PERFORMANCE ANALYSIS OF CI ENGINE USING BIODIESEL FROM PONGAMIA PINNATA

[1]DR. S. NARASIMHA KUMAR, [2]BERA DHANUSH TEJA, [3]GUBBA SAI NARAYANA,

[4]MUSHINI NARENDER

[4](Assistant Professor), Department **of Mechanical Engineering, CBIT(A), India**

[123]B.E. scholar, **Department of Mechanical Engineering, CBIT(A), India**

ABSTRCT

The increasing awareness of the depletion of fossil fuels resources and the environmental pollution caused due to the extensive use of these fuels creating a serious requirement in replacing the fossil fuels by the biofuels. The biofuels have an environmental benefit compared to any other renewable forms of energy resources. Since it creates the product of nontoxic and biodegradable material it creates an opportunity to clean the polluted environment caused due to fossil fuels. The products such obtained from the biomass that we are concentrating on no edible vegetable oils (Karanja oil) to use directly in most diesel engine without requiring extensive engine modification, however the availability of oil to meet the demand is over a major issue and also the cost of the Karanja oil is a major hurdle to its commercialization in comparison to petroleum-based diesel fuel. The high cost of oil is primarily due to the seasonal availability of fresh seeds, the processing and the transportation costs; however, the cake produced after the extraction of oil is used as fertilizers.

The Karanja oil in its crude from will have organic sticky and wax materials which in turn results in high viscosity, density and also flash point. To reduce this property the Karanja oil is blended with various proportion of petrol, such as 88% Pongamia + 12% petrol, 86% Pongamia + 14% petrol, 84% Pongamia + 16% petrol and one more sample is taken which is 100% Pongamia. Since petrol is highly solvent in nature the Karanja oil can be blended easily with any proportions required for the study. The

sample prepared are subjected for series of tests to check the quality characteristics by determining some of the parameters such as kinematic viscosity, density, dynamic viscosity are tested at the temperature of 35, 40 and 45°C to check its variation in the behavior of each parameter with temperature and also parameters like flash point, calorific value is tested and compared with the properties with the diesel fuel.

Running the diesel engine with one of the most desirable proportionate samples and testing the engine to determine the performance parameters with the same sample and comparing it with the properties of the diesel fuel. The performance parameters like IP, BP, FP, BSFC ηboth, ηith, ηmech are calculated for both diesel and selected Pongamia oil blend sample and the respective graphs are plotted. The same engine setup is subject to determine emission characteristics like Hydrocarbon, C02, C02, 02, N0X and the respective graphs are plotted to compare with the petroleum diesel emission. An outcome of the project will be a fuel which is to be used in C I Engines with minimum processing cost for fuel and least modification in C I Engine. The fuel produced can be used successfully as straight fuel in stationary and as well as locomotive C I Engine.

1.INTRODUCTION

A fuel is defined as a substance that reacts with oxygen to release heat energy. Fossil fuels are hydrocarbons, primarily petroleum and coal. It forms from the fossilized remains of organic debris exposure to high pressure in the absence of oxygen beneath the earth cover over several million years. Fossil fuels are considered as conventional and non-renewable sources. These are depleting at a very faster rate because of continuous usage and the use of fossil fuels in any form pose environmental issues. To reduce pollution, to deal global warming, to save cost involved in the production, to reuse waste and finally to have more choices alternate fuels are established. Biofuels are such kind of alternate source of energy produced from modern biological processes.Biofuels are resulted from plants or from agricultural, industrial wastes and domestic wastes. Pongamia is one of those biofuels which is considered as prominent alternate fuel for diesel. Biodiesels can be derived from plant oils and animal fats. Plant oils may be edible or non-edible. There are many methods used to convert the raw plant oil into biodiesel.In India, Jatropha and Pongamia are the leading biodiesel crops. Pongamia oil is extracted from Millettiapinnata seeds. Millettiapinnata otherwise known as Pongamiapinnata and Pongamiaglabra are well suited in the tropical and temperate climatic regions of Asia.

In the countries like India usage of edible oil for biodiesel production causes problems such as the competition with edible oil market which increase cost of oil and biodiesel. Pongamia is a non-edible type of oil. It is recorded that non-edible crops can be grown in waste land and cost of cultivation is much lower because these crops can still sustain reasonably high yield without intensive care.

