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Application of Sunflower Biodiesel For Enhancement of Characteristics of Diesel

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Abstract: *Bio-Diesel is defined as a fuel comprised of monoalkyl ester of long chain fatty acids derived from vegetable oil or animal fats. It is made by using chemical reaction of vegetable oil and alcohol which produce fatty acid ester. It is basically a ecofriendly, alternative fuel for the compression ignition engine & mainly known as "B" factor which denotes amount of biodiesel in any fuel mixture.one of the promising substitute source of energy fuel in the transportation sector due to rapid depletion of petroleum reserves on one side and increased demand of energy as well as environmental pollution hazards on the other side. The addition of biodiesel to the diesel significantly improves the properties and it contributes to enhanced performance .This study investigate the use of Sunflower biodiesel. Experiments were conducted to study the effect of different blends of Sunflower biodiesel on the performance and emission characteristics of diesel engine at different operating conditions.*

Keywords:*Sunflower Biodiesel,Emission Parameters, Blended Fuels*

I. Introduction

Looking at the current scenario it can be easily predictated that the generations of Twenty-first century and ahead would be already running out of fuel. Recent natural calamities like floods and earth-quakes, are happening against the human civilization, because of this global warming. Scientists are assuming that the rate of earth quake and flood has increased dramatically in the recent years, which is somehow related to global warming. Global warming is the most harmful man made phenomenon,which the earth has ever experienced, and its consequences are far too dangerous than itself. The word itself says its meaning rise of global temperature of earth, and it's now become a chain reaction. It's all initiated because of recent industrialisation. With the beginning of the eighteen century the industrialization started, but then no one really knew what they are preparing for their children, but in recent years ,human being actually came to know about the long lasting hazards of global warming. Global warming is now a well accepted as hazardous phenomenon. It is extremely important to find out various ways to stop it. One of the main ingredient of this is green house gases, which are almost essential by product of automobiles and industries. Green house effect has been caused by these green house gasesresulting into the global warming. Green housegases playing major role are carbon dioxide, water vapour, ozone, methane, nitrus oxide. According to scientific study the situations could be worst if the average temperature of the earth is increased just by 4 degree Celcius. On the other hand natural resources like existing coal, petroleum and are almost used up by the human being , without which human existence can not be imagined .It is necessary to explore the new ways of getting energy.Human's dependencyon earth's natural resources to generate energy is very high. So it is on highest priority to find the possible solution to get some technology which will supply energy in both clean and inexhaustible way.

One of the most feasible solution for such problems is biodiesel. Biodiesel has dual advantage forthe current situation as biodiesel is inexhaustible at the same time clean. Biodiesel is almost a renewable energy source. There are many plants which can produce the biodiesel e.g. Jatropha, Karanja, Sunflower etc. The seeds of suflower are rich of oil which has very good calorific value. The recent work on the biodiesel as fuel goes around the extraction and blending it with ethanol or diesel in right proportion to make it an ideal fuel. There are many works that has been done in this area. This paper gives details of work mainly concerning sunflower biodiesel in the area of testing the performance of the compression ignition engine.

II. Experimental Study

The method of preparation of the biodiesel along with the experimental methods for obtaining the fuel properties and the details of the performance test facility are all presented below.AISSMS College's Chemistry Lab is utilized for the preparation and property testing of sunflower biodiesel.

2.1. Preparation of Biodiesel

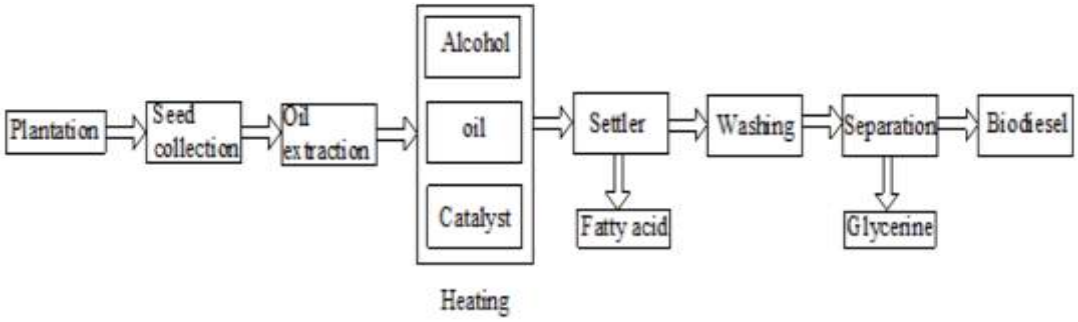

Figure No. 2.1: Block diagram of production process of biodiesel.

