EXPERIMENTAL STUDY ON PERFORMANCE CHARTERISTICS OF C.I. ENGINE FUELED WITH BIODIESEL AND ITS BLENDS DI ETHYL ETHER

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Abstract:

Diesel engines are widely used in almost all walks of life and cannot be dispensed with in the near future. As the fossil fuels now mainly used in diesel engine and continually depleting accompanied by increasing consumption and prices day by day, there is a need to find out an alternative fuel to fulfill the energy demand of the world. Alternative fuels like bio-diesel, are being used as an effective alternative to diesel. The feasibility of bio-diesel production from palm oil was investigated with respect to its fuel properties. In this study an oxygenated additive diethyl ether (DEE) was blended with Palm Oil Bio-Diesel (POME) in the ratios of 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%and 50% and tested for their properties improvement. These blends were tested for their performance characteristics on C.I engine. Based on the performance characteristics of the fuel blends the best fuel blend is concluded.

Keywords: Bio-diesel, Di-ethyl ether, C.I.Engine

Introduction:

Diesel engines are the major source of transportation, power generation, marine applications, etc. Hence diesel is being used extensively, but due to the gradual depletion of fossil fuel reserves and the impact of environmental pollution, there is an urgent need for suitable alternative fuels for the use in C.I. engine (Kumar et al., 2008). In view of this, Vegetable oils have become more attractive recently because of its environmental benefits and the fact that it is made from renewable resources. Vegetable oils are a renewable and potentially inexhaustible source of energy with an energetic content close to diesel.

More than one hundred years ago, Rudolf Diesel tested vegetable oil as the fuel for his engine (Sharma et al., 2008; Anbumani and Singh, 2010). With the advent of cheap petroleum, appropriate crude oil fractions were refined to serve as fuel and diesel fuel and diesel engines evolved together. In the 1930s and 1940s vegetable oils were used as diesel fuel from time to time, but only in emergency situations. Recently, there has been a renewed focus on use of vegetable oils and biodiesel fuel (Suryawanshi,2006; Prasad et al., 2009).

Different kinds of vegetable oils and biodiesel have been tested in diesel engines. Its reducing characteristic for greenhouse gas emissions, its help on reducing a country's reliance on crude oil imports, its supportive characteristic on agriculture by providing a new market for domestic crops, its effective lubricating property that eliminates the need of any lubricate additive and its wide acceptance by vehicle manufacturers can be listed as the most important advantages of the biodiesel fuel (Srivastava and Verma,2008; Karaosmanoplu, 1999; Lawrence et al., 2011; Singh and Singh, 2010). There are more than 350 oil- bearing crops identified, among which only jatropha ongamia, sunflower, safflower, soya bean, cottonseed, rapeseed and peanut oils are considered as potential alternative fuels for diesel engines. The present study aims to investigate the use of palm oil as an alternate fuel for compression ignition engine, to find performance characteristics of blended bio-diesel samples (blended with Diethyl ether) and to find the best fuel sample for the C.I engine as a fuel.

Diethyl ether, also known as ethyl ether, sulfuric ether, simply ether, or ethoxy ethane, is an organic compound in the ether class with the formula. It is a colorless, highly volatile flammable liquid. It is commonly used as a solvent and was once used as a general anesthetic. It has narcotic properties and has been known to cause temporary psychological addiction, sometimes referred to as etheromania. Which is having the properties, Density: 713.40 kg/m^3, Formula: $(C_2H_5)_2O$, Boiling point: 34.6 °C, Molar mass: 74.12 g/mol, Melting point: -116.3 °C, IUPAC ID: Ethoxy ethane

Fuel sample preparation:

To prepare a fuel sample of oxygenated fuel we opted the method of using magnetic stirrer shown in figure 2.1 which helps us in making the fuel homogenous. We are mixing the bio-diesel with Diethyl ether according to percentages in volume of liquids which we are mixing. At first we need to take the Bio-diesel and Diethyl ether in two separate beakers with the help of measuring jar measure the bio-diesel up to 950ml and in the other measuring jar measure Diethyl ether up to

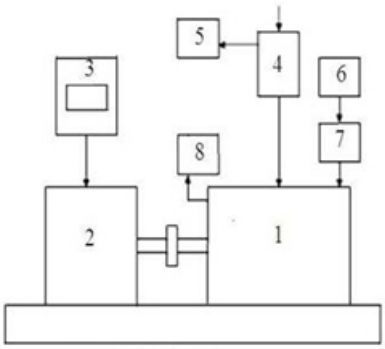
50ml.pour the two solutions in the beaker and place the magnetic stirrer in it and place the beaker on the pan as shown in the and start stirring the sample well for a time span of 1hour. Then allowed to cool the sample and store the sample which is now called as homogenous oxygenated fuel which can be used in experimentation.