Based on global crop production statistics, the country will require tenfold increase in ag- ricultural production if its total energy demands are to be met using biofuel crops. This will cause deforestation in some countries and slowdown food production. The waste land areas are considered as potential niches for promotion of perennial non-edible crops for biofuel, that aid in restoring afforestation, conservation, and environmentally friendly energy production. India is a signatory of the Kyoto Protocol and bio-fuel is an instrument of clean Development Mechanisms (CDM) India also can profitably trade carbon credits which may be generated from

using bio-fuel with the developed countries, apart from curtailing emission of carbon dioxide in to the atmosphere.

Ethics [a]

1. Biofuels development should not be at the expense of people's essential rights (including access to sufficient food and water, health rights, work rights and land entitlements)
2. Biofuels should be environmentally sustainable.
3. Biofuels should contribute to a net reduction of total greenhouse gas emissions and not exacerbate global climate change.
4. Biofuels should develop in accordance with trade principles that are fair and recognize the rights of people to just reward (including labor rights and intellectual property rights).
5. Costs and benefits of biofuels should be distributed in an equitable way.
6. If the first five principles are respected and if biofuels can play a crucial role in mitigating dangerous climate change, then, depending on certain key considerations, there is a duty to develop such biofuels.

Biofuel policy of India [b]

To meet the increasing energy needs of the country and to provide Energy Security, National Policy on Biofuels was announced in December 2009. The major goals of the policy are Development and utilization of indigenous non-food feed stocks raised on degraded or waste lands, thrust on research and development on cultivation, processing and production of biofuels and a blending mandate of 20% Ethanol and Bio-diesel by 2017.

The government proposes to encourage farmers and landless laborers to plant non-edible oil seeds to boost the production of bio-diesel and bio-ethanol. The government looks to solve several problems in the environment, agriculture, and economic domain. Apart from curbing air pollution from the transportation sector, the government plans to increase employment opportunities for farmers, especially the ones with little financial means.

Policy Statement of Karnataka [c]

- Only non-edible oil seed would be harnessed for the purpose of producing bio-diesel so that the edible oil is left for cooking purposes for the people.
- Cultivation of non-edible oil seeds required for bio-diesel would be promoted on dry land, marginal land, and waste land and degraded forest land, owned by private or government, including "Block Plantation". Use of food crop land to grow non-edible oil seeds will be not encouraged, so as not to compromise food security.
- The state will encourage de-oiled cake, a by-product of non-edible oil, to be used as organic manure.
- The government will encourage public-partnership models in this regard. E.g. long-term lease of wastelands to private agencies to promote growing of plant species producing seed will be envisaged.
- The conversion to oil will be encouraged in a time bound and decentralized manner, where oil seeds collection and processing are promoted in rural areas and small terms.
- Traditional communities involved in oil seeds collection and or oil extraction activities in rural areas, self-help women groups and local user groups would be encouraged to participate in the related activities.
- The State will facilitate organizations with suitable expertise, both governmental and non-governmental to promote research, dissemination, and outreach activities in promoting bio-fuel use. The State will establish required administrative

and fiscal mechanism to facilitate all the above activities.

Non-Edible Plant Oils as New Sources for Biodiesel Production [d]

The use of edible vegetable oils and animal fats for biodiesel production has recently been of great concern because they compete with food materials. As the demand for vegetable oils for food has increased tremendously in recent years, it is impossible to justify the use of these oils for fuel use purposes such as biodiesel production. Moreover, these oils could be more expensive to use as fuel. Hence, the contribution of non-edible oils such as jatropha, Pongamia pinnata and soapsuds will be significant as a non-edible plant oil source for biodiesel production.

2.LITERATURE SURVEY

P. Brahatheeswaran et al. [1] "Performance and emission characteristics of Bio Diesel from Pongamia oil, Methanol, Koh and its effect on CI Engine" Biodiesel is an alternative fuel formulated exclusively for diesel engines. It is made from vegetable oil or animal fats or it is the name for a variety of ester-based fuels generally defined as the oxoalkyl esters made from vegetable oils through simple transesterification process. It is recommended for use as a substitute for petroleum-based diesel mainly because biodiesel is a renewable, domestic resource with an environmentally friendly emission profile and is readily biodegradable. Biodiesel is nontoxic, biodegradable. It reduces the emission of harmful pollutants from diesel engines but emissions of nitrogen oxides are increased. Biodiesel has a high cetane number. The high cetane numbers of biodiesel contribute to easy cold starting and low idle noise. The use of biodiesel can extend the life of diesel engines because it is more lubricating and furthermore, power output is relatively unaffected by biodiesel.