The raw materials involved in the reaction are sunflower oil, ethanol and the catalyst (NaOH). The reaction is made in a fume cup board. The different steps for the biodiesel production in laboratory are:

Figure No. 2.2: Measuring Cylinde **Figure No. 2.3:** Experimental Setup **Figure No. 2.4:** Separation Process

1. The mix ethanol/NaOH is heated to 50°C (inawaterbath) and stirred by a magnet at 800 rpm (constant speed), until, the catalyst is completely dissolved in the ethanol.
2. Reactor is used for pouring 100ml of sunflower biodiesel and heated upto 60°C by using heater.
3. The solution ethanol catalyst and the oil are mixed in a reactor. The reactor is deep in a water ultrasonic bath at 50°C and stirred to 600 rpm. The reaction is performe during 60 minutes.
4. Separation funnel is used to poured the final solution. The upper layer is the biodiesel and the lower layer is the by product glycerol.
5. Seperatingthe glycerol from the biodiesel.

6. The biodiesel is washed by water to neutralize the catalyst residue.
7. The amount of biodiesel is measured.
8. Measuring ofthe properties of the biodiesel: density, specific gravity, viscosity.
9. The experiment is repeated a number of times varying the ratio of ethanol/oil and the catalyst weight.
10.

$$\text{Triglyceride} + \text{ROH} \leftrightarrow \text{Diglyceride} + \text{RCOOR}_1$$

$$\text{Diglyceride} + \text{ROH} \leftrightarrow \text{Monoglyceride} + \text{RCOOR}_2$$

$$\text{Monoglyceride} + \text{ROH} \leftrightarrow \text{Glycerol} + \text{RCOOR}_3$$

Figure No. 2.5:Reaction for methyl ester biodiesel.

The experimental investigations are carried out in two phases. In the first phase, the various physiochemical properties of modified biodiesel are determined and compared with those of the base fuels. The properties studied are the flash and fire points, cloud and pour points and viscosity. Standard ASTM test procedures are used in the experiments. In the second phase, extensive performance tests are conducted on a single cylinder compression ignition engine using the modified blends of biodiesel and base fuelsblends.In order to evaluate the engine performance as well as the emission characteristics using an exhaust gas emission analyzer.

Table No. 2.1: Properties of sunflower biodiesel

Properties	Sunflower Biodiesel	Diesel
Specific gravity at 60º/60º F	0.8829	0.8434
Kinematic viscosity at 40 ºC (cSt)	4.29	3.60
Acid number (mg KOH/g)	0.42	-
Flash point (ºC)	92	70
Cetane index	46.62	54.0

2.3. Biodiesel Blends

Preparation of blends is completed by using measuring beaker and various blends like B20,B40,B60are prepared.

Figure No. 2.6: Bottlesof SunflowerBiodiesel Blends

2.4. Engine Experimentation

The experimental setup is as shown in Fig. No. 2.7 and the specifications are tabulated in Table No.2.2. The test fuel is checked for performance and emission in a Single Cylinder, Four Stroke, Direct Injection, Constant Speed, KirloskarDiesel Engine. Exhaust gas analyzer of AVL India PVT. LTD. is used to measure exhaust gases like CO, NOx, HC. Experiments are conducted with pure diesel, biodiesel and various blends of Sunflower biodiesel and diesel.