As mentioned above the preparation of 5% Diethyl ether and 95% bio-diesel volume based on a magnetic stirrer cum heater. Similar methodology is used for preparation of other 10 fuel samples by adding oxygenated fuels, which the test samples are listed below.

1.95% Bio-diesel and 5% Di Ethyl Ether
2.90% Bio-diesel and 10% Di Ethyl Ether
3.85% Bio-diesel and 15% Di Ethyl Ether
4.80% Bio-diesel and 20% Di Ethyl Ether
5.75% Bio-diesel and 25% Di Ethyl Ether
6.70% Bio-diesel and 30% Di Ethyl Ether
7.65% Bio-diesel and 35% Di Ethyl Ether
8.60% Bio-diesel and 40% Di Ethyl Ether
9.55% Bio-diesel and 45% Di Ethyl Ether
10.50% Bio-diesel and 50% Di Ethyl Ether
11.100% Bio-diesel
12.100% Diesel

Experimental setup:

For the Present project work, the existing 4 stroke Diesel engine which is available in thermal engineering laboratory has been chosen. The test engine is having the following specifications and is shown in figure.



1. Diesel engine
2. Eddy current dynamometer
3. Rheostat
4. Air box
5. U tube manometer
6. Fuel tank
7. Fuel measurement flask
8. Exhaust gas analyzer

Greaves make. 4stroke, single cylinder, air cooled, hand cranking type diesel engine.

Engine Bore : 78 mm
Engine stroke : 68mm
Displacement : 325cm3
Compression ratio : 18:1
s.f.c : 205 gm/hp/hr.
Dry weight : 38kg
Loading device : eddy current dynamometer load

The fuel measuring device used in the experiment is a burette with 3way cock.

Experimental procedure:

Oxygenated fuel (fuel sample) is to be taken into the fuel tank and is allowed to flow towards test engine by opening the 3 way cock, the knob facing to left. In this position the fuel flows from the tank to the engine filling the burette. It is mandatory to remove air blocks in the hose by removing the hose from the engine and hold it vertically up. After conformation it is reconnected (the hose back to the engine) and open the air bleed screw to allow the fuel to freely flow through the screw. Provide the decompression lever up. Remove load on the brake drum by loosening the screw rod Crank the engine to hear the fuel injection creek and the engine starts. After engine gets started weight for 10 minutes to stabilize the engine.

After engine gets stabilized speed, for no load condition apply 0 load on brake drum by using eddy current dynamometer and then adjust the speed of engine to1500rpm by using the throttle valve. Check the speed of the engine by using tachometer. Now take the readings of the water level in the two legs of U-tube manometer, note down the exhaust gas temperature and then measure the time taken for 5CC of fuel consumption.

Repeat the above procedure by applying the loads on brake drum by using eddy current dynamometer for the loads of 2, 4, 6,8 kgs for constant speed of 1500rpm ,and note down the corresponding readings.

Repeat the same experiment for all fuel samples including pure diesel, tabulate the corresponding readings, parameters and plot the corresponding graphs for each fuel samples.

Based on the above calculations and graphs we can analyze the performance characteristics of the engine for all fuel samples.

Result Analysis:

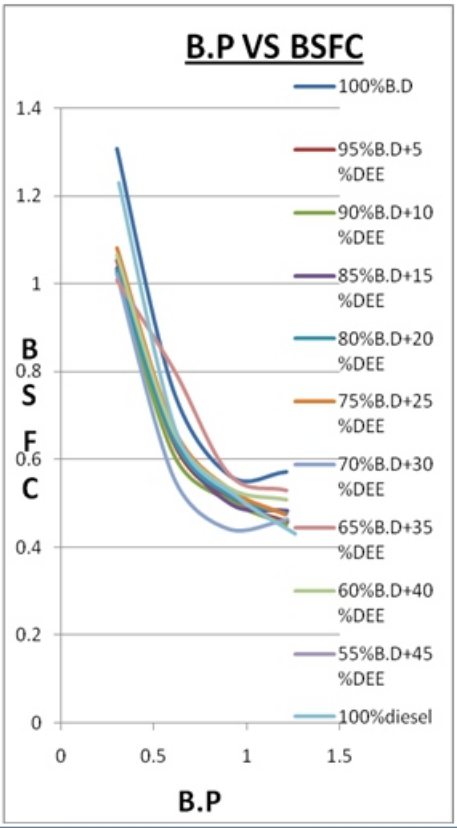
Graphs which are plotted for the values obtained by the testing of all the fuel samples are compared along with the values obtained by the pure diesel run.

