Engine Performance & Emission Testing by using Hybrid Biodiesel Added with Diethyl Ether

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Abstract - *An* in This present research work waste cooking biodiesel combined with diesel fuel blends where used as alternative fuels for diesel engines. The six different types of blends namely B06, B12,B18,B24,B30,B36 where prepared. The optimization of production of biodiesel from transterification process was evaluated on varying the various parameters such as reaction time and molar ratio. *Now a day present conditions of fuels price are* going increasing day by day. And the emission no0rms are becoming stringent. So there is need for reducing the emission and improve the performance of engine.

The aim of this work is to provide an environmental assessment of a diesel engine by analyzing the emission of CO, CO2 and NOx that result from the combustion process as well as analyzing technical performance related to consumption and development of power and torque in industry test Rig.

Key Words: **hybrid biodiesel, emission, biodiesel blends B06,B12,B18,B24,B30,B36.**

1. INTRODUCTION

Fossil fuels are reducing and in order to maintain the current levels of energy use and the transport systems we rely on we need to find alternatives. There are also environmental matter about the effects of using fossil fuels such as pollution and climate change. In case of internal combustion engine fuel is most necessary thing for the working of automobiles, without which automobile cannot run. The heat energy required in the I.C. Engine of the automobile is generally produced by the chemical reaction of used fuel and oxygen from inside of the engine cylinder. The reaction time for efficient operation is very small. The characteristics of the engine fuels should be such that the rate of pressure and temperature rise inside the engine cylinder due to combustion is moderate; also it should reduce the possibility of large mechanical and thermal stresses in the engine components. The fuels must require to have properties like low pollution, high energy density, and high thermal stability, low deposit forming tendencies, low wear and corrosion of the engine parts. It should help in easy starting under ambient conditions. The most commonly fuels used for today's engines are refined petroleum products. These fuels are liquid in nature and they include petrol and diesel.

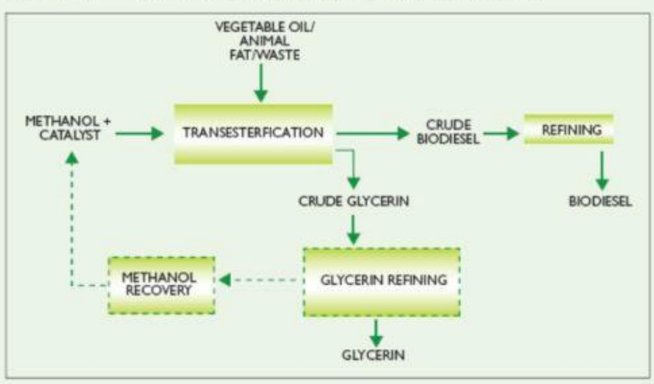
1.1 Esterification

Etherification is the first process of making biodiesel from crude oil. This process consisting of removal of acid content in the crude oil. Sulphuric acid is used as acid removal agent in the etherification process.

1.2 Transesterification

Generally, biodiesel is produced by means of transesterification. Transesterification is the reaction of a lipid with an alcohol to form esters and a by product, glycerol. It is, in principle, the action of one alcohol displacing another from an ester, referred to as alcoholysis (cleavage by an alcohol). The reaction i reversible, and thus an excess of alcohol is usually used to force the equilibrium to the product side. The stoichiometry for the reaction is 3:1 alcohol to lipids. However, in practice this is usually increased to 6:1 to raise the product yield. Transesterification consists of a sequence of three consecutive reversible reactions. The first step is the conversion of triglycerides to diglycerides, followed by the conversion of diglycerides to monogly cerides, and finally monogly cerides into glycerol, yielding one ester molecule from each glycerine at each step, equilibrium lies towards the production of fatty acid esters and glycerol. The catalyst used has a significant effect on the reaction, raising the rate notably.

FIGURE I BASIC BIODIESEL PRODUCTION PROCESS



2. Properties of Biodiesel Blends

Table -2.1: Properties of Biodiesel Blends

Sr. No	Test Descriptions	B00%	B6%	B12%	B18%	B24%	B30%	B36%
1	Density (gm/cc)	0.832	0.833	0.834	0.836	0.837	0.838	0.840
2	Calorific Value (MJ/Kg)	42.5	42.4	42.22	42.09	41.90	41.77	41.55
3	Cetane No.	49.00	49.45	49.73	49.90	50.13	50.29	50.51
4	Viscosity (mm2/s cc)	2.7	-	-	-	2.96	-	-
5	Flash Point (°C)	64	67	76	86	95	102	107
6	Fire Point (°C)	71	-	-	-	102.0	-	-
7	Cloud Point (°C)	-4	-	-	-	2.0	-	
8	Pour Point (°C)	-9	-	-	-	-1.0	-	-
9	Ash (%)	0.05	-	-	-	0.1	-	-

3. Engine performance testing and analysis

3.1 Title of test rig

Single cylinder CI Engine with eddy current Dynamometer. In this test following terms are involved:

3.2 Brake Specific Fuel Consumption [BSFC]:

BSFC is determined based on brake output of engine while ISFC is determined based on indicated output of the engine.