Figure No. 2.7: Diesel Engine Setup

Table No. 2.2: Specifications of Engine

Type of Engine	VCR Engine test setup 1 cylinder, 4 strokes, Diesel (Com.)
Power	3.5kW at 1500 rpm
Stroke	110mm
Bore	87.5mm
Dynamometer	Type eddy current, water cooled, Type Hydraulic

III. Result and Discussion

3.1. Fuel Consumption

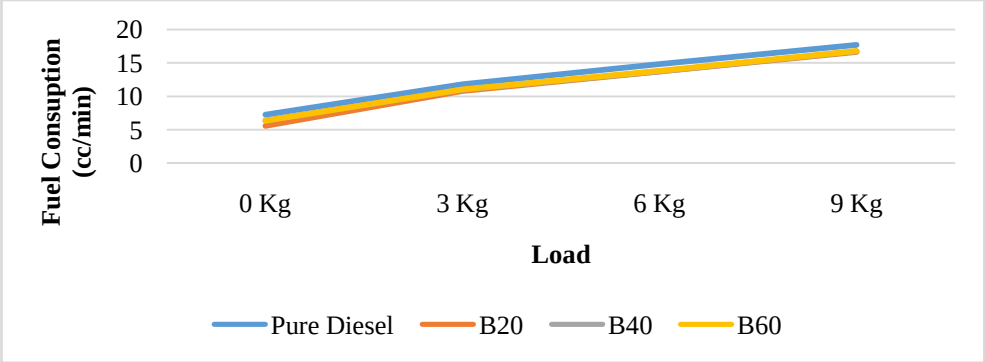

Figure No. 3.1: Fuel Consumption Vs Load

3.2. Brake Power

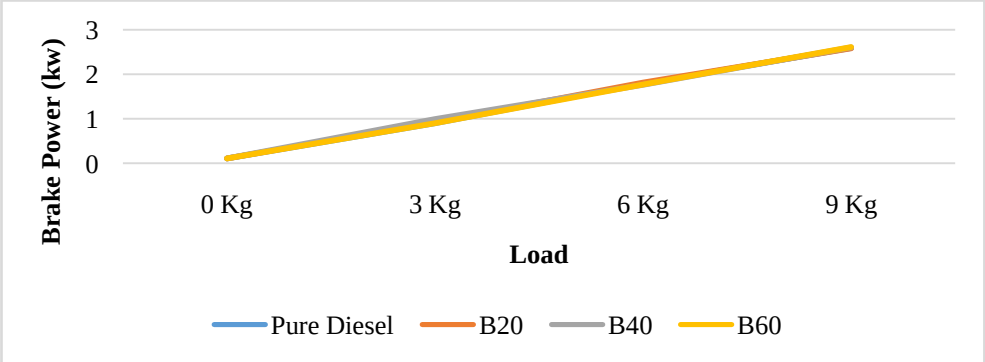

Figure No. 3.2: Brake Power Vs Load

3.3. Brake Thermal Efficiency

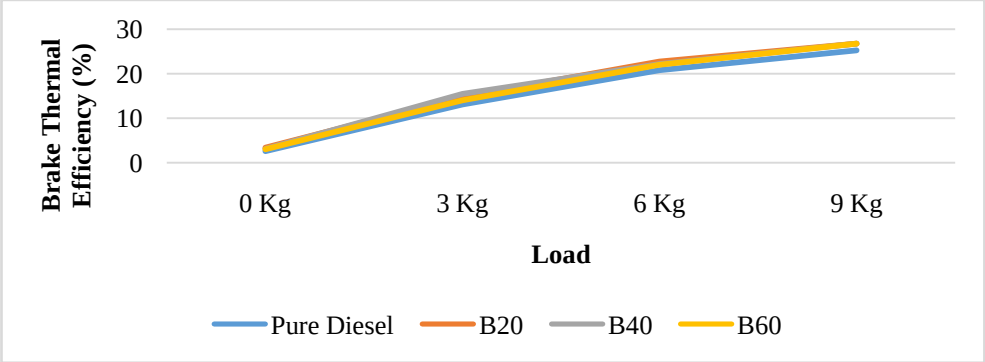

Figure No. 3.3: Brake Thermal Efficiency Vs Load

3.4. CO_2 Emission

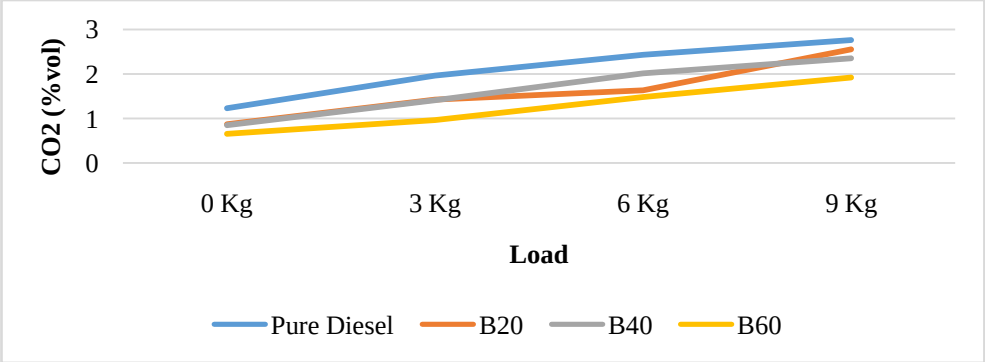

Figure No. 3.4: CO_2 Vs Load

3.5. HC Emission