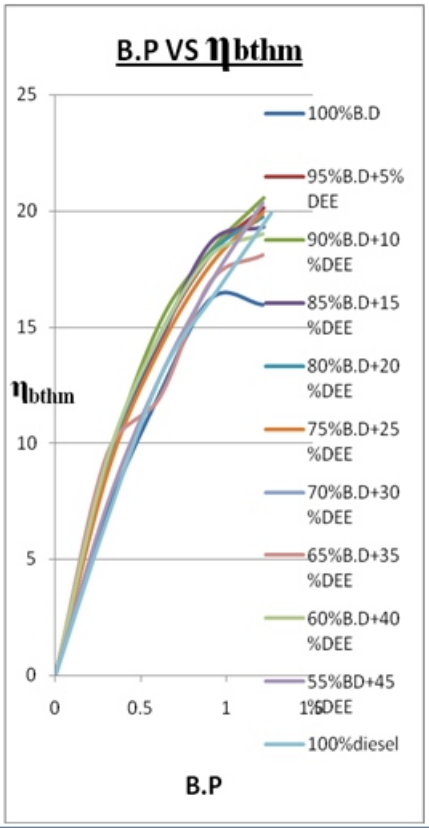
Conclusion:

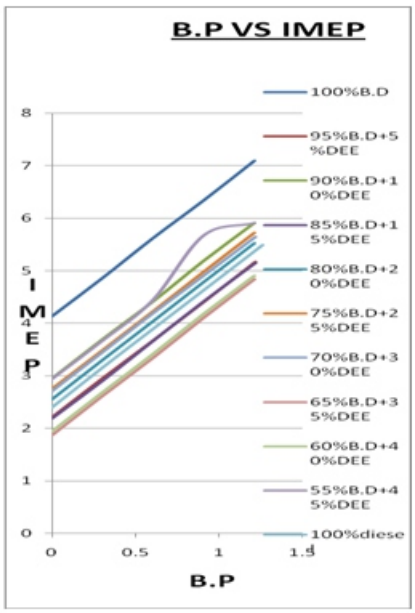
In this study an oxygenated additive diethyl ether (DEE) was blended with palm oil bio-diesel (POME) in the ratios of 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%and 50% and experimented in the C.I engine. The performance parameters of each fuel blend is calculated and then performance characteristic plots are plotted for all fuel blends.

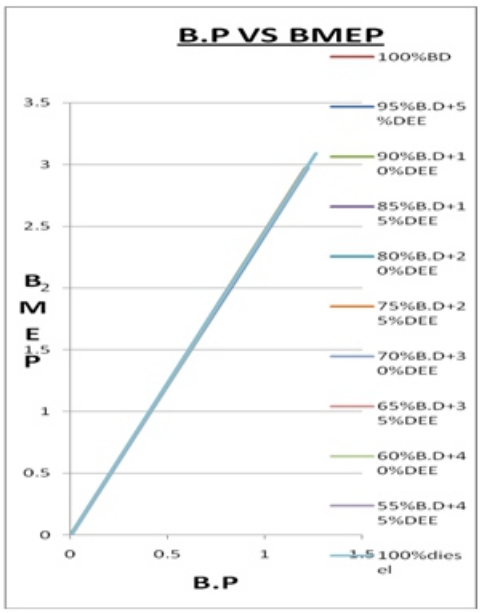
In this experimentation for the fuel sample of 50%B. D+50%DEE the performance test on C.I engine has not occurred because more amount of diethyl ether content in the solution. As we know diethyl ether has more volatile and more oxygen content in the solution. So the speed of the engine was fluctuated and temperature of the engine reaches to so high, hence the engine cannot run by this sample.