Sukanta Kumar et al. [2]

"Preparation of Biodiesel from Karanja (Pongamia Pinnata) Oil" Biodiesel was prepared from the non-edible oil of Karanja by transesterification of the crude oil with methanol in the presence of NaOH as catalyst. A maximum conversion of 92% (oil to ester) was achieved at 600c. Important fuel properties of methyl esters of biodiesel produced from Karanja oil like viscosity, flash point, fire point, calorific value etc., was found out and compared to the properties of Indian standard biodiesel.

A. Prabhu et al. [3]

"Effect of Al2O3 Nano additives on the performance and emission

characteristics of Jatropha and Pongamia methyl esters in CI engine" Pongamia oil is extracted from Millettiapinnata seeds. Millettiapinnata otherwise known as Pongamiapinnata and Pongamiaglabra are well suited in the tropical and temperate climatic regions of Asia. Jatropha curcas or simply Jatropha is cultivated in tropical and subtropical climatic regions of the world. These are a non-edible type of oil. The seeds Jatropha contain about 40% of oil content that makes them produce a quality biodiesel. Both these types of biodiesels are usable in a normal CI

Gayatri Vaidya et al [4] "Comparative Evaluation of Bio productivity Studies of Simarouba, Pongamia and Jatropha for Biodiesel Parameters"

Vegetable oils (triglycerides) are promising feedstock for biodiesel production, since they are renewable in nature and can be produced on the large scale and are environmentally friendly. Several plant species like, Azardirachta indica, Ricinus communis, Shorea robusta, Mesua ferra, Mallotus phillippinensis, Salvador, Garcinia indica are considered as fuel crops for biodiesel production. These species are resistant to drought, non- Jatropha cruces, Pangamic pinnata, Simarouba glauca, Calophyllum epiphyllum, Maduca indica, Hevea brasilinsis grazing, high seed yield, a n d sustain their growth in a r i d a n d semiarid a g r o c l i ma t i c c o *n* d i t i o n s . Preliminary evaluation of several oil seed crops for their growth, and utilization under agro- forestry system has been recorded (14) most of these plants have multiple uses such has commercial, pharmaceutical, pesticidal properties and have capability to grow in the arid and semiarid regions.

Venkata Ramesh Mamilla et al. [5]

Biodiesel was prepared from the non-edible oil of Karanja by transesterification of the crude oil with methanol in the presence of NaOH as catalyst. A maximum conversion of 92% (oil to ester) was achieved at 600c. Important fuel properties of methyl esters of biodiesel produced from karanja oil like viscosity, flash point, fire point, calorific value etc., was found out and compared to the properties of Indian standard biodiesel.

Younus Pasha et al. [6] has made a thorough study on straight vegetable oils (SVOs) as the best alternative energy options in C I engine. However, the high viscosity of SVOs often causes blockages if it is fed at room temperature to the engine. In this work the viscosities and flash point temperatures were found for the three most popular non-edible oils such as Pongamia oil, Castor oil and Neem oil with 3% or 5% of Kerosene or Petrol as additives. Pongamia oil with 3% Petrol as the additives was tested in a diesel engine and found to be a satisfactory replacement of diesel fuel requiring no further heating of the fuel mixture. Therefore the paper addresses the task of developing an alternative fuel which can be used directly into a diesel engine without further processing or heating. Such an engine can be suitable to use for irrigation water pumps to run on locally obtainable non edible oil, such as Pongamia oil with small proportion of additives such as Petrol.

Pranab K. Barua et al. [7] the biodiesel that are produced from Jatropha seeds is comparable with the biodiesel marketed by the Numaligarh Refinery. Assam biodiesel B-100 is of slightly higher density, of slightly lower cetane number, and of slightly lower final boiling temperature have evaluated. Experiments have shown the superiority of Jatropha biodiesel over conventional diesel as far as sulphur content is concerned .The carbon residue is slightly higher than that of biodiesel. These points lead to conclude that biodiesel produced from Jatropha seeds found in Assam is of good quality.

