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PERFORMANCE AND TESTING OF EMISSION CHARACTERSTICS BIO FUEL USING DIESEL ENGINE WITH ALEXANDRIAN LAUREL SEED OIL

[1]KOTA RAHUL, [2]JITENDRA GUMMADI

[1]M.Tech Student, Department of mechanical engineering, NRI Institute of Technology(Autonomous) , Agiripalli(M), vijayawada,Andhrapradesh.

[2]Assistant Professor, Department of mechanical engineering, NRI Institute of Technology(Autonomous) , Agiripalli(M), vijayawada,Andhrapradesh

1rahulamor6341@gmail.com 2gummadijithendra@gmail.com,

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ABSTRACT

Biodiesel, a light to dark yellow liquid, is biodegradable, non-toxic and has significantly fewer emissions than petroleum-based diesel. It is practically immiscible with water, has a high boiling point and low vapour pressure. Biodiesel is produced from a wide range of feedstock, including fresh soybean oil, mustard seed oil, waste vegetable oil, palm oil, rapeseed, sunflower, soybean and jatropha, copra, palm, groundnut and cotton seed.In the present years, population of vehicles increased enormously which increases the demand of fossil fuel, The availability of conservative fuels decreased continuously, these reasons makes to find the alternative fuels especially biofuels . The use of biodiesel considerably reduced emission and increase the performance of the engine.Now a days researchers have reported the possibility for the production of biodiesel from non edible oil jatropha curcus , pongamia pinnata etc. There is a best source of raw material that is Alexandrian laurel seed oil for biodiesel production. In present study Alexandrian laurel seed oil is used as fuel in C.I engine. The main objective of the present study was to use the non-edible Alexandrian laurel seed oil as biodiesel in ci engine. to reduce the viscosity of neat Alexandrian laurel, transesterification was done to bring it close to that of conventional diesel. In order to obtain a basis for comparison, Various blends are used such as (B10, B20,B30,B100) from this blends B20 shows best results compared to the diesel. Observe the brake thermal efficiency, Brake powder, Break mean effective pressure, Specific fuel consumption at various loads.To improve the performance characteristics Isobutanol additive added in the B20 in the concentration of 10% and 15%. Observe the which blend gives the good result in single cylinder operation based on the result. Finally we conclude that by observing performance, combustion and emission analysis CO, HC, Nox the combination of bio fuel alexandrian laurel seed oil and conventional diesel fuel which one gives better results compared.

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ALEXANDRIAN LAUREL

The Alexandrian Laurel has derived its generic name from the Greek terms ‘kalos’ denoting beautiful and ‘phullon’ meaning leaf. In other words, the generic name of this species means the beautiful-leafed tree in Greek. Similarly, the precise nickname (epithet) of this tree also has its origin in two Greek words – ‘is’ meaning fiber and ‘phullon’ denoting leaf that refers to the prominent veins on the underside of the leaves of the Alexandrian Laurel.The tree is cultivated for providing shade as well as reforestation and afforestation – an initiative to reclaim soil.

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In many places, tree is also planted along the shores because it has proved to be effective in preventing soil erosion by the sea. While the growth of the tree is very sluggish, it is very popular as a roadside plantation in India. Additionally, it is also an attractive ornamental plant, as it has young foliage that is crimson in color. Even the flowers are very aromatic.

Figure 1ALEXANDRIAN LAUREL LEAFS AND SEEDS

HISTORY

Alexandrian Laurel is a native of the old world tropics from East Africa, southern coastal India to Malesia, northern Australia and the Pacific islands. The species is extensive along the coasts of eastern Africa (from Kenya to northern Mozambique), Madagascar and other Indian Ocean islands, tropical Asia, northern Australia and the islands of the Pacific Ocean. Although it is considered wild in most of this area, it is often unclear where it is truly wild or a relict of former cultivation.

MODREN WORK

Many methods have been proposed to perform this task, including pyrolysis, blending with solvents, and even emulsifying the fuel with water or alcohols, none of which have provided a suitable solution. It was a Belgian inventor in 1937 who first proposed using transesterification to convert vegetable oils into fatty acid alky1 esters and use them as a diesel fuel replacement. Due to the widespread availability and low cost of petroleum diesel fuel, vegetable oil-based fuels gained little attention, except in times of high oil prices and shortage. World War II and the oil crises of the 1970's saw brief interest in using vegetable oils to fuels diesel engines. Unfortunately, the newer diesel engine designs could not run on traditional vegetable oils, due to the much higher viscosity of vegetable oil compared to petroleum diesel fuel. A way was needed to lower the viscosity of vegetable oils to a point where they could be burned properly in the diesel engine. In the early 1980s concerns over the environment, energy security, and agricultural overproduction once again brought the use of vegetable oils to the forefront, this ti-me with transesterification as the preferred method of producing such fuel replacements. Recently the Indian railway started that bio-diesel is used as a fuel inlocomotives.

Figure 2CAR AND TRAIN USING BIO FUELS

ABOUT BIO-DIESEL& DIFFERENT SOURCES OF BIO- DIESEL:

BIODIESEL

A Fuel other than petrol (or) diesel to propel the vehicle is called alternate fuel.Biodiesel is a cleaner burning replacement fuel made from renewable sources like new and used vegetable oils and animal fats.

DIFFERENT SOURCES

FIRST-GENERATION: biofuels are made from sugar, starch, vegetable oil, or animal fats using conventional technology. These are generally produced from grains high in sugar or starch fermented into bioethanol; or seeds that which are pressed into vegetable oil used in biodiesel. Common first-generation biofuels include vegetable oils, biodiesel, bioalcohols, biogas, solid biofuels, syngas.

