are summarized as follows,

- It is noticed, B25 gives approximately same Brake Thermal Efficiency to diesel, B50, B75, B100 at peak loads and part load conditions have same value.
- B25 and diesel have similar performance characteristics at most of the loads.
- It can be seen that the Specific Energy Consumption is higher in the case of B100 and lower for B25.
- It can be seen that Efficiency of the engine with B25 is closer to diesel. The thermal efficiency is lower for B100 and it is 5.4%. This is also due to low heating value of Bio-diesel.
- It is also observed that mechanical efficiency of B25 is similar to diesel. The experimental investigations revealed that the overall combustion characteristics were quite similar for bio diesel and diesel.
- The emission of UBHC form the engine with B25 is slightly higher than diesel and forB75, HC emission decreasing gradually. Diesel and B100 have higher HC emission because of incomplete combustion
- Nox content for the B50 is higher than Sarguia oil blends. Diesel and B100 are having minimum Nox content compare to other blends of bio-diesel fuels.

This detailed experimental investigation confirms that bio-fuels of Sarguia oil methylesters can substitute mineral diesel without any modification in the engine.

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