

Performance and Emission Characteristics of Diesel Engine from Non Edible Vegetable Oil

Dr.M.Pandian¹, S.Harish kumar², S.Nandha kumar³, S.Parthiban⁴, P.G. Pranav ram⁵

¹Professor Department of Mech, Erode Sengunthar Engineering College, Perundurai, 638057

^{2 3 4 5}UG Student Department of Mech, Erode Sengunthar Engineering College, Perundurai, 638057

Abstract—The growing demand for conventional fuel sources has prompted people to consider alternative fuels that can replace current needs by a certain percentage. A great deal of investigation and research has been carried out to identify the non edible seeds as a potential raw material for which oil can be extracted. Experimental studies have been carried out by several researchers in the production of biodiesel from extracted, transesterified oils and have studied the different characteristics of the fuel produced. This biodiesel is made by mixing the Cotton seed oil and jojoba oil and test is done by the mixing this diesel. A number of experimental works are carried out using available fuel from non-edible oil raw materials to study the performance of this biodiesel using a compression ignition engine.

Index Terms: Biodiesels, Cotton seed oil, Jojoba seed oil, diesel engine.

INTRODUCTION

Due to the scarcity of petroleum and the rising expense of diesel fuel, a new source of diesel fuel is urgently needed. The majority of oil fields in the globe (located in the Middle East) are linked to political and economic issues. Finding a new strategy or solution for finding various places to develop new fuels will minimize the turmoil caused by the world's reliance on Middle Eastern fuel supplies. Alternative fuels reduce toxic exhaust emissions (such as carbon dioxide, carbon monoxide, particulate matter, and sulphur dioxide) and ozone-producing emissions significantly. Alternative fuels can be less expensive to use, not only in terms of the fuel itself, but also in terms of the amount of time they can be used for Biofuels derived from locally grown and processed crops assist to reward farmers for their dedication and hard work. Biodiesel and ethanol cooperatives are the consequence of large, obsolete farmer cooperatives

that help individuals regain control of their own power. Alternative fuels are frequently developed domestically, leveraging a country's resources and bolstering the economy. When compared to a comparable gasoline car, vehicles powered by hydrogen fuel cells and diesel are more fuel efficient.

EXPERIMENTAL SETUP

The goal of this research is to investigate the performance and emission characteristics of a tiny direct injection (DI) type compression ignition engine that runs on vegetable oil methyl esters. This engine is coupled to a Pony brake dynamometer, which measures engine performance as a function of engine speed. The emission characteristics of this diesel engine are determined using a gas analyzer and a smoke metre. The engine used in the present study is the Twin cylinder, 4 stroke, water cooled, single cylinder diesel engine of 5.2 kW rated power. The engine was directly coupled to an eddy-current dynamometer equipped with a load controller. On a computer, the fuel flow rate, speed, load, exhaust gas temperature, and gas flow rate were all shown in figure1.





Figure 1 Figure 2

The transesterification response become accomplished 6:1 of molar ratio with 0.6% of KOH catalyst. it's far an equilibrium reaction wherein extra alcohol is required to expedite the response very close to finishing touch. The Cotton seed oil , jojoba oil changed into chemically reacted with methanol or ethanol within the presence of catalyst to produce methyl ester. at the stop of response glycerol turned into produced as a by means of product. first of all produced the aggregate changed into stirred continuously and then allowed to settle under gravity in a separating funnel.

After 24 hours the Cotton seed oil was separated as two awesome layers comprised of gravity settle. The top layer turned into separated out it is known as ester. lower layer is called glycerol. The separated ester is blended with heat water around 10% quantity of ester to do away with the catalyst present inside the ester. allowed to settle below gravity for another 24 hours the catalyst dissolved in water from which changed into separated and eliminated the moisture.