K. V. Yathish et al. [8] has evaluated the biodiesel recognition as a clean alternative fuel or as a fuel additive to reduce pollutant emission from CI engine and minimum cost so there is need for producing biodiesel other than from seed oil. In this study the diary waste scum were used as the raw material to produce biodiesel. Scum oil methyl ester (SOME) is produced in laboratory

by tranestrification process. The performance parameters elucidated includes brake thermal efficiency, brake specific fuel consumption, and exhaust gas temperature.

VijittraChalatlon et al. [9] have evaluated the study on non-edible vegetable oil produced from *Jatropha* fruits as a substitute fuel for diesel engines and its usability was investigated as pure oil and as a blend with petroleum diesel fuel. A direct injection (DI) diesel engine was tested using diesel, *Jatropha* oil, and blends of *Jatropha* oil and diesel in different proportions. At low load operations, CO2 emission with blends was lower than that of diesel, whereas, at high loads, CO2 emission became higher with a higher percentage of *Jatropha*oil in the blends. CO emission with blends was much higher than that of diesel; the higher the percentage of *Jatropha*oil in the blend, the higher the CO emission.

P. Nakpong et al. [10] has made a thorough study on optimization of biodiesel from Jatrophacurcas oil, crude Jatrophacurcas oil which was used as feedstock for biodiesel production by alkali-catalysedmethanolysis. The reaction in the presence of NaOH as catalyst was carried out to investigate the optimum conditions and to study the effects of variables on the reaction. The results reveal that all of the reaction variables in this study had positive effects on the reaction.

Ravichandra V Koti1 et al. [11] have studied the production of biodiesel from Safflower Oil and Milk Scum Oil meeting with international standards. The mixture of Safflower Oil -Milk Scum Oil meeting with methyl ester was used as a new fuel. The performance and emission test were carried out in a single cylinder direct injection compression ignition engine. The HC, CO and CO2 emissions were found to be less than that of neat diesel fuel except NOx. Break Thermal Efficiency of biodiesel and its blends was found to be less than diesel fuel, Exhaust Gas Temperature, Break Specific Fuel Consumption for biodiesel and its blends were found to be higher than diesel fuel.

Alireza Shirneshan et al. [12] have evaluated the study on a 4-cylinder direct-injection diesel engine using biodiesel as an alternative fuel and their blends to investigate the emission characteristics of the engine under four engine loads (25%, 40%, 65% and 80%) at an engine speed of 1800 rev/min. A test was applied in which an engine was fuelled with diesel and four different blends of diesel/ biodiesel (B20, B40, B60 and B80) made from waste frying oil and the results were analyzed. The use of biodiesel resulted in lower emissions of hydrocarbon (HC) and CO and increased emissions of CO2 and NOx. This study showed that the exhaust emissions of diesel/biodiesel blends were lower than those of the diesel fuels.

Prof. Naveen Kumar et al. [13] has made a thorough study on most versatile engine as diesel engine, which are mostly using as main prime movers in transportation. The mixture includes 5%, 10%, 15% and 20% (v/v %) blends of Jatropha oil methyl ester (JOME)and ethanol were prepared and further compared with neat diesel and 100 %JOME in terms of performance and emission characteristics.

Transesterification process was used to produce methyl ester from oil. From the experimental trial it has been found that Brake thermal efficiency of the engine is higher for all the blends compare to baseline diesel fuel. At full load condition BTE of 20 % blends of JOME and ethanol is 12.1% higher than that of neat diesel fuel. At 100 % loading condition neat JOME showed BTE of 23.91%.Brake Specific energy Consumption (BSEC) was highest for 100% JOME and lowest for 20 % blend.

S.M. Ashrafur Rahman et al. [14] has made a thorough study on an engine running at low load and low rated speed is said to be subject to high idling conditions, a mode which represents one of the major problems currently the transport industry is facing. During this time, the engine cannot work at peak operating temperature. This leads to incomplete combustion and emissions level increase due to having fuel residues in the exhaust. Although biodiesel blends decrease carbon monoxide and hydrocarbon emissions, they increase nitrogen oxides emissions in high idling modes. Compared to pure diesel fuel, fuel consumption also increases under all high idling conditions for biodiesel blends; with a further increase occurring as blend percentage rises.