SECOND-GENERATION: biofuels are produced from non-food crops, such as cellulosic biofuels and waste biomass (stalks of wheat and corn, and wood). Common second-generation biofuels include vegetable oils, biodiesel, bioalcohols, biogas, solid biofuels, and syngas. Research continues on second-generation biofuels including biohydrogen, biomethanol, DMF, Bio-DME, Fischer-Tropsch diesel, biohydrogen diesel, mixed alcohols and wood diesel.

THIRD-GENERATION: biofuels are produced from extracting oil of algae – sometimes referred to as “oilgae”. Its production is supposed to be low cost and high-yielding – giving up to nearly 30 times the energy per unit area as can be realized from current, conventional ‘first-generation’ biofuel feedstocks

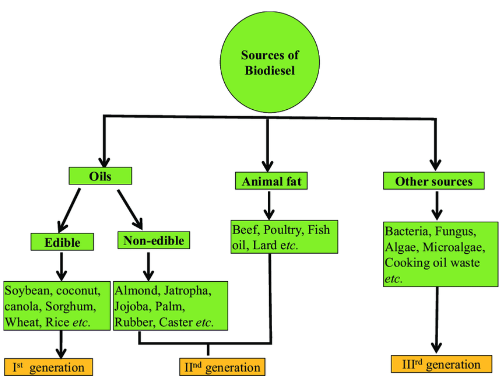

Figure 3Classification of sources of bio-diesel

NEED FOR BIO-DIESEL IN INDIA.

One of the most important ingredients in the recipe of 21st century growth is energy. And to surmount the challenge of availing such energy without compromising the government’s progress towards other targets – including climate change – India launched the National Biofuel Policy (NBP) in 2008. One motivation was that 10 million litres of E10 biofuel could save Rs 28 crore in forex and around 20,000 tonnes of carbon dioxide emissions. Biofuel is the product of blending a fossil fuel with a certain percentage of ethanol. This ethanol is generally extracted from crops, oilseeds and waste, and mixed in a ratio that doesn’t affect the properties of the fossil fuel while reducing the amount of greenhouse gases it emits when combusted. In 2008, the NBP targeted an ethanol fraction of 20% in both petrol and diesel by 2017.However, by 2017, the government had achieved only a 2% blend with petrol and about 0.1% with diesel. So it revised the policy the next year and set new targets: 20% ethanol in petrol and 5% ethanol in diesel by 2030.

SOME OF THE REASONS NEED BIO-DIESEL IN INDIA:

1. Lack of crude oil (conventional) resources.
2. For reducing pollutant products to fulfil the aim of ‘SWACHH BHARAT ‘.
3. Utilizing the sources available in forest areas.
4. To reduce the amount of imported fuels from other countries.
5. By introducing the bio diesel into the agricultural sector can become a great revolution
6. for reducing diesel usage in locomotive engines.

INTERNAL COMBUSTION ENGINE & ALTERNATEFUELS:

The fuels of both SI and CI engines are commonly fossil based and have uncertain future because of their limited reserve and environmental impact. Hence to meet the international standard for both fuel consumption and exhaust emission, several proven options are being available starting from expensive engine hardware modification to cheaper alternative fuels. In Indian context, the use of existing IC engines with little or no modifications is a promising and viable solution which can only be possible through the route of alternative fuels. In general, two broad types of IC engines are spark ignition (SI) engine and compression ignition (CI) engine which are popular in the society as petrol and diesel engine respectively. SI engine uses fuels with high auto ignition temperature like petrol, alcohol and gaseous fuels. The combustion in this engine is initiated at a single location by a spark and the developed flame then propagates in to the pre-mixed fuel air mixture in a progressive manner. Whereas, in CI engine, fuels with low self- ignition temperature like diesel are used. In this engine, towards the end of compression process, fuel is injected to an environment of hot compressed air having a temperature higher than the self-ignition temperature of the fuel used which initiates combustion at several locations.

A number of non-traditional liquid and gaseous fuels are being tried in the existing internal combustion engines. The use of alternative fuels in both SI and CI engines are decided on the basis of their combustion characteristics. Some of the results obtained are of encouraging nature and need micro-level critical analysis for its sustainable application. Considering the need of the day, number of diesel engines used in agriculture and public transportation sector are far ahead of that of petrol engines. Therefore, it is more relevant to highlight the common features of diesel alternatives fuels.

OBJECTIVES OF PRESENT WORK:

In the present project work the following objectives are met.

1. Collection of Alexandrian laurel seeds from different sourcesand extracting oil.
2. Collecting requirements for the present work based on standard journals.
3. Converting raw oil into bio-diesel.
4. Make ready the computerized MFVCR engine.
5. Conducting base line test using diesel.
6. Checking the properties of bio-diesel and compare with the base line values.
7. Checking the performance. Combustion and emission analysis of the Alexandrian laurel seed bio-diesel with additives

LITERATURE REVIEW

The main purpose of this literature review is to provide background information on the issues to be considered in this work and to emphasize the relevance of the present study. An intensive literature survey has been carried out from bio-diesel and its blends in diesel engine.

The chapter contains the information we have got from different papers

Sanjaykumar Dalvi [1] et al. studied biodiesel fraction from oil content of Undi (Calophyllum innophyllum L.) is found 60-70 %.The extraction of oil is a primary step in any biodiesel production system. To escape this step in-situ transesterification method is used in which the Undi seed crush is directly converted into biodiesel with in- situ transesterification which is fatty acid methyl & ethyl ester composition.