EXPERIMENTAL SETUP OVERVIEW

The Diesel engine (also known as a compression-ignition engine) is an internal combustion engine that makes use of the warmth of compression to provoke ignition and burn the gasoline that has been injected into the combustion chamber. This contrasts with spark-ignition engines which includes a petroleum engine (fuel engine) or fuel engine (using a gaseous gas as opposed to gas), which use a spark plug to ignite an air-gas aggregate. Compression ignition engines have excessive thermodynamic efficiency therefore they've usually been the first preference for heavy duty motors. however, future emission regulation poses a mission for upcoming diesel engine combustion systems. destiny emission rules are be coming greater restrictive, forcing engine

designers toward lower exhaust emissions and better performance. With this perspective, expertise of the injection and the combustion procedures is presently being considered as a chief studies objective. specially, the evaluation is focused on direct injection Diesel engines, in which the gasoline-air mixing process plays a dominant function on engine overall performance. best with a great knowledge of these phenomena it will be feasible to reduce the emission levels without impairing the engine overall performance and performance.

STUDY OF FUEL PROPERTIES

CHARACHTERISTICS OF JOJOBA OIL

1. Freezing point 7-10.6 °C.
2. Refractive index 1.5650 at 25 °C.
3. Specific gravity 0.863 at 25 °C.
4. Smoke point 195 °C.
5. Flash point 295 °C.
6. Iodine number 82.
7. Viscosity 48 SUS at 99 °C & 127 SUS at 37.8 °C.
8. Viscosity index 190-230.
- 9.

CHARACTERISITICS OF COTTON SEED OIL

1. It is a clear yellow color and looks quite similar to corn oil.
2. It has smoke point of 232C (450F)The cotton seed oil is neutral in taste.
3. The density of cotton seed oil at 15C is 925.87kg/cubic m2
4. It contains a high amount of antioxidants (tocopherols) which are essential for good health.

CHARACTERISTICS OF DIESEL

1. Centane number: minimum 40 (as of 2000).
2. Cloud point: -34 degrees celsius (maximum).
3. Fame content (biopart): approximately 7%.
4. Density: 0.832 kg/L.
5. Sulphur content: 500ppm.
6. CFFP - cold filter plugging point: up to -5 degrees Celsius.
7. Heating (calorific) value: 45.5MJ/kg.
8. Flash point: 40 degrees celsius (minimum).
9. Viscosity: (at 40 degrees celsius) 2.5-3.5mm2/s.
10. Carbon residue: 0.1% (maximum mass).

11. Ash: 0.01% (maximum).
12. Oxidation stability: up to 0.025mg/ml.

Volatility

Volatility of fuel's potential to vaporize under distinct stress and temperature. It's far the property that most affects start up engine overall performance and is of specific interest, while excessive volatility is suitable in bloodless climate, it could reason lack of electricity or vapour lock in hotter climate. Excessive volatility can also cause evaporative emissions.

Cetane wide variety

The combustion and ignition traits of diesel engine fuels are expressed within the Cetane range. Fuels with high Cetane numbers have low automobile ignition and short ignition delay time. When you consider that an excessive octane variety means a decrease Cetane number not one of the opportunity behave Cetane number values high enough for use by myself in unmodified CI engines.

Unique gravity

Unique gravity is determined with the aid of ASTM-D-287. Diesel well-known shows a particular gravity of 0.85. Biodiesel particular gravity is stated to vary among zero.86 and 0.90 relies upon at the feedstock used. The common gravity reported for soy methyl esters is zero.885. The precise gravities of biodiesel and diesel are very comparable.

Flash point

Flash factor, as defined by using ASTM-D-93, is a measure of the temperature to which a fuel need to be heated such that an aggregate of the vapor and air above the gasoline may be ignited. All conventional diesel fuels have high flash factors (54°C, minimum, seventy one°C, common). The flash factor of neat biodiesel is normally extra than 93°C.

Boiling point determination

20 ml of biodiesel became poured into a heating beaker and thermometer inserted, cautiously converted and heated with a warm plate. Because the temperature increases, the factor at which the pattern commenced boiling was document.

Response time

It located that the conversion charge of fatty acid esters will increase with reaction time. At the start, the reaction is gradual because of the integration and dispersion of alcohol into the oil. After some time, the response proceeds very speedy. Usually, the yield reaches a maximum at a response time of 60 min, and then stays tremendously consistent with an addition growth in the response time moreover, excess response time will result in a discount in the product yield due to the backward reaction of transesterification, resulting in a loss of esters as well as inflicting greater fatty acids to form soaps.

