

Performance Investigation on Four Stroke Diesel Engine by Using Linseed Oil blend, Combination of Sunflower and Coconut Oil blend

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Abstract- In coming days alternative sources of energy will be given more importance due to the gradual depletion of fossil fuels. Diesel engines are used for automobile application because they have low specific fuel consumption and high efficiency compared to S.I engines. Consumption of bio-fuels increasing in internal combustion engines due to the scarcity, increased cost, increased emissions of conventional fuels. Vegetable oils have been used to possible alternative to diesel fuel in CI engines. In the present work, initially the tests are conducted on the four stroke single cylinder water cooled direct injection diesel engine with constant speed by using diesel and base line data is generated by varying loads. After that experimental investigation has been carried out on the same engine and same operating parameters by using the linseed oil and blend of (sunflower and coconut oil) methyl esters in different proportions as L10, L20, L30 and SC10, SC20, SC30. Performance parameters like brake thermal efficiency, brake specific fuel consumption, volumetric efficiency and air fuel ratio are evaluated. The emissions like CO, CO₂, NO_x, HC and smoke density are measured. It is observed from the experimental results, that L20 and SC20 are the optimum blends after comparing performance parameters and emissions.

Index Terms- linseed oil, sunflower oil, coconut oil.

I. INTRODUCTION

Diesel fuel has an essential function in the industrial economy of a developing country and used for transport of industrial and agricultural goods and operation of diesel tractors and pump sets in agricultural sector. the alternative fuels, bio-diesel obtained from vegetable oils holds good promises as an eco-friendly alternative to diesel fuel Vegetable oil is a promising alternative fuel for CI engine because it is renewable, environment friendly and can be

produced in rural areas. The use of non-edible vegetable oils compared to edible oils is very significant in developing countries because of the tremendous demand for edible oils as food and they are too expensive to be used as fuel at present. The term, bio-diesel, was first introduced in the United States during 1992 by the National Soy Development Board (presently National Biodiesel Board), which has pioneered the commercialization of biodiesel in the USA.

One of the problems associated with non-edible seeds is that the mechanical presses are not efficient for extraction of oils. Same mechanical press cannot be used for different type of seeds. Therefore, several methods have been proposed in recent years like solvent extraction technique, ultra sonication, etc. Another problem with non-edible vegetable oil seeds is that they contain high free fatty acids and are not suitable as a feed stock for production of biodiesel by conventional alkaline transesterification method.

II. BIODIESEL PRODUCTION

Biodiesel is a clean burning renewable fuel made using natural vegetable oils and fats. Biodiesel is made through a chemical process which converts oils and fats of natural origin into fatty acid methyl esters (FAME). Biodiesel is not vegetable oil. Biodiesel is intended to be used as a replacement for petroleum diesel fuel, or can be blended with petroleum diesel fuel in any proportion. Biodiesel does not require modifications to a diesel engine to be used. Biodiesel is simple to use, biodegradable, nontoxic, and essentially free of sulphur and aromatics. The use of vegetable oils for engine fuels may seem insignificant

in past. But such oils may become in the course of time as important as petroleum and the coal tar products of the present time.

III. TRANS-ESTERIFICATION PROCESS

The characteristics of the oil/fat are determined by the nature of the fatty acids attached to the glycerine. The nature of the fatty acids can in turn affect the characteristics of the bio-diesel. A successful transesterification reaction is signified by the separation of the ester and glycerol layer after the reaction time. The heavier, co-product, glycerol settles out and may be sold as it is or it may be purified for use in other industries, e.g. the pharmaceutical, cosmetics etc. In this experiment first 250ml of methanol is taken in conical flask. The amount of KOH required is determined by titration process by slowly adding of potassium hydroxide to ethanol. In this trial I observed 5.5grams of KOH is needed for every 250ml of methanol. After this mixture is mixed with one litre of raw linseed oil, is heated and maintained at 65-70°C for 8hr, while the solution is continuously stirred. Two distinct layers are formed, the lower layer is glycerol and the upper layer is ester. The upper layer (ester) is separated and moisture is removed from the ester by using calcium chloride. It is observed that 90% ester can be obtained from vegetable oils.