A.G. Mohod [2] et al. prepared methyl ester from Calophyllum Inophyllum L. oil by using base catalyzed transesterification process. Different properties of raw Calophyllum inophyllum L. oil and its methyl ester were determined by using the standard procedures. The specific gravity and kinematic viscosity, Gross calorific value, Flash point, Fire point, Acid value, Free fatty acid content and Saponification value for raw Undi oil were 0.908, 5.80 cS, 35.55 MJ/Kg, 2480C, 283 0C, 0.933 mg KOH/g, 1.2 %, 210, respectively, While for Undi methyl ester were 0.856, 3.58 CS, 39.21 MJ/Kg, 188 0C, 231 0C, 0.523 mg KOH/g, 0.66 %, 200.7, respectively.

Gaurav Dwivedi[3] et al. investigated renewable sustainable and alternative fuel for compression ignition engine, biodiesel instead of diesel has been increasingly fuelled to study its effects on engine performances and emissions in the recent 15 years. Their objective was to do a comprehensive review of engine performance and emissions using biodiesel from different feedstocks and to compare that with the diesel.

Rahul Krishnaji Bawane[4] et al. conducted experiment to obtain the operating and emission characteristics of Undi Oil Biodiesel on Vari-able Compression Ratio (VCR) engine run on various blends of biodiesel, compression ratios and load conditions. From the comparison of results, it is inferred that the engine performance is improved with significant reduction in emissions for the chosen oils with-out any engine modification. Harshad.

T. Magar[5] et al. Studied Undi based biodiesel is a non-edible fuel suitable for petrol & diesel engines. Transesterification process is used for preparation of Undi biodiesel. The physical & chemical properties of Undi biodiesel is nearly same as diesel. Experimental investigation of Undi oil has been carried out to analyze emission, performance characteristics in diesel engine with blends in diesel (0%,20%, 40%, 60%) by changing compression ratio and engine load. The emissions from the diesel engine calculated with the help of smoke meter & gas analyzer. We can change compression ratio & engine load of diesel engine without any major modifications in variable compression ratio (VCR) diesel engine.

Ashish. G. Bandewar[6] et al. Investigated that Diesel engines provide important fuel economy and durability advantages for heavy-duty trucks, buses, non-road equipment, passenger cars and heavy-duty applications. Inspite of the various advantages diesel engines possess, they also have disadvantages of emitting significant amounts of particulate matter (PM) and oxides of nitrogen (NOx) and to a lesser amount, hydrocarbon (HC), carbon monoxide (CO), and toxic air pollutants. [1, 2]Biodiesel is attractive since it can be used in diesel engines without modification, easy and effective blending with pure diesel and cleaner emission profile compared to diesel fuel.

Mr. A. V. Jagtap[7] et al. investigated that The performance of vegetable oils can be improved by modifying them through the transesterification process. In their work, the performance of single cylinder water-cooled diesel engine using blends of diesel blended with undi biodiesel as fuel was evaluated for its performance and exhaust emissions. The fuel properties of biodiesel such as kinematic viscosity, calorific value, flash point, carbon residue and specific gravity were found. Results indicated that H25 has closer performance to diesel and H75 has lower brake thermal efficiency, mainly due to its high viscosity compared to diesel.

Ravi.S.D [8] et al. worked to study the performance, emission and combustion characteristics of Calophyllum Inophyllum (Surahonne) oil. The results were compared with diesel fuel, and the selected Calophyllum Inophyllum (Surahonne) oil fuel blends (10%, 20%, and 100%). For this experiment a single cylinder, four stroke, water cooled diesel engine was used.

H. Suresh Babu Rao[9] et al. considered biodiesel as a promising option as they are clean renewable fuels and best substitute for diesel fuel in any compression ignition engine. The important advantages of using biodiesel are its renewability and better quality of exhaust gas emissions. Therefore, the attention is shifted towards non-edible oils like Jatrophacurcas, Kanaja, Mahau, Calophyllum inophyllum etc. Avinash.

K. Hegde[10] et al. Studied biodiesel is mono alkyl esters of long chain fatty acids derived from renewable feed stock like vegetable oils and animal fats. It is produced by transesterification in which, oil or fat is reacted with a monohydric alcohol in presence of a catalyst. The process of transesterification is affected by the mode of reaction condition, molar ratio of alcohol to oil, type of alcohol, type and amount of catalysts, reaction time and temperature and purity of reactants.

D. Subramaniam[11] et al. investigated experimental study, performance, emission, and combustion characteristics of methyl esters of Punnai, Neem, Waste Cooking Oil and their diesel blends in a C.I. engine was experimentally examined. For the study, Punnai oil methyl esters (POME), neem oil methyl esters (NOME), and Waste Cooking Oil Methyl Esters (WCOME) were prepared by tranesterification process. The Bio diesel-diesel blends were prepared by mixing 10%, 30%, 50%, and 70% of bio diesel with diesel.

Chavan.S.B. [12] et al. focused on the collection of seeds and oil extraction then proceed for biodiesel production with molar ratio 8:1, KOH were 1.2wt%, tempreture 65oc, reaction time 90minutes were used and testing of parameters as per ASTM 6751 standards. The physical properties like acid value, density, Calorific value, Flash point, Fire point and Moisture, Viscosity shows of calophyllum methyl esters were0.702,892gm/cc, 37.18MJ/Kg, 1760c, 1820c and 0.01% . The physico-chemical parameters showed that Calophyllum may works as a sustainable feedstock for biodiesel production that is equivalent to fissile fuel as per ASTM 6751.