3 .3 Brake Power:

The power produced by an engine is expressed in Kilowatt. When the power developed is measured by means of a dynamometer or similar braking device, it is called brake power.

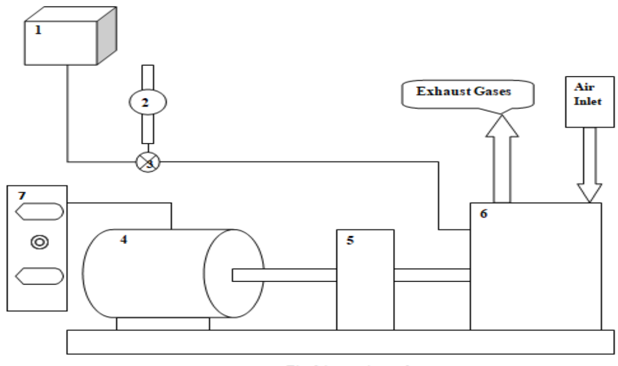
3.4 Brake Thermal Efficiency:

Brake thermal efficiency is based on the brake power of the particular engine. This efficiency gives an idea of the output generated by the engine with respect to heat supplied in the terms of fuel.

3.5 Eddy Current Dynamometer:

Eddy current dynamometer is used to measure engine torque and power. It works on the principle of eddy current generation that opposes change in magnetic flux.

Eddy current is generated when conductor moves in changing flux. The load on engine is varied by varying current supply.



1. Fuel Tank
2. Burritt (50 cc fuel measurement)
3. Valve
4. Motor
5. Eddy current dynamometer
6. Engine
7. Control panel

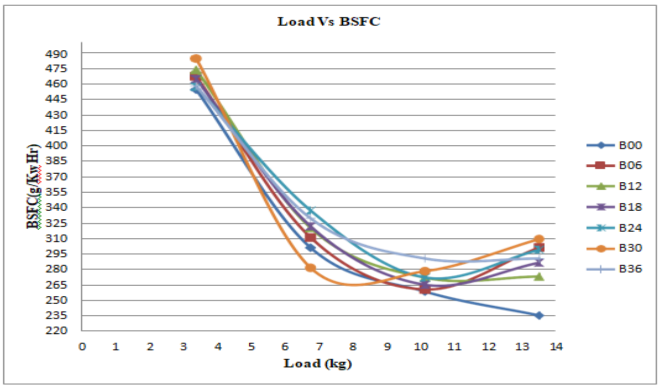
3.6 Engine specifications:

As single cylinder CI engine is available in Gadre Industries, we took permission for that and we decided to perform on single cylinder C.I.engine. The specifications of selected engine are as follows:

Make	: Gadre mini
Type	: 4 Stroke (C. I.) Diesel
Bore	: 80 mm
Fuel Capacity	: 3.75 lit
Displacement	: 1432 cc
Compression ratio	: 16:1
Rated Output	: 5 HP
Speed	: 2600
Dynamometer	: Eddy Current Dynamometer
SFC	: 270 g/KwH
No. of cylinder	: 1

4 RESULTS

4.1) Load Vs BSFC

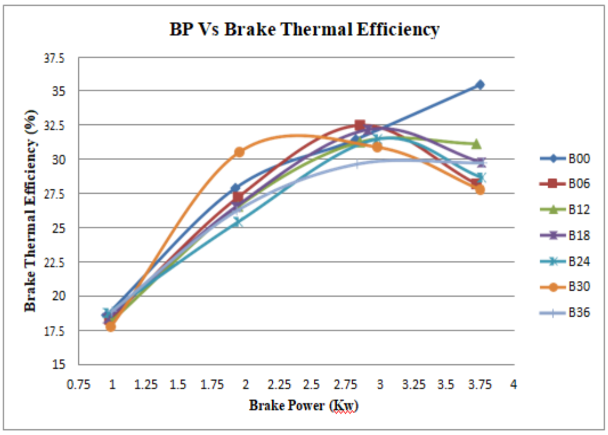


Graph 4.1 Load Vs BSFC

This graph is of Load Vs Brake Specific Fuel Consumption.