OBJECTIVES

- To lessen the reliance on overseas petroleum.
- To reduce the Herbage- house fuel emigration.
- To lessen the air pollution.

Air

Due to the fact the carbon dioxide emitted from biodiesel burning is compensated by means of carbon dioxide absorbed from developing soybeans or other feedstocks used to make the power, the use of it minimise existence cycle emigrations. Argonne country wide Laboratory performed an existence cycle evaluation and determined that the usage of B100 reduced carbon dioxide emigrations by using 74 while as compared to petroleum diesel.

METHOD AND MANUFACTURING OF BIODIESEL

Biodiesel

Biodiesel manufacturing is the technique of producing the biofuel, biodiesel, via the chemical reactions of transesterification and esterification.

Reaction

Base-catalyzed transesterification reacts lipids (fat and oils) with alcohol (normally methanol or ethanol) to provide biodiesel and an impure coproduct, glycerol.

If the feedstock oil is used or has an excessive acid content material, acid-catalyzed esterification may be used to react fatty acids with alcohol to produce biodiesel. Other strategies, including fixed bed reactors, supercritical reactors, and ultrasonic reactors, forgo or lower the usage of chemical response that reduces the first-rate of substance in

chemistry. almost all biodiesel is made out of virgin vegetable oils the use of the base-catalyzed technique as it's miles the maximum economical manner for treating virgin vegetable oils, requiring most effective low temperatures and pressures and producing over 98% conversion yield (supplied the starting oil is low in moisture and loose fatty acids). but, biodiesel comprised of different resources or via other methods may additionally require acid catalysis is which is much slower.

Ultrasonic reactor method

In the ultrasonic reactor technique, the ultrasonic waves motive the reaction aggregate to supply and fall apart bubbles constantly; this cavitation simultaneously provides the integration and heating required to perform the transesterification procedure. Use of an ultrasonic reactor for biodiesel production can substantially reduce reaction time and temperatures, and electricity input using such reactors, the system of transesterification can run inline in preference to the usage of the time-ingesting batch processing. commercial scale ultrasonic devices allow for processing of numerous thousand barrels in step with day.

Transesterification

Transesterification is defined because the chemical conversion technique of triglycerides with alcohol into alkyl esters with the assist of a catalyst. on this method, generally used alcohols are methanol and ethanol due to their low fee and clean availability.



Figure 3: BIODIESEL AFTER FILTRATION



Figure.4 BIODIESEL



Figure.5 GLYCEROL

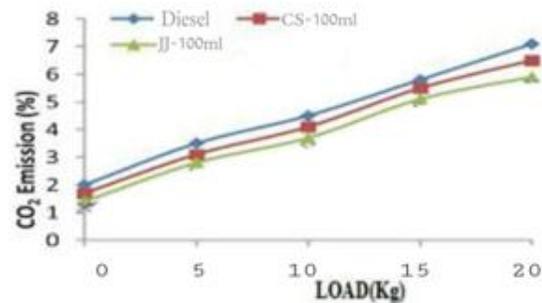
UNITS

- Load – w.
- Breake power (Bp) – kw.
- Total Fuel Consumption (TFC) – kg/hr.
- Specific Fuel Consumption (BSFC) – kg/kW.hr.
- Brake Thermal Efficiency (BTE) – (%) percentage.
- Speed – rpm
- Diameter – mm
- Power – BHP
- Time – seconds(sec)

EMSSION TEST

EMISSIONS CHARACTERISTICS LOAD ON CO₂ EMISSIONS:

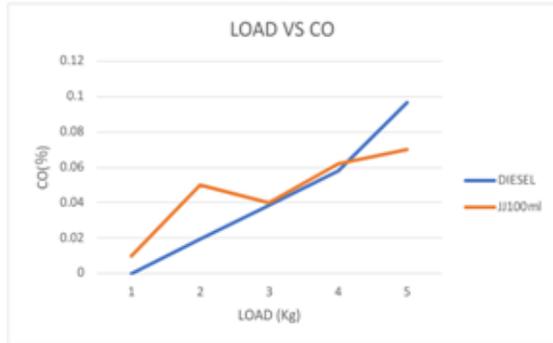
It are often observed from the graph that the increasing load results in the co2 emissions. this is often because, of complete combustion of fuel place. this is often achieved by means of having more amount of oxygen in of Esterified Cotton seed oil.