C. Srinidhi.[13] et al. studied The biodiesel derived from Honne oil is considered as one of the promising alternative fuel derived from non-edible sources. The aim of this paper is to evaluate the utilization of this fuel in diesel engine in maximum possible effective way. To find this, an experiment analysis of performance parameter (such as brake power, break specific fuel consumption, brake thermal efficiency and Exhaust Gas temperature) and emission characteristics (NOx, HC, CO. etc.) is obtained for various bio diesel and diesel blends and compared with ordinary diesel at various loads on a modified variable compression ratio CI engine. The results of the investigation shows that the performance and emission characteristics of the engine fuelled with Honne oil methyl ester – diesel blends is comparable to the ordinary diesel.

Dattatray A. Chavan [14] et al. studied The rapid depletion of petroleum in the world, increasing fuel prices and the environmental problems has triggered the need of alternatives and renewable energy sources. Combustion of fuel results in the emission of carbon dioxide (CO2) and other harmful pollutants. This results in increasing the global CO2 level and global warming. The harmful pollutants not only affect on the environment but also on human being. This situation leads to seek turmeric leaf oil as an alternative fuel for diesel.

R. Bhaskar Reddy [15] et al. investigated the important factors which influence the performance and emission characteristics of D.I diesel engine is fuel injection pressure. honne oil has to be investigated in a constant speed, on D.I diesel engine with different fuel injection pressures. The scope of the project is to investigate the effect of injection pressures on a blend of 50% honne oil with 50% diesel and compare with pure diesel on performance and emission characteristics of the diesel engine. Two tested fuels were used during experiments like 100 % diesel and a blend of 50% honne oil mixing in the diesel. The performance tests were conducted at constant speed with variable loads. From experiment results it was found that with honne oil- diesel blend the performance of the engine is better compared with diesel.

BIO-DIESEL

In the present years non edible oils are easily obtained because of the availability. In the paper stated that potential Alexandrian laurel seed oil as a most promising feed stock for biodiesel production In this paper, several aspects such as physical and chemical properties of crude Alexandrian laurel seed oil and methyl ester, fatty acid composition, Transesterification blending and engine performance and emissions of Alexandrian laurel methyl ester were studied. Overall, Alexandrian laurel seed oil appears to be an acceptable feedstock for future biodiesel production.T.M.M. Marso et al. studied the production of biodiesel from Alexandrian laurel seed. In this biodiesel production raw oil is prepared and then the viscosity of the oil is reduced by the transesterification process.

Sahid at el studied the use of biodiesel in CI engine by using edible oils such as soybean oil, sunflower oil, cotton seed oil. It can reduce the emission reduced in the engine but it has one limitation for the use edible oil as biodiesel i.e. edible oils are used as the food crops in daily life due to its unavailability non edible oils are used as biodiesel. Soo-young No studied the scope non edible oils in the present generation. Due to the unavailability of edible oils non edible oils are preferred. Non edible oil such as jatropha, Karanja, linseed, rubber are used as fuels. In this jatropha is used as biodiesel in CI engine and the results were obtained concluded that NOx emissions increased by the use of bio diesel and reduced CO and HC emissions compared to diesel. B.AshokK.Nanda gopal, D.shakthi Vignesh stated Alexandrian laurel is a source of bio-diesel in India. The Alexandrian laurel trees in India can reduce the dependency on petroleum products. In present study different types of blends such as B100,B30,B60 are used for engine testing and comparing this results with conventional fuel. The results obtained by the engine shows performance characteristics increased by using Alexandrian laurel bio-diesel with out any modification.

BIODIESEL ADDITIVES:

B.Ashok,k.Nanda gopal in the present study anti oxidant additives are used in Alexandrian laurel seed

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bio-diesel to improve the performance of the engine. Anti oxidant additives such as Ethanox and Butylated hydroxytoluene are added to the Alexandrian laurel seed biodiesel in different concentrations. Experimentation conducted then results are compared. Ethanox has better performance compared to the Butylated hydroxytoluene.

In this paper Effect of leaf extract from pongamia pinnataon the oxidation stability, performance and emission characteristics of Alexandrian laurel biodiesel from this paper oxidation stability of Alexandrian laurel biodiesel can improved by adding leaf extract additive to the ALSO 20.due to the additive concentration emission OF CO and HC slightly increased compared to the diesel .

N. Yilmaz et al studied the effect of butanol additive on the performance and emission characteristics on the diesel engine. Additives are added to the biodiesel to improve the characteristics. Results are concluded that the reduced the NOx emissions and slight increase in the CO and HC emissions by the addition butanol in the concentration of 5% and 10%. Al-Hasan studied the effect of Isobutanol addition to the diesel engine and the results are concluded that decrease brake thermal efficiency and increase the specific fuel consumption with the addition of Isobutanol compared to dieselengine.

The knowledge we have got from the studying the above papers

1. Different sources of production of bio-diesel inIndia
2. How to convert the raw oil into bio-diesel (transesterification)
3. Modifications required for engine.
4. Different parameters that have been considered while the test is conducting.
5. Pollutants from the bio-diesel and base line.
6. Improving the performance of the diesel engine by adding additives.

PREPARATION OF BIO-DIESEL.

Preparation of bio diesel involves following process.

1. Collection of seeds from the sources and converting into raw oil.
2. Pre-treatment
3. Acid-test
4. Esterification.
5. Transesterification.
6. Settling & separation
7. Water washing.
8. Post-treatment.

COLLECTION OF SEEDS FROM THE SOURCES AND CONVERTING INTO RAW OIL:

The dry & cleaned Alexandrian laurel fruits from the different sources are collected sufficiently. By peeling the Alexandrian laurel dry fruits seeds has been extracted. The seeds are now used for producing raw oil. The seeds are gently cleaned and crushed in an oil mill. In the oil mill the seeds are fed into hopper and crushed by using helical grooves, due to high pressure, the seeds are crushed then raw oil & oil cake are the by products from this sources. The oil recovery was calculated to be near about 27%.We extracted (200 – 250) ml of oil by grinding 1kg of Alexandrian laurel seeds.