1. In this graph it is as the load increases the brake specific fuel consumption decreases. Brake specific fuel consumption is higher for B30 blend.
2. Also the nature of graph for B3 blend is very much different than the other. The BSFC for B30 blend increases after8 Kg load.

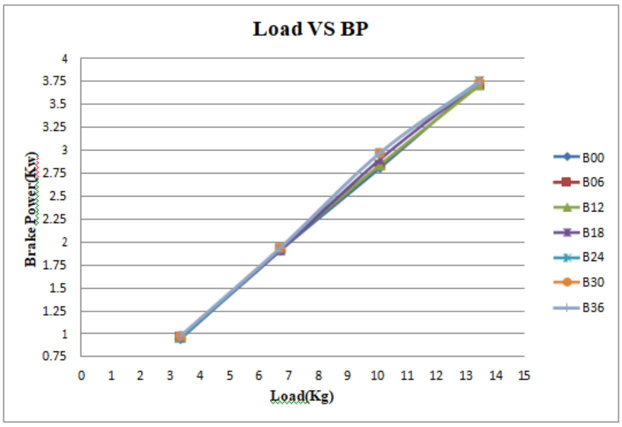
4.2) BP Vs Brake thermal efficiency:



Graph 4.2 **BP** Vs Brake thermal efficiency

1. This graph is of Brake Power Vs Brake Thermal efficiency.
2. For the other blends brake thermal efficiency increases up to certain load and after that it decreases.
3. Brake thermal efficiency for B00 is better than other.
4. Brake thermal efficiency for B30 is very much less.

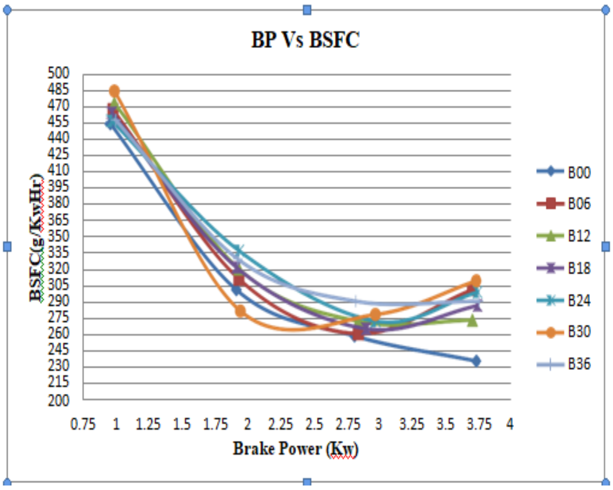
4.3) Load Vs BP:



Graph 4.3 Load Vs BP

1. In this graph as the load increases brake power also increases. This graph is of increasing nature.
2. The Brake power obtained for all blends are nearly equal at different loads except B36.
3. Brake power of B36 at full load condition is more than that of diesel.

4.4) Graph BP Vs Brake specific fuel consumption



4.4 Graph BP Vs Brake specific fuel consumption

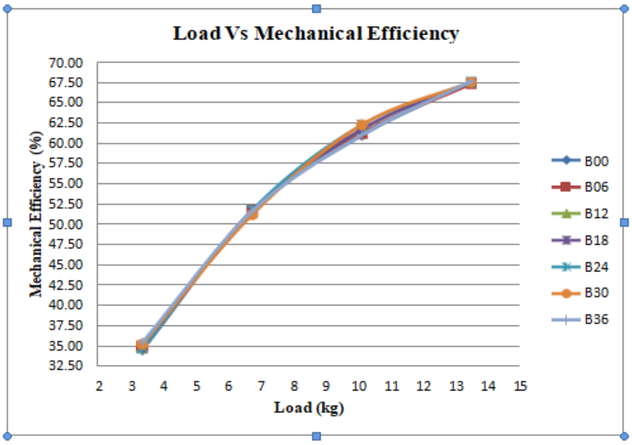
This graph of BP Vs BSFC.

1) As brake power increases brake specific fuel consumption decreases.

2) Brake specific fuel consumption for B30 is more than any other blend.

3) Brake specific fuel consumption for B00 is less at maximum power.