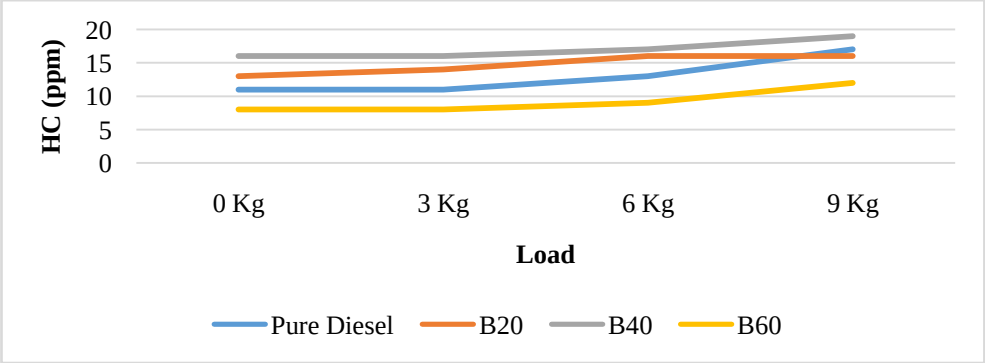

Figure No. 3.5: HC Vs Load

3.6. NO_X Emission

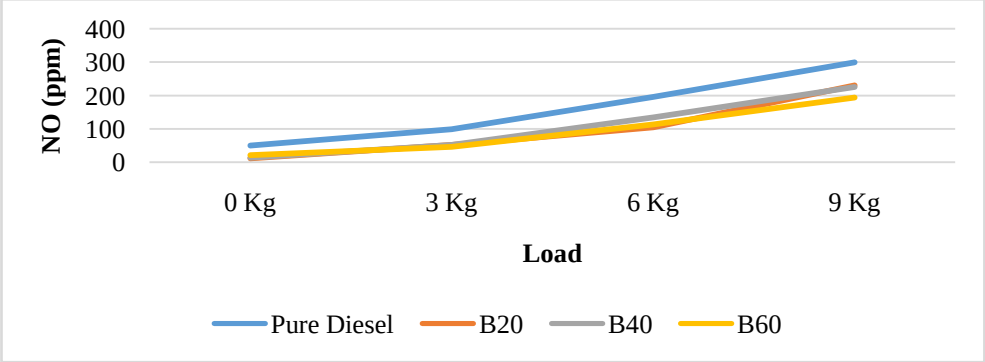

Figure No.: NO_X Vs Load

IV. Conclusion

The experiments are conducted with Sunflower biodiesel. Study of detail investigation regarding the performance and emission characteristics is discussed in results. The conclusions based on the experimental testing are as follows:

- In the B20 biodiesel blend, the fuel consumption is decreased by 9.32%, brake power increased by 2.61% and also brake thermal efficiency is increased by 9.58%.
- In case of emissionparameters B60 biodiesel blend as CO_2 decreased by 22.79% and NO decreased by 38.04% but HC is increased by 13.46%.

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