Figure 4Alexandrian laurel tree, seeds

PROPERTIES OF PREPARED BIO-DIESEL.

CHECKING THE PROPERTIES OF PREPARED BIO-DIESEL

After completion of bio-diesel preparation, we have to check the required properties ofbio-diesel.

Properties of bio-diesel:

- Calorific value(CV)
- Flash point.
- Fire point
- Cloud point.

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- Pour point.
- Cetane number.
- Acid value.
- Density.
- Viscosity.

Acid Value: (ASTM D 6584)

The acid value of the fuel represents corrosive resistance of the engine withincrease in the acid value of the fuel the engine parts become corroded.

PROCEDURE:

The acid number is a measure of the amount of carboxylic acid groups in a chemical compound, such as fatty acid.

The apparatus required:

Chemicals required:

- Conical flask.
- Measuring jar.
- Weighing machine.
- Burette.
- Heater
- Ethanol (99% pure).
- Phenolphthalein indicator.
- Potassium hydroxide (KOH).

The oil sample of 2.5 gm is taken in a conical flask and added 20 ml of ethanol. Now the flask is placed on a hot plate, heat the solution up to formation of bubbles. Next the flask is taken out from the hot plate and subjected to rapid cooling. After cooling 2-3 drops of phenolphthalein indicator is added as a colour indicator. Then the solution is titrated with 1% of KOH solution until the colour changes to pale pink.

Burette reading: 0.9

Formula = $\frac{(^{e\ reading}) * 5.6}{oil\ sample\ weight}$

Acid value = 2.016 mg of KOH/gm.

Figure 5 acid testing

CETANENUMBER:

Cetane number is a relative measure of the interval between the beginning of injection and auto ignition of the fuel. The higher the cetane number, the shorter the delay interval and the greater its combustibility. Fuels with low Cetane Numbers will result in difficult starting, noise and exhaust smoke. In general, diesel engines will operate better on fuels with Cetane Number is above 51.2 .

COMPARING THE PROPERTIES OF BIO-DIESEL WITH BASE LINE VALUES

SL.NO	PROPERTY	ALEXANDRIAN LAUREL BIO-DIESEL	Isobutanol	DIESEL
1	CALORIFIC VALUE kJ/kg	38500	33100	41888
2	FLASH POINT(°c)	146	35	93
3	FIRE POINT(°c)	152	-	62-106
4	CLOUD POINT(°c)	7.5	-	-12
5	POUR POINT(°c)	-	-	-20
6	ACID VALUE mg/KOH	-	-	0.36 mg/KOH
7	DENSITY kg/m^3	878	825	849
8	KINETIC VISCOSITY mm^2/s	4.18	2.63	2.6
9	CETANE NUMBER	51.2	25	54.6

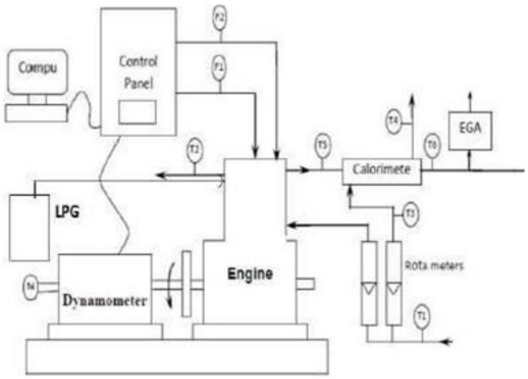
Tab 4.1 properties of prepared bio-diesel & comparing with base line value

EXPERIMENTAL SETUP

DETAILS OF TEST RIG AND ITS SPECIFICATIONS:

The MFVCR engine test rig is a computer based analysis engine by using different sensors and thermocouples. The sensors are used in the present test rig that are used to find the speed, torque, fuel consumption etc., k-type thermocouples are used in the test rig to measure the temperature at various points.

ENGINEERING SPECIFICATIONS:



- Engine: 4 stroke computerized variable compression ratio multifuel direct injection water cooled engine
- Make: TECH-ED
- Basic engine: Kirloskar
- Rated power: 5 HP (DIESEL)
- Rated power: Up to 3 HP (PETROL)
- Bore diameter: 80mm
- Stroke length: 110mm
- Connecting rod length: 234mm
- Swept volume: 551cc
- Compression ratio: 5:1 to 20:1
- Rated speed: 1500 rpm

Initially the baseline test was conducted using diesel at various loads from no load to full load condition in five intervals(0%,25%,50%,75%,100%) . the performance and combustion are observed using engine test software which are loaded in the computer through interface The emission analysis is carried out Airval automation emission analyser and AVL smoke meter The six gas smoke analyser gives the percentage of CO (carbon monoxide) ,NOx (nitrogen oxide), SOx (sulphur oxide), oxygen (O2), carbon dioxide (CO2), HC(hydro carbons) and smoke meter will gives the amount of smoke coming from the engine.

Figure 6 experimental setup

In the present project we have used Multi Fuel Variable Compression (MFVCR) Engine. The total test rig is accumulated with sensors to know the required values from the experiment. The test is integrated with sensors to know the properties like Temperature, Fuel consumption, Pressure, Heat release, Water flow, Air flow etc…

Sensors: The complete VCR engine is completely integrated with sensors to know the different characteristics during running of the engine. Sensor is a electronic device that sense the anything and convert that into electric signal form. The following are the sensors that are used in the present test rig.