PERFORMANCE AND EMISSIONS CHARACTERISTICSLOAD ON CO EMISSIONS

It is often observed from the graph that the increasing load results in a decrease in the CO emissions. this is

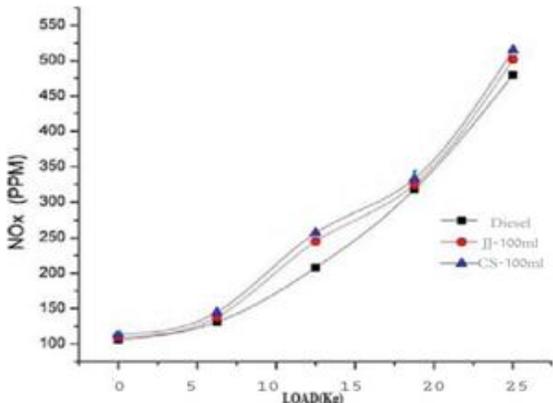
often because, of complete combustion of fuel happening.



This is achieved by means of having more amount of oxygen in case of Esterified Cotton seed oil. The variation of carbon monoxide gas (CO) emission of Cotton seed oil bio diesel with ordinary diesel at various load conditions. it's shown that increasing biodiesel within the blends at low and middle engine loads has only a slight effect on the CO emissions due to the dominant premixed lean combustion with excess air. The CO emissions of B20 are evidently but those of diesel fuel. this is often often due to the fact that biodiesel which contains more number of oxygen atoms leads to more complete combustion.

PERFORMANCE AND EMISSIONS CHARACTERISTICS LOAD ON NO EMISSIONS

The variation of nitrogen oxides (NOx) emission with power output for the varied fuels tested. There are mainly three factors, oxygen concentration combustion temperature, and time, affecting the NOx emission. because the load increases, the concentration of NOx is additionally increasing.



The graph clearly shows the diesel NOx is typically higher than the biodiesel. When comparing the

general results, the C30 mix emits less NOx but features a lower BTE than the C20 blend. In the case of C10, however, NOx emissions were reduced. C20, C30 and C40 as compared to neat diesel. At partial loads NOx emissions of neat biodiesel and its blends are above those of diesel oil. Higher values of combustion temperature and presence of oxygen with biodiesel end in a rise in NOx generation.

CONCLUSION

The first phase, which involved making Bio-Diesel from cotton seed oil, was successful since the procedure was straight forward. The physiochemical parcels of Biodiesel are compared to those of glycerol during this step. The performance and emigration testing of a Manufactured Biodiesel during a CI machine was the third and most vital phase. The results showed that the Brake Thermal Efficiency and Brake Power attained with Biodiesel were 6 percent and three percent advanced than those attained with conventional diesel at 60 percent and full cargo, independently. Likewise, biodiesel features a lower total energy consumption per cargo than conventional diesel, with a maximum cargo of kg/hr and a specific energy consumption of 0.286 kg/kw hr. The quantum of energy emitted could also be a significant factor. Furthermore, biodiesel features a lower total energy consumption per cargo than conventional diesel, with a maximum cargo of 1.282 kg/hr and a specific energy consumption of 0.286 kg/kw hr. The quantum of energy emitted could also be a significant factor. There are multitudinous emigration reductions. When against the opposite three composites, the B20 features a lower ideal. The unburied hydrocarbons are reduced by 9 when using the mixture B20. CO2 emigrations are reduced by 15. Emission rules, on the other hand, increase NOx by 13. Overall, as compared to diesel, biodiesel emits far smaller adulterants. From these findings, it's apparent that blending Cotton seed canvas with diesel reduces adulterants and is environmentally friendly.

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