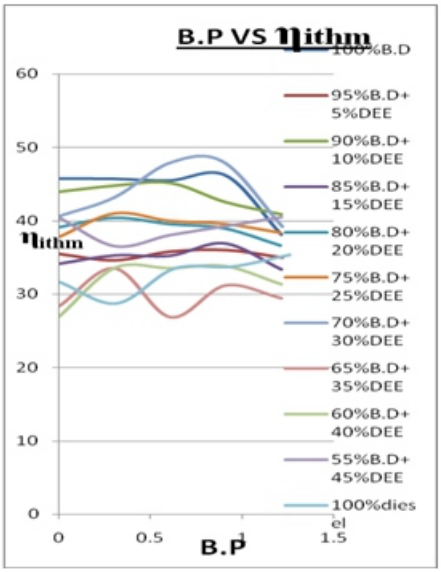
By comparing the performance parameters and performance characteristics of all fuel blends, the fuel blend of 70%B.D+30%DEE given the best result over the all other fuel blends. Hence the fuel blend of 70%B. D+30%DEE is the best alternative fuel for Diesel.

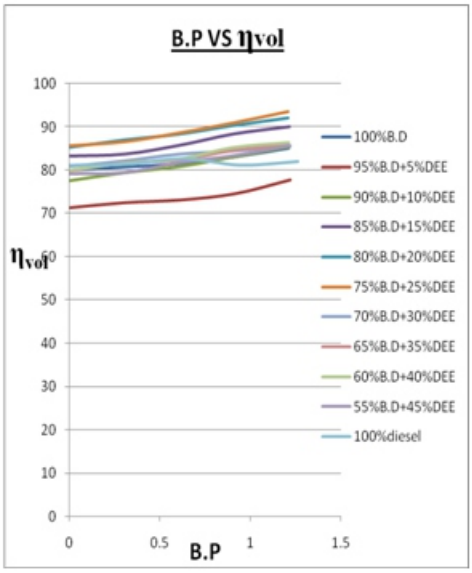


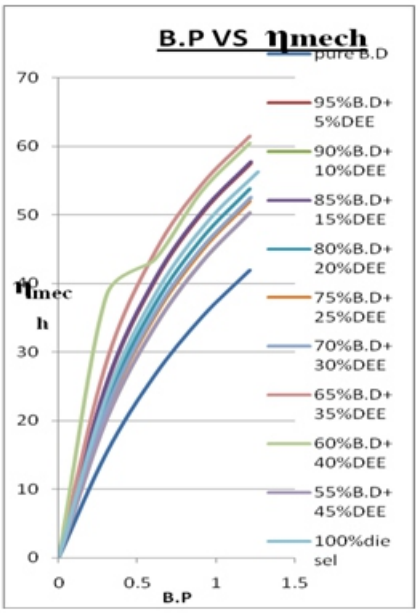


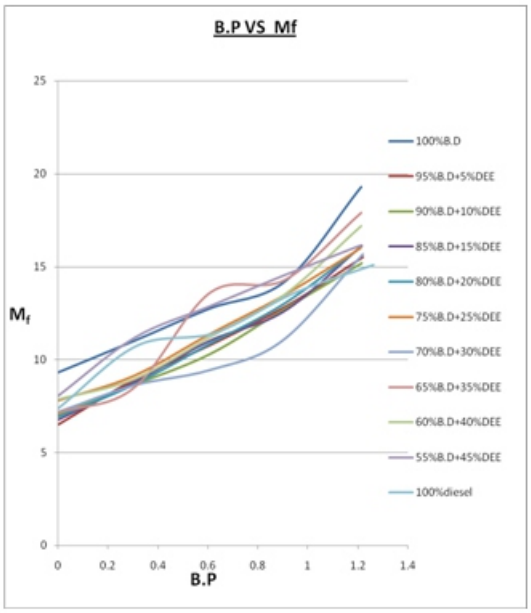












Fuel sample	Load(kgf)	B.S.C.Fkg/kwhr)	η_{bthm} %
100% Bio diesel	6	05626	16.24
95%B.D+5%DEE	6	0.5623	18.172
90%B.D+10%DEE	6	0.5055	18.33
85%B.D+15%DEE	6	0.5007	18.63
80%B.D+20%DEE	6	0.517	18.16
75%B.D+25%DEE	6	0.534	17.704
70%B.D+30%DEE	6	0.4415	21.59
65%B.D+35%DEE	6	0.5663	16.96
60%B.D+40%DEE	6	0.5358	18.06
55%B.D+45%DEE	6	0.5758	16.93
50%B.D+50%DEE	6	-	-
100% diesel	6	0.516	16.58

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