- Torque measuring sensor.
- Speed measuring sensor (tachometer).
- Thermocouples.
- Combustion sensor.
- Fuel consumption measuring sensor.
- Water flow measuring sensor.

Torque measuring sensor:

Torque sensor is a electronic device that convert torque with respect to the load application into the digital form by using electric current.

Figure 7 Torque measuring sensor

SPEED MEASURING SENSOR:

speed sensor is a electronic device that convert speed of the engine into digital form. The speed sensor is placed near the flywheel, based on the fly wheel revolutions it will convert that into digital form. By using this sensor no need any manual speed measuring devices like tachometer etc..

Figure 8 speed measuring sensor

Thermocouples: thermocouples are the electronic devices that convert heat energy into digital form. The thermocouple is worked on the principle of SEEBECK effect. In the present test rig 6 thermocouples are used for measuring required temperatures.

Figure 9 thermocouples

Combustion sensor: combustion sensor is the one of the heart part of our test rig. The combustion test rig is used to find the pressure variation, heat release rate at inside the combustion chamber. This sensor will gives the required values at each and every crank angle.

Figure 10 combustion sensor

Apparatus required for emission analysis:

The emission analysis is done by using airval automation emission analyzer and smoke meter

Indus six gas smoke analyser:

The six gas smoke analyzer gives the percentage of CO (Carbon monoxide), NOx (nitrogen oxide), SOx (sulphur oxide), oxygen (O2),Carbon dioxide (CO2), HC (hydro carbons) and smoke meter will gives the amount of smoke coming from the engine.

Smoke meter:

Smoke meter will gives the intensity of smoke coming from the engine.

Experimentation:

- In the present project initially we have conducted base line test i.e. using diesel andnoted down all the values.
- Now the main work that is checking the performance using Alexandrian laurel biodiesel as fuel.
- Now the operation done by using Alexandrian laurel biodiesel as fuel.
- After the operation additives are added to the Alexandrian laurel biodiesel inthe concentration of 10%,15%.
- Now the operation is repeated as same as for the biodiesel blends.

The test is conducted by using MFVCR engine. The required values completely given by thecomputer.

OBSERVATIONS

The experiment is done on the multi fuel variable compression ratio (VCR) engine. The results are completely given by the computer. The following are the observations taken from the computer.

DIESEL PERFORMANCE PARAMETERS

Observation Data

Speed (rpm)	Load(kg)	Comp Ratio	T1 (degC)	T2 (degC)	T3(degC)	T4 (degC)	T5 (degC)	T6 (degC)	Air (mmWC)	Fuel(cc/mi	Water Flow Engine (lph)	Water Flow Cal (lph)
1538	0.50	17.50	30.76	34.62	30.76	37.03	128.59	99.80	68.91	8.00	150	100
1525	2.97	17.50	30.84	37.32	30.85	38.26	147.18	111.79	67.06	10.00	150	100
1510	6.08	17.50	30.97	40.33	30.97	41.05	178.40	134.97	64.78	13.00	150	100
1487	8.99	17.50	31.16	43.73	31.16	44.42	220.27	159.70	63.30	17.00	150	100
1473	11.88	17.50	31.48	47.32	31.48	47.88	253.21	185.13	61.22	20.00	150	100

Table 7.1 Diesel observation data

RESULTS & ANALYSIS

PERFORMANCE ANALYSIS:

BP v/s LOAD:

The BP v/s load graph will gives the information about the engine condition at different loads with respective to the BP is high at higher loads will ensure the use of that combination fuel the main consideration when working with any fuel BP and load are very more important when working with any fuel BP and load are very much important.

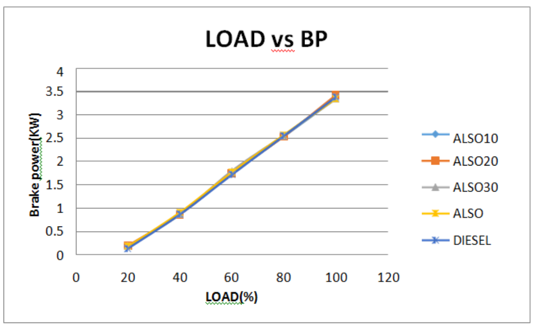


Figure 11LOAD v/s BP diagram

Observations:

1. By observing the graph BP varying linearly with respect to the Load
2. At 100% load ALSO20 have highest BP

BP vs SFC:

Importance:

Specific fuel consumption consideration is mainly for economic purpose at higher loads condition at which fuel will give low SFC value that is used as economic fuel.

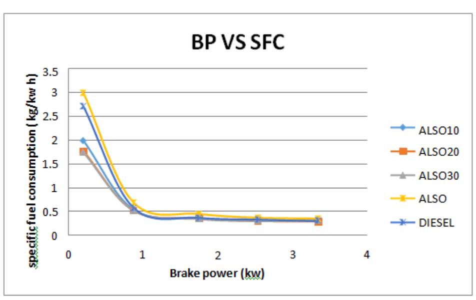


Figure 12BP v/s SFC diagram

Observations: By observing SFC v/s BP the SFC is decreasing linearly for all fuel combinations with respect to the load. The indication of SFC is for economy. By comparing all fuel combinations the ALSO20 having the lowest SFC and ALSO combinations having less fuel consumption

BP v/s ηB the:

Importance: The performance analysis mainly depends on the BTHE, BP and BSFC.

From this diagram we get how the BTHE is varies for different fuel combination with respective to the BP is to be formed at higher BP condition which having higher BTHEthat will be considered as efficient fuel.

