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RESEARCH ARTICLE OPEN

Experimental Investigation of Performance of Rapeseed Oil Biodiesel on Single Cylinder CI Engine

Bhanu Pratap Singh Tomar[1],Prashant Gupta[1] ,Gaurav Saxena[2]
[1] (bpstmechanical@gmail.com,prasant.gupta2@gmail.com)
[2](gwlgaurav82@gmail.com)
[1](M.Tech(Automobile Engineering) Research scholars,RJIT BSF Academy Tekanpur,Gwalior(M.P), India
[2](Asst.Prof of Automobile Engineering Department, RJIT BSF Academy Tekanpur, Gwalior (M.P), India

ABSTRACT
India rank in fourth position in production of rapeseed and India is the world's fourth largest petroleum consumer and the vehicular pollution is estimated to have increased eight times over the last two decades. To combat declining global oil productive capacity combined with a growing oil demand ethanol, biomass, butanol and biodiesel have been felt that can aid in achieving the Indian target of 20% biofuel blending by 2017.In the present work analysis of engine performance was done for various blends of biodiesel on Kirlosker single cylinder diesel engine ,simulated with engine- soft software to provide graphical results . This engine have been fueled with different blend of diesel and rapeseed oil. Fuel consumption increased compared to fossil diesel because biodiesel has slightly less energy per gallon than diesel fuel. The fuel filter had to be changed more often compared to what would normally be experienced with petroleum diesel. This may have been because the fuel filter material did not hold up well with biodiesel. This is due to the combined effects of the fuel density, viscosity and lower heating value of blends. It is observed that dual biodiesel blends BB 10 and BB 20 shows closer BSFC values with diesel than other dual biodiesel blends.
Keywords: Biodiesel, IC Engine, engine-soft, Methanol, rapeseed oil, performance

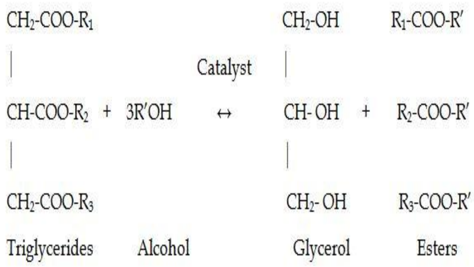
I. Introduction

Rapeseed oil, sometimes called vegetable or canola oil, is from the Fourth most important crop grown in the India after wheat and barley, and along with linseed are the only oils grown and bottled in the India. It comes from the black seeds of the rapeseed plant, Brassica napus, from the same Brassica family as th

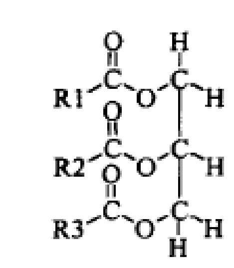
health enhancing vegetables broccoli, cabbage and cauliflower. The plant produces sunny, yellow flowers around springtime. Rapeseed oil has in the past been in the shadow of its better known Mediterranean counterparts, olive and sunflower oil. Due to gradual depletion of the world petroleum reserves and the impact of environmental pollution, there is an urgent need for suitable alternative fuels for use in diesel engines. In view of this, rapeseed oil is a promising alternative because it is renewable, environmental friendly and produced easily in rural areas, where, there is acute need for moderns form of energy. In recent years systematic efforts have been made by several research workers to use rapeseed oil as fuel in engine. Seeing the cost and the edible oil consumption, the use of non-edible oils compared to edibles oils is very significant. Rapeseed tree or shrub grows practically allover India under a variety of the agro-climatic conditions and it is commonly found in most of the tropical and sub-tropical regions of the world. Thus it ensures a reasonable production of seeds with very little inputs.

II. Synthesis Of Biodiesel

Biodiesel, a methyl ester, is an alternative to diesel that is made from a triglyceride (like vegetable oil) and either ethanol or methanol. The oil used in the process can come from many sources including soybeans, corn, canola, and used frying oil. Because it comes from renewable resource, it is referred to as a biofuel. The process involves taking the oil, a triglyceride, combining it with an alcohol, to form biodiesel, which is either an ethyl ester or a methyl ester. The process uses a base, either potassium hydroxide or sodium hydroxide, as a catalyst to help in the process and forms glycerol as a byproduct. The reaction is shown below:



The process involves combining the methanol with the catalyst, in this case sodium hydroxide. This forms sodium methoxide, very strong base which is then combined with the vegetable oil. After the reaction is complete, the oil and glycerol form two separate phases with the glycerol being on the bottom and the biodiesel on the top. The glycerol is
then removed and the biodiesel layer is then rinsed with water to remove any remaining catalyst.
The saturated or unsaturated hydrocarbonchains R1, R2 or R3 plus the carboxylic group COO compose the whole structure of each fatty acid. Thesetriglycerides make up all kind of fats and oils both from
animal and vegetable origin. Excess in oil aciditydetermines a higher portion of fatty acids dissociated from the triglyceride molecule. Acidity is normally observed in values not greater than 10% in a volume basis; with acidityrate depending on time elapsed since oil extraction from feedstock.For recently manufactured oils or fats this acidity does not exceed 2 or 3%, which could be considered as the most frequent occurrence.



III. Experimental Setup

The experimental setup consist of Kirloskar single cylinder diesel engine having engine soft simulation software to provide various results.