Transesterification process

IV. EXPERIMENTAL SET UP

Experimental set up consists of a water cooled single cylinder vertical diesel engine coupled to a rope pulley brake arrangement and absorb the power produced necessary weights and spring balances are induced to apply load on the brake drum suitable

cooling water arrangement for the brake drum is provided. A fuel measuring system consists of a fuel tank mounted on a stand, burette and a three way cock. Air consumption is measured by using a mild steel tank which is fitted with an orifice and a U-tube water manometer that measures the pressures inside the tank. For measuring the emissions the gas analyser is connected to the exhaust flow.



4-Stroke diesel engine



Dynamometer



Linseed oil blend



blend of sunflower and coconut oil

Table: properties for oils

Oil	Diesel	Linseed oil	Combine oil SC
Specific gravity	0.835	0.925	0.962
Kinematic viscosity(stokes)	0.364	3.85	3.79
Flash point(⁰ C)	58	185	183
Fire Point(⁰ C)	62	192	185
Calorific Value (kj/kg)	42500	32306	34205

V. RESULTS AND DISCUSSIONS

Brake Thermal Efficiency

The variation of brake thermal efficiency with brake power for different fuels is presented. In all cases, it increased with increase with brake power. This was due to reduction in heat loss and increase in power with increase in load. The maximum thermal efficiency for L20 at full load 35.5% and higher than that of diesel (31.8%). Similarly the maximum thermal efficiency for SC20 at full load 32.74% and higher than that of diesel (31.8%). Increase in thermal efficiency due to percentage of oxygen presence in the biodiesel, the extra oxygen leads to causes better combustion inside the combustion chamber.

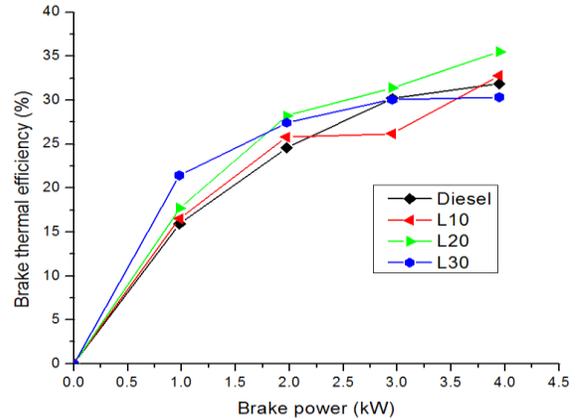


Fig: Variation of brake power with brake thermal efficiency using LNO ME

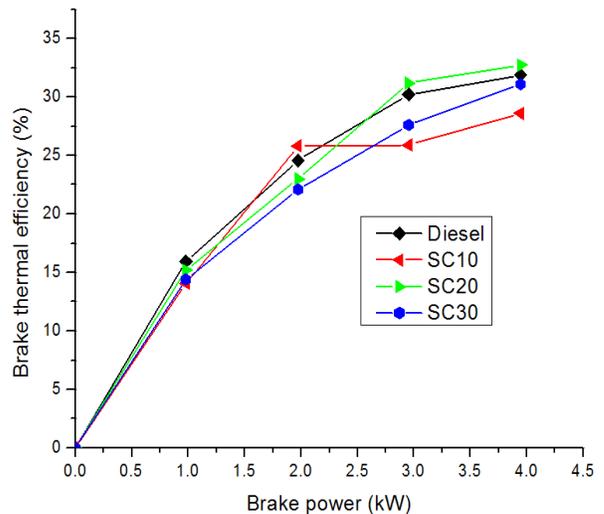


Fig: Variation of brake power with brake thermal efficiency using SC

Carbon Monoxide (CO)

The comparison of carbon monoxide for various biodiesel blends with respect to brake power. Carbon monoxide (CO) occurs only in engine exhaust, it is a product of incomplete combustion due to insufficient amount of air or insufficient time in the cycle complete combustion. In diesel engine combustion takes places normally at higher A/F ratio, therefore sufficient oxygen is available to burn all the carbon in the fuel fully to CO₂ it was noticed that CO emission of 0.19%vol for diesel and 0.011%vol for L20. At full load diesel contains 7.8 % of CO₂ emissions where as in case of SC20 it is 7.4% .The decreased in CO₂ emissions is 5.1% in case of SC20 blend with diesel.