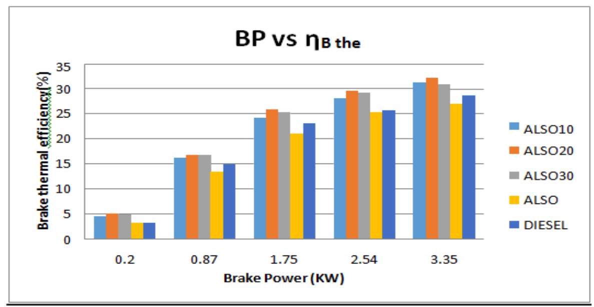
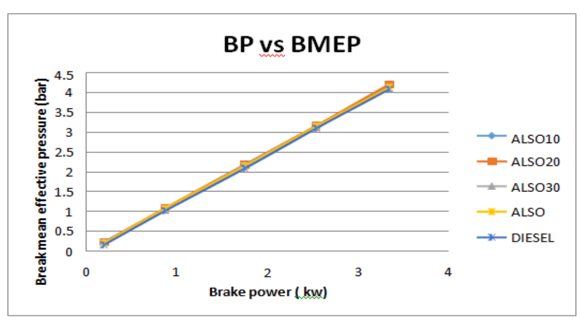


Figure 13BP v/s ηB the diagram

Observations:

BTE for various blends were observed. The plot of BTE against brake power is shown in Fig.8.1.3The comparison of BTE for ALSO10,ALSO20,ALSO30, ALSO100 are shown in the graph. It is found that ALSO20 gives better BTE at highest BP compared standard diesel. This may be attributed to extra oxygen content of biodiesel blends which improves the combustion process tending to increase in BTE of the engine.

BP v/s BMEP:



Graph. 8.1.4 BP v/s BMEP diagram

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Observations: By observing the graph all the fuel combinations are varying linearly with small deviations. The diesel and ALSO20 are producing highest BMEP, then both are having highest BP. At full load condition the ALSO20 will produce maximum BMEP,so it will produce maximum output. It is recommendable for higher loads.

P vs ηMech

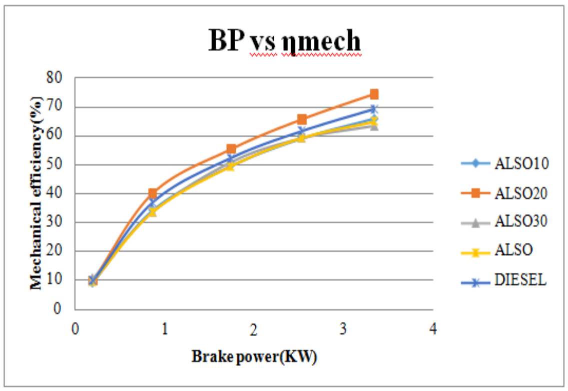

Figure 14BP v/s Mech Efficiency diagram.

Observations:

Mechanical efficiency for various blends were observed. The plot of Mechanical efficiency against brake power is shown in fig.8.1.5.The comparison Mech eff for ALSO10,ALSO20,ALSO30,ALSO100 and diesel are shown in the graph. It found that diesel and ALSO20 gives better mechanical efficiency compared to the other blends.

EMISSION ANALYSIS:

Load v/s CO:

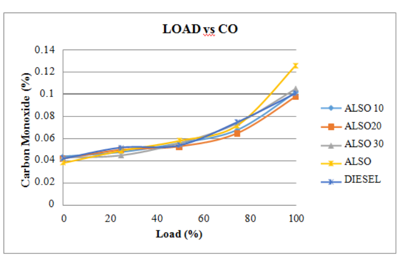

Figure 15Load vs CO diagram

Observations:

CO emissions from the engine occur due to partial oxidation of the fuel mixture. The rate of CO formation is a function of unburned fuel and mixture temperature during combustion. The variation of CO emissions against brake power is shown in Fig.8.2.1.It is observed that ALSO20 has low emission of CO, at part load as compared with neat diesel. The CO emission is increased for higher loads.

Load v/s HC:

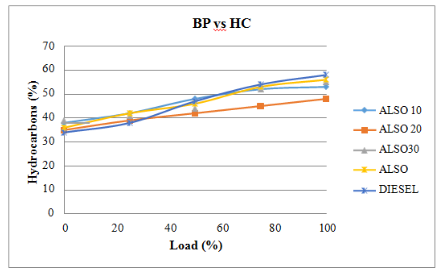

Figure 16Load v/s HC diagram

- It is a pollutant gas which hikes the air pollution and it is alsogreenhouse gas.

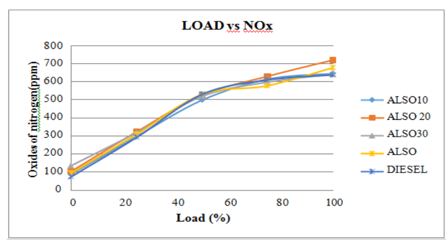

Figure 17Load vs Nox

Load v/s NOx

- HC emission from the vehicles cause irritation in the respiratory organs.
- HC emissions reacts with the ozone layer and perforates it.
- HC emissions are aldehydes, alkyl nitrates ketones whichreacts with environment creates air pollution.

PERFORMANCE ANALYSIS WITH ADDITIVES:

It is observed that ALSO 20 has good performance characteristics compared to the other blends and diesel. To improve the performance characteristics of ALSO 20,fuel additivessuch as Isobutanol is added to the ALSO20 in two different concentrations(ISO10% ,ISO15%).