Amit Pal et al. [15] has made a thorough study energy source in India and preferred as automotive fuel. In present paper the engine performance and exhaust emissions of jatropha oil biodiesel blends, were investigated on a 39 kW multi cylinder engine, in B10 to B30 percent blends and compared with the petroleum diesel fuel. The experimental results show that the engine power and torque of the mixture of oil–diesel fuel are close to the values obtained from diesel fuel and the amounts of smoke, CO and HC exhaust emissions are lower than those of diesel fuel, except slight increase of NOx emissions at higher loads.

Mohammed E.L. Kassaby et al. [16] has made a thorough study on wasted cooking oil from restaurants which was used to produce neat (pure) biodiesel through transesterification, and then used to prepare biodiesel/diesel blends. The effect of blending ratio and compression ratio on a diesel engine performance has been investigated. Emission and combustion characteristics were studded when the engine operated using the different blends (B10, B20, B30, and B50) and normal diesel fuel (B0) as well as when varying the compression ratio from 14 to 16 to 18. The result shows that the engine torque for all ratio increases and at all compression ratios bsfc remains higher for the higher blends as the biodiesel percent increase.blends increases as the compression ratio increases. The bsfc for all blends decreases as the compression

Dr. S.V. Prakash et al. [17] has made a thorough study on bio fuel which provides a sustainable solution to energy crisis by displacing oil use in agriculture and transport sector. Biogas is an obvious choice and has a promising future in India due to tropical location, very high population of livestock and wide variety of substrates available in abundance for biogas generation. In addition to gas around 350 million tons of organic manure would also be produced. If organic wastes such as sewage, municipal solid waste, waste from industrial effluents can also be taken as feedstock to increase biogas potential further. Current study deals with these aspects and also effective utilization of slurry which is the byproduct of bio-gasification.

Dr. R Suresh et al. [18] has made the thorough study on crude mixed oil which was used as feedstock for biodiesel production by Homogeneous Catalyst. The variables included methanol to oil molar ratios, catalyst concentrations, reaction temperature and reaction times. Gas chromatography was used to determine the fatty acid composition of mixed oil. The optimum conditions for mixed oil biodiesel production were a catalyst concentration of 1.0% w/w of oil, a reaction temperature of 70 ºC, a reaction time of 30minutes 6:1 methanol to oil molar ratio at 400rpm. The methyl ester content under these optimum conditions was 95.10%, and all the measured properties of mixed oil biodiesel met the ASTM standards.

Dr. A C Tiwari et al. [19] has made a thorough study on experimental investigations which was carried out to evaluate the effect of ethanol to vegetable oil on performance and emission characteristics of a compression ignition engine. Use of straight vegetable oil (SVO) for diesel engine is limited due to their higher viscosity and poor volatility. In long term, SVO exhibits injector coking, fuel pump damage and fuel filter clogging, etc. To reduce the viscosity and to increase the volatility of the fuel, an ethanol is added to the vegetable oil so that thermal efficiency and emissions can be improved. During investigation, blends of vegetable oil with different proportions of ethanol are prepared. Blends BSVO-80 and BSVO-70 are prepared using 20% and 30% of ethanol with SVO respectively. It could be concluded that blend BSVO-70 can be a good substitute for diesel.

D.K.Ramesha et al. [20] has made a thorough study on the non-renewable energy resource which is in most demand, because of its easy availability and cheap processing methods. The diesel engines are also in more demand nowadays because of its higher thermal efficiency, longer engine life and more robustly built in contrast to the petrol engines.

All these act as contributing factors for the increase in demand for diesel. Non-edible oils such as Jatropha, Neem, Pongamia, Mahua etc. The exhaust emission gas is tested for HC, CO, CO2 and UBHC and the variation of these parameters with the variation in blend percentages and loads. The decrease in the UBHC, CO and CO2 is seen at 50% load condition though no definite values are observed at no load conditions.