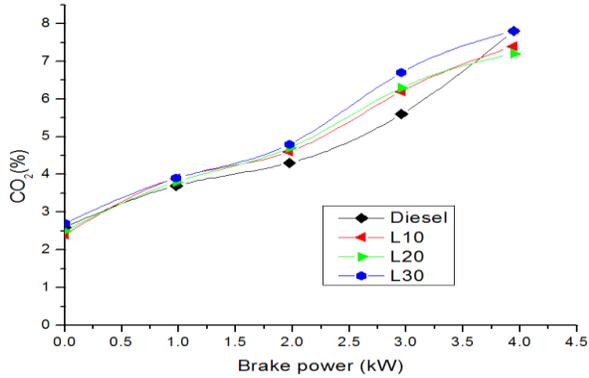


Fig: Variation of brake power with CO₂ using LNome blend

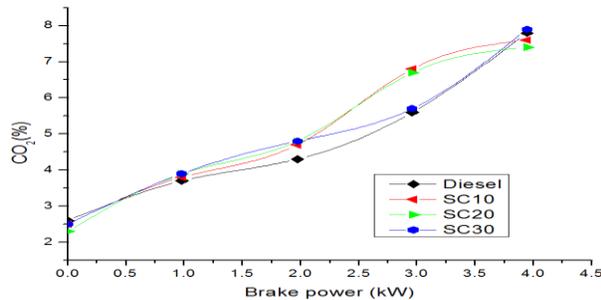


Fig Variation of brake power with CO₂ using SCOME blend

Oxides of Nitrogen (NO_x):

Variation of NO_x with engine brake power for different fuels tested nitrogen oxides emissions formed in an engine are highly dependent on combustion temperature, along with the concentration of oxygen present in combustion products. The amount of NO_x produced for L20 and 935ppp, where as in case of diesel fuel is 1007 ppm for diesel fuel. From figure it can be seen that decreased proportion of biodiesel in the blends was found to decreased NO_x emissions slightly 7.7% compared to diesel. The amount of NO_x produced for SC20 and 845 ppm, where as in case of SC20

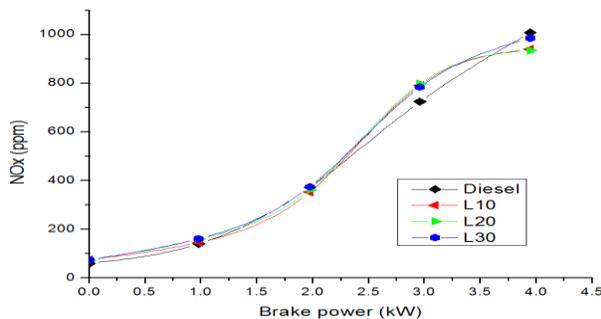


Fig Variation of brake power with NO_x using LNome blend

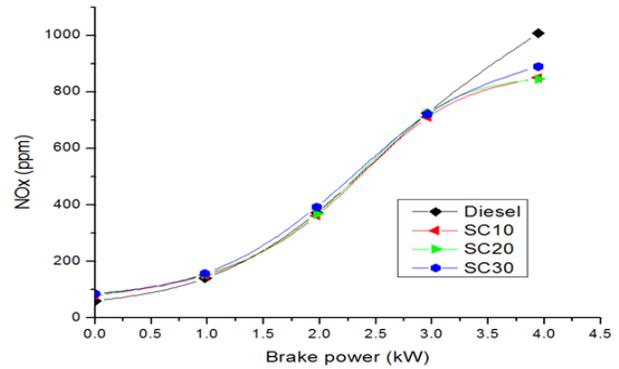


Fig Variation of brake power with NO_x using SCOME blend

VI. CONCLUSION

- The brake thermal efficiency increases with increase biodiesel percentage. Out of all the blends L20 shows best performance and emissions parameters. The maximum brake thermal efficiency obtained is 35.5% with L20 blend with increased 11.39% when compare with diesel. The maximum brake thermal efficiency obtained is 32.74% with SC20 blend with increased 2.72% compare with diesel.
- Significant decreased in NO_x emission is 7% when compared with diesel. Significant decreased in NO_x emission is 16% when compared with diesel.

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