Load Vs Mechanical Efficiency:

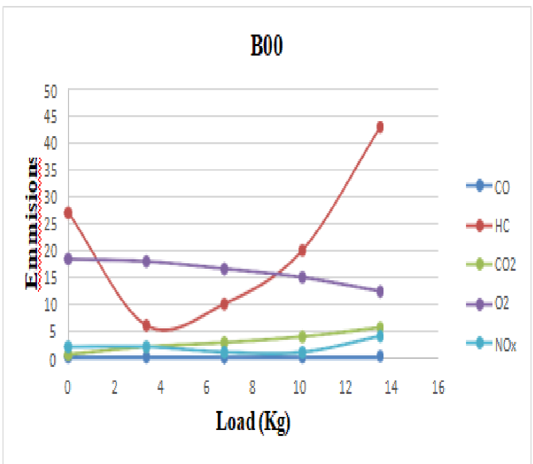


4.5) Graph Load Vs Mechanical Efficiency

1. This graph shows load Vs Mechanical efficiency. This graph is of increasing nature.
2. As load increases mechanical efficiency also increases.
3. Mechanical efficiency is nearly equal at all loads.

5. Emission results for various blends at different load are as shown below:

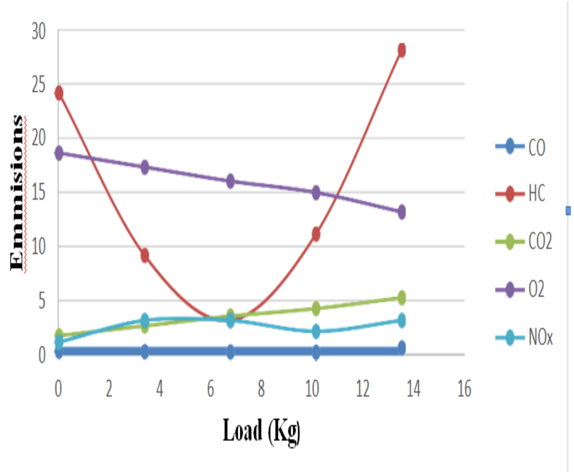
5.1) Emission of B00:



Graph 5.1 Load vs Emissions

1. This graph is for emissions of pure diesel. In this graph it is stated that at full load maximum HC is emitted.
2. NOx emission is high at full load condition.
3. As load increases the emissions are also increases.

5.2) Emission of B06:



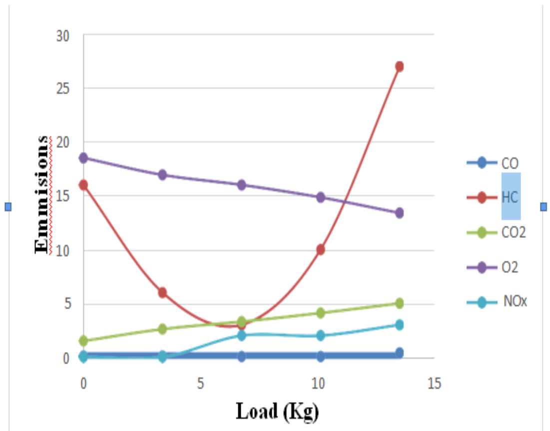
Graph 5.2 Emission of B06

1) This graph is for B06 blend. At full load Condition emission of CO and CO2 gases is maximum.

2) NOx emission is less as compared to B00 at full load condition.

3) As load increases emission of O2 decreases.

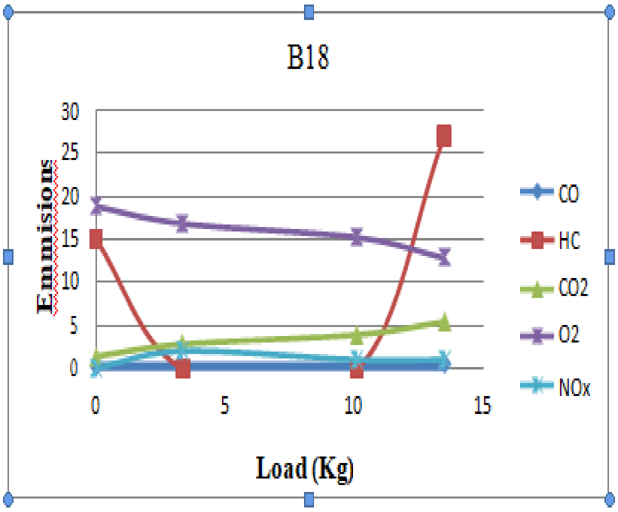
5.3) Emission of B12:



Graph 5.3 Emission of B12

1. This graph is of B12
2. Emission of HC goes on decreasing up to 50% load and after that it is increased.
3. As load increases O2 goes on decreasing.
4. As load increases NOx, CO2, CO goes on increasing.