N. P. Rathod et al. [21] has made a thorough study on vegetable oil which poses some problems when subjected to prolonged usage in compression ignition engines because of high viscosity as reported by different researchers. The research on alternative fuels for compression

ignition engine has become essential due to depletion of petroleum products and its major contribution for pollutants, where vegetable oil promises best alternative fuel. Various fuel inlet temperatures, blending ratio, viscosity and various loading conditions are some of the parameters that need to be analyzed for better engine performance and reduced emissions. In this study, a review of research papers on various operating parameters have been prepared for better understanding of operating conditions and constrains for methyl ester kusumoil and its blends fuelled compression ignition engine.

Bobade S.N. and Khyade V.B. [22] Pongamia pinnata can be a definite source of raw material due to its easy availability in wild. Pongamia pinnata is drought resistant, semi- deciduous, nitrogen fixing leguminous tree. It grows about 15-20 meters in height with a large canopy which spreads equally wide.

After transesterification of crude oil shows excellent properties like calorific value, iodine number, cetane number and acid value etc.

R. N. Singh et al. [23] has made a thorough study on SVO (Straight Vegetable Oil) of Jatropha which was de-waxed and de-gummed as per the standard procedure, and was tested in irrigation pump set, kerosene cook stove and kerosene lamp. It was found that Jatropha oil could be successfully used as irrigation pump fuel, however at interval of every 25 - 30 hours of operation, fuel injection nozzle and head needs to be cleaned in spite of maintaining the Jatropha oil temperature between 80 to 90 °C. No significant, wear and tear in the engine component such as liner, piston, and piston rings, except bore gauge was observed. However for kerosene lamp it can be used with a blending of 10 % Jatropha oil and 90% kerosene.

Summary of literature survey:

From the literature survey it is clear that the production of biodiesel is possible using the non- edible vegetable oil, either by subjecting non-edible vegetable oil to chemical reaction called transestrification process to produce biodiesel or using the straight vegetable oil to run the engine by least modification in the chemical property of the oil and the detailed study of properties of pongamia oil.

The several studies showing the performance parameters of the engine running with blended biodiesel with the different proportion of additives such as petroleum diesel etc, testing and implementation of straight vegetable oil to run the engine either by adding some additives such as petrol, kerosene etc to reduce the viscosity or by subjecting the non- edible vegetable oil to dewaxing

3.OBJECTIVES AND METHODOLOGY

Objectives of the project:

To predict suitable non-edible vegetable oils as straight fuel in the compression ignition engine.

To characterize the blended vegetables oil to check the feasibility as alternative fuel based on their properties.

To establish the test facilities at 60%, 80% and full load condition.

To determine the performance parameters based on which feasibility can be claimed at 60%, 80% and full load conditions.

To analyze the various performance parameters with the conventional petroleum diesel.

To determine the emission characteristics of the selected fuel sample and compare with the emission characteristic of petroleum diesel.

The main objective of the project is to predict suitable non-edible vegetable oil as a straight fuel in the compression ignition engine without any alteration in the engine. To characterize the blended vegetable oil to check the feasibility as an alternative fuel based on their property to run the diesel engine. The selected oil blend was used to run the diesel engine to check the feasibility at 60%, 80% and full load condition. From the testing the readings are used to determine the performance parameters based on which feasibility can be claimed at 60%, 80% and full load conditions. The diesel sample is also considered for the testing for the comparison between the performance parameter of petroleum diesel and pongamia oil blend. The selected sample is subjected to emission test at full load condition and compared with the emission characteristic of petroleum diesel.

3.2. Methodology

STEP-1: Preparation of fuel samples

In the present work Pongamia seed oil is selected to prepare the fuel samples with the varied proportionate of Petroleum gasoline i.e. Petrol. Based on the past literature it has been concluded that C I engine can be run by vegetable oils with the blended proportion of Petrol up to 5% [least %].

In the present work four experimental trials has to conduct for the following blended proportion of petrol with Pongamia oil.

(i). Pongamia oil [88%] + Petrol [12%]

(ii). Pongamia oil [86%] + Petrol [14%]

(iii). Pongamia oil [84%] + Petrol [16%]

(iv). Pure Pongamia oil [100%]

STEP-2:Measurement of blended fuel properties

In order to conclude the feasibility of blended vegetable oil with petrol as Diesel substitute the following properties has to determine by using various experimental setups.

At the temperature 35°C, 40°C and 45°C.