Specification Of The Engine On Which Performance Test Carried Out

Engine type	Single cylinder, Diesel
Power	3.5KW at 1500rpm
Stroke ,bore	110mm,87.5mm
Crankshaft radius	36mm
Mass of connecting rod	280 gms
Mass of piston assembly	410gms
Izz of the connecting rod about centre of gravity	$0.660x10^{-3}kg\text{-}m^2$
Distance of C.G. of connecting rod from crank end centre	28.6mm
Maximum gas pressure	60 bar
Software for engine performance	Engine soft LV

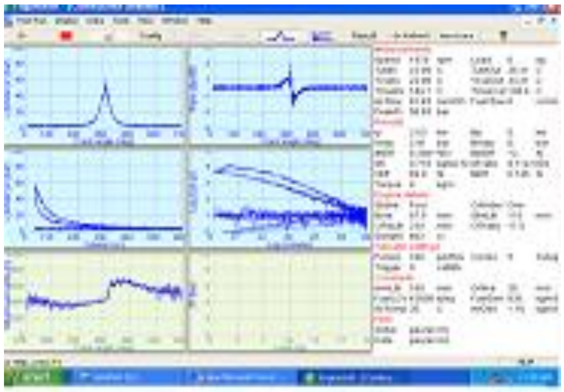


Fig.4a. Boundary condition Data obtained on Engine soft Software

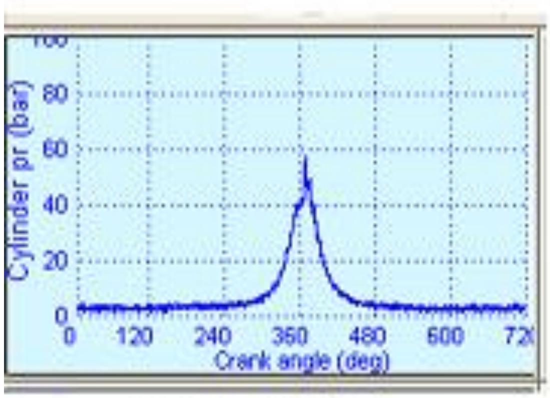
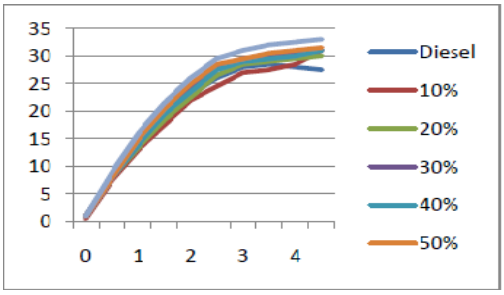


Fig.4b. Enlarge view of cylinder pressure

IV.

Results & Discussions

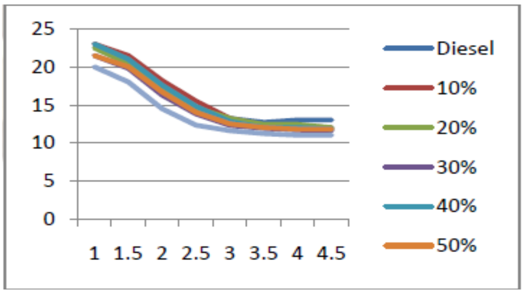
The outcomes of performance. Parameters by the given instrumentation as shown In graph below.in the graphs, horizontal axis shows The resistance and the vertical axis shows the respected determined
terms.



Brake thermal efficiency with load

V. Brake Specific Energy Consumption

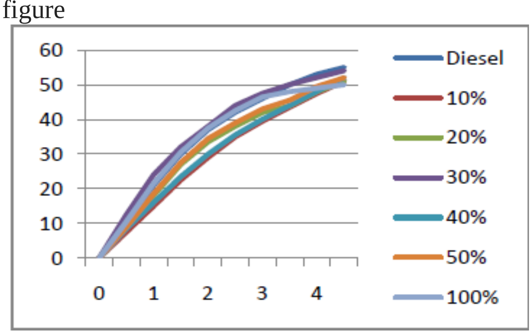
Brake specific energy consumption With load in MJ/KW hr. all the Resistance loading conditions rapeseed oil biodiesel and their blends with mineral diesel lower than diesel as Shown in figure.



Brake specific energy consumption with load

VI. Mechanical Efficiency

The mechanical efficiency is good with 30% blend of rapeseed oil biodiesel at lower loading but other blends are all most equal shown in figure



Mechanical efficiency with load

VII. Conclusions

Although the findings from this analysis were not conclusive, the results from this study were positive concerning the use of biodiesel and biodiesel blended fuel for diesel engines. As such, the following conclusions were drawn from the investigation:
1. Replacing the diesel fuel with biodiesel reduced the wear of aluminum components in a diesel engine.
2. Replacing the diesel fuel with biodiesel reduced the wear of iron, chromium and lead components in a diesel engine.
3.Fuel consumption is nearly same for neat diesel and blended diesel at all BMEP and have lower value at all BMEP for neat diesel
4.BSFC for bio-diesel increases for higher blending of bio-diesel, because of the lower heating value of bio-diesel as compared to diesel fuel.

It was concluded that SRO can be used as a diesel fuel extender in unmodified direct injection diesel engines. The only practical difference observed in this study is that the injectors require more frequent servicing compared with diesel operation. The technology for producing SRO is relatively simple and hence

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