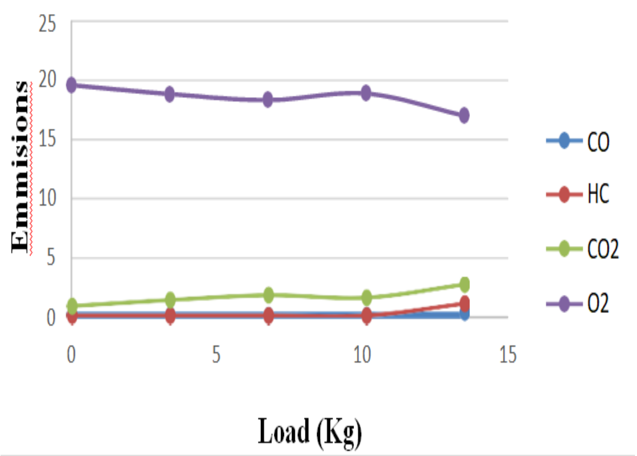
5.4) Emission of B18



Graph 5.4 Emission of B18

1. This graph is of B12
2. As load increases HC goes on decreasing up to 30% load, further it increases.
3. As load increases, CO_2 increases. As load increases O_2 decreases

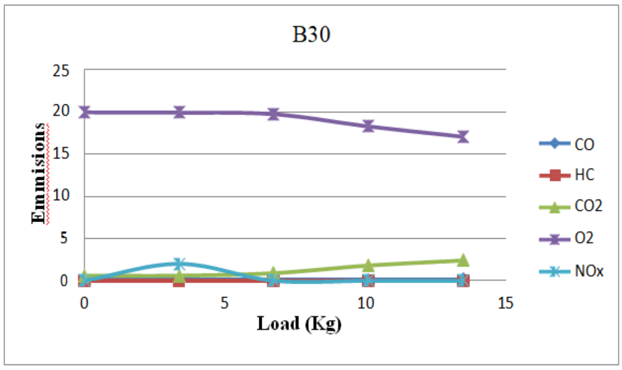
5.5) Emission of B24:



Graph 5.5 Emission of B24

1. This graph is of B24
2. HC is almost zero at all load except full load
3. As load increases O_2 decreases
4. As load increases CO_2 slightly increases

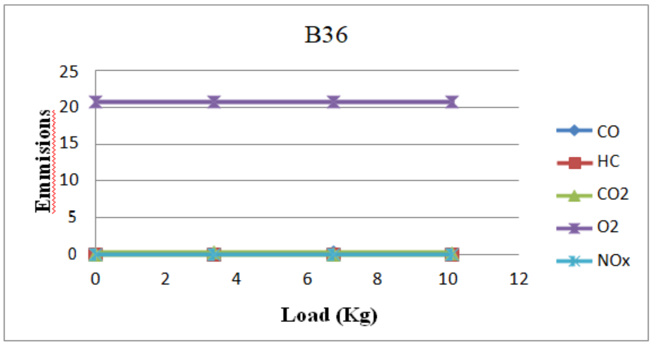
5.6) Emission of B30



Graph 5.6 Emission of B30

1. As load goes on increasing O_2 decreases and CO_2 goes on increasing
2. Emission of HC and NOx is almost nearly equal to zero.

5.7) Emission of B36:



Graph 5.7 Emission of B36:

1. As load goes on increasing O_2 remains same.

2. All the other emission gases equal to zero.

6. CONCLUSIONS

The study aims to evaluate the suitability of using biodiesel as an alternative fuel in I.C engine. Experimental investigations were carried out on the operating characteristics of the engines. The following conclusions are drawn from the investigations.

1 Biodiesel and its blends results in decreased brake thermal efficiency for load. This is due to biodiesel, have medium volatility result in atomization and spray

Characteristics, which lead to poor homogeneity of air fuel mixture which in turn lower the heat rate thereby reduction in brake thermal efficiency than that of diesel.

2) BSFC for biodiesel and its blends are higher than that of diesel. This is due to lower heating value of biodiesel,

lower the power generation for the same fuel consumption rate as compared to diesel. Due to lower heating value of biofuels, increasing percentage of biofuel in the blend increases BSFC.

3) The NOx, HC CO2 emissions for B30 B36 are comparatively much lower than that of diesel for part load, and slightly increase for full load. This is due to relatively

Complete combustion taking place at higher loading conditions.

4) Due to lower heating value of biofuels and increasing percentage of biofuel in the blend, increase in BSFC and brake power remains constant.

5) Brake power is slightly increased for B36 at full load.

From the above conclusions, it is proved that the biodiesel could be used as an alternative fuel in C.I engine which is used for agriculture purpose without any engine modifications.

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