(a). Viscosity

(i) Kinematic viscosity

(ii) Dynamic viscosity

(b). Density

(c). Flash Point temperature

(d) Calorific Value

4.EXPERIMENTAL SETUP USED FOR TESTING

Fig:4.1 The with an alternator and circuits engine setup

Fig: 4.2 Engine and alternator

SPECIFICATIONS OF ENGINE SETUP USEDTO DETERMINE PERFORMANCE PARAMETER:

Model	KILOSKAR
Power	13.7KW
Cooling	Water Cooled
No. of cylinder	One
Type	Vertical,4-stroke, Compression ignition
Rpm	1500
Rotation	Clockwise handle stroke
Starting	Handle start with cranking

Table No.-4.1: Specification of the Engine setup

Type of Fuel	Load in Watts	Time to run down 10cc of fuel (t) in sec	Voltage in (V)	Current in (Amps)
Diesel	1200	47	240	4.8
	1600	41	240	6.6
	2000	34	240	7.6
Pongamia oil (84%) +petrol (16%)	1200	42	240	4.8
	1600	36	240	6.4
	2000	31	240	8

TABULAR COLUMN FOR READING

5.RESULTS AND DISCUSSIONS

In the current investigation it was found that the pongamia oil blend of proportion 84%+ petrol 16% is chosen because of the more superior quality to that of diesel fuel. When compared to the other proportion of pongamia oil blends and a sample of 100% pongamia oil based on the a t ta inment of fuel properties out of four samples, the sample comprising pongamia oil 84% + petrol 16% was selected.. The pongamia oil 84% + petrol 16% and the petroleum diesel tested result are listed below.

6. CONCLUSION

In the present experimentation attempt has made to prepare a fuel substitute for petroleum diesel in diesel engine. In usual practice in order to prepare biodiesel from any vegetable oil it has to be subjected to transesterification process.

Transesterification involves vegetable oil or animal fats being reacted with short chain alcohols such as methanol or ethanol, in presence of catalyst. In the transesterification process the added alcohol is deprotonated with a base to make it a stronger nucleophile. During reaction triglycerides are reacted with an alcohol such as ethanol to give ethyl esters of fatty acids and glycerol. During transesterification the viscosity of vegetable oil falls to the acceptable range and the flash point temperature also falls to the required level. In the present experimentation the above deciding parameters such as kinematic viscosity, flash point temperature and density of the vegetable oil lower to the required range by blending the petrol in appropriate proportions. Based on the engine performance and emission characteristics, one can conclude that the prepared sample consist of pongamia oil [84%] + petrol [16%] shows more feasible results. At the full load condition, the engine behaves normal working with prepared sample similar to the engine behavior when it is fueled with petroleum diesel. Even the emission level can be minimized to acceptable level as per the ASTM standard emission norms.

7.REFERENCES

1. **"Jatropha and Karanja oil derived DMC–biodiesel synthesis: A kinetics study."** Rathore V et al. Jatropha and Karanja oil derived DMC–biodiesel synthesis: A kinetics study. Fuel **(2014)**, http://dx.doi.org/10.1016/ j.fuel.2014.10.003

2. Bobade S.N. et al. "**Detail study on the Properties ofPongamia Pinnata (Karanja) for the Productionof Biofuel"** ISSN 2231-606XVol. 2(7), 16-20, July (2012)
3. **Extraction and recovery of karanjin: A value addition to karanja (Pongamia pinnata) seed oil** Vismaya et al. / Industrial Crops and Products 32 (2010) 118–122

4. **Optimization of alkali-catalyzed transesteriWcationof Pongamia pinnata oil for production of biodiesel** L.C. Meher et al. / Bioresource Technology 97 (2006) 1392–1397

5. Vigya Kesari et al. **"Physico-chemical characterization and antimicrobial activity from seed oil of Pongamia pinnata, a potential biofuel crop"** biomass and bio energy 34 (2010) 108 –115

6. Paul T et al. **"Pongamia pinnata: An Untapped Resource for the Biofuels Industry of the Future Bioenerg."** Res. (2008) 1:2–11 DOI 10.1007/ s12155-008-9003-0

7. **"Preparation of biodiesel from crude oil of Pongamia pinnata"** S.K. Karmee, A. Chadha / Bioresource Technology