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Load vs BP:

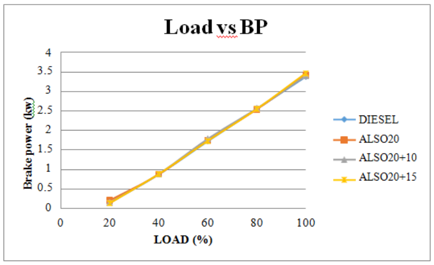

Figure 18Load vs BP diagram

Observations:

It is observed that graph is drawn between Load vs BP, From the above graph ALSO20+ISO15 has highest BP. Load is varying linearly with BP but has very small variation between other blends and diesel. At full load condition ALSO20+ISO15 has highest BP.

BP vs ηBthe

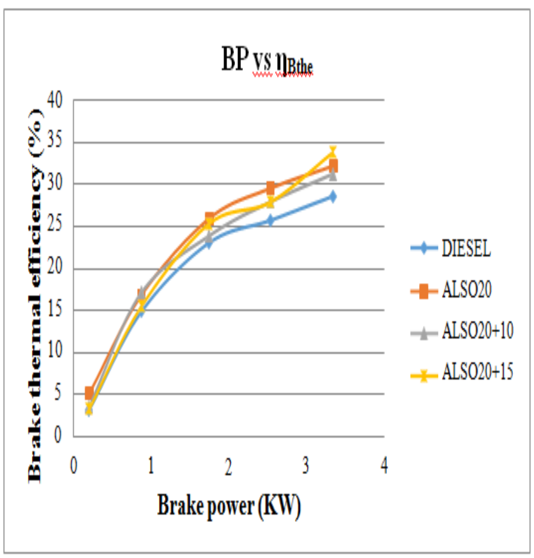

Figure 19BP vs Bthe

Observations:

It is observed that graph is drawn brake power against brake thermal efficiency. From the graph ALSO20+ISO15 has high thermal efficiency compared to the other blends compared to diesel. This may be attributed to extra oxygen content of biodiesel blends which improves the combustion process tending to increase in BTE of the engine.

EMISSION ANALYSIS:

Load v/s CO:

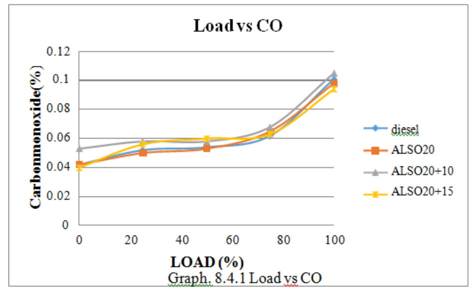

Figure 20 load vs co

Observations:

CO emissions from the engine occur due to partial oxidation of the fuel mixture. The rate of CO formation is a function of unburned fuel and mixture temperature during combustion. The variation of CO emissions against brake power is shown in Fig.8.4.1.It is observed that ALSO20+ISO15 has low emission of CO, at part load as compared with neat diesel. The CO emission is increased for higher loads.

CAUSES FOR CO EMISSIONS:

- Main reason behind the CO emission is incomplete combustion.Due to the faulty dry air filter.Mixture of air-fuel ratio.Leak of lubricating oil into the combustionchamber.
- ADVERSE EFFECTS ON HUMAN AND ENVIRONMENT:
- CO is a colourless gas and toxic gas.

Load v/s HC:

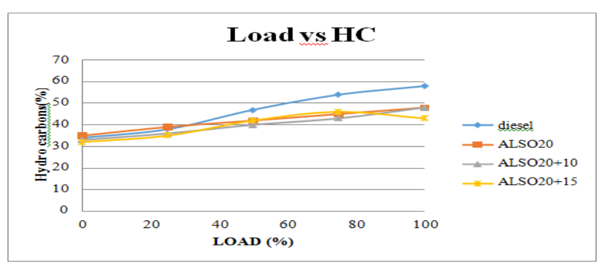

Figure 21Load v/s HC diagram

Observations:

The comparisons of hydrocarbon emissions for straight diesel, biodiesel are shown in Fig. While compared with base diesel, hydrocarbon emission was found in decreasing Rate in ALSO20+ISO15.From the figure 8.4.2 all the parameters has small variations

.At full load condition ALSO 20 has low hydrocarbon emission. CAUSES FOR HC EMISSIONS:

1. Poor fuel quality exerts high HC emissions.
2. Unburnt fuel traces in combustion chamber.
3. Mixing of lubricating oil with the fuel.Low suction of ambient air into the combustion chamber. ADVERSE EFFECTS ON HUMAN AND ENVIRONMENT:
4. HC emission from the vehicles cause irritation inthe respiratory organs.
5. HC emissions reacts with the ozone layer and perforates it.
6. HC emissions are aldehydes, alkyl nitrates ketones which reacts with environment creates air pollution.

CONCLUSION

The main objective of the present study was to use the non-edible Alexandrian laurel seed oil as biodiesel in CI engine. To reduce the viscosity of neat Alexandrian laurel, transesterification was done to bring it close to that of conventional diesel. In order to obtain a basis for comparison, Various blends are used such as (B10,B20,B30,B100) from this blends B20 shows best results compared to the diesel. To improve the performance characteristics Isobutanol additive added in the B20 in the concentration of 10% and 15%

OBSERVATIONS:

- ALSO20 gives the good performance and emission results in single cylinder operation
- In ALSO20 has low emission parameters except NOX compared to diesel engine operation.
- The performance of ALSO20 is further increased by adding Isobutanol additive.
- Finally we conclude that by observing performance, combustion and emission analysis the combination of ALSO20+ISO15 gives better results compared to conventional diesel fuel. At full load condition the ALSO20+ISO15 will produce maximum B.P. so, this combination is recommendable for the stationary engine.

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