A PROJECT REPORT

ON

"STUDY ON EFFECT OF BLENDS OF DATURA STRAMONIUM BIODIESEL ON THE PERFORMANCE AND EMISSION CHARACTERISTICS ON DIESEL ENGINE"

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfilment of the Requirement for the Award of

BACHELOR'S DEGREE IN
MECHANICAL ENGINEERING

BY

SHAIKH MOHD NOORUL ISLAM ABDUL KHALIQUE	15ME47
NAJMUS SAQUIB ABDUL WAHAB	15ME33
HAWALE PARAG CHANDRAKANT	16DME139
KHAN FARHAN ADAM	15ME16

UNDER THE GUIDANCE OF
PROF. RAHUL R. THAVAI

DEPARTMENT OF MECHANICAL ENGINEERING
Anjuman-I-Islam's Kalsekar Technical Campus
SCHOOL OF ENGINEERING & TECHNOLOGY
Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

2018-2019

AFFILIATED TO

UNIVERSITY OF MUMBAI

A PROJECT REPORT
ON

"STUDY ON EFFECT OF BLENDS OF DATURA STRAMONIUM BIODIESEL ON THE PERFORMANCE AND EMISSION CHARACTERISTICS ON DIESEL ENGINE"

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfilment of the Requirement for the Award of

BACHELOR'S DEGREE IN MECHANICAL ENGINEERING

BY

SHAIKH MOHD NOORUL ISLAM ABDUL KHALIQUE	15ME47
NAJMUS SAQUIB ABDUL WAHAB	15ME33
HAWALE PARAG CHANDRAKANT	16DME139
KHAN FARHAN ADAM	15ME16

UNDER THE GUIDANCE OF
PROF. RAHUL R. THAVAI

DEPARTMENT OF MECHANICAL ENGINEERING
Anjuman-I-Islam's Kalsekar Technical Campus
SCHOOL OF ENGINEERING & TECHNOLOGY
Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

2018-2019
AFFILIATED TO

UNIVERSITY OF MUMBAI

Anjuman-I-Islam's Kalsekar Technical Campus

Department of Mechanical Engineering
SCHOOL OF ENGINEERING & TECHNOLOGY
Plot No. 2 3, Sector - 16, Near Thana Naka,
Khandagaon, New Panvel - 410206

CERTIFICATE

This is certify that the project entitled

"STUDY ON EFFECT OF BLENDS OF DATURA STRAMONIUM BIODIESEL ON THE PERFORMANCE AND EMISSION CHARACTERISTICS ON DIESEL ENGINE"

submitted by

SHAIKH MOHD NOORUL ISLAM ABDUL KHALIQUE	**15ME47**
NAJMUS SAQUIB ABDUL WAHAB	**15ME33**
HAWALE PARAG CHANDRAKANT	**16DME139**
KHAN FARHAN ADAM	**15ME16**

is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Mechanical Engineering) at ***Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai*** under the University of MUMBAI. This work is done during year 2018-2019, under our guidance.

Date: / /

(Prof. RAHUL R. THAVAI)
Project Supervisor

(Prof. RIZWAN A. SHAIKH)
Project Coordinator

(Prof. ZAKIR ANSARI)
HOD, Mechanical Department

DR. ABDUL RAZAK HONNUTAGI
Director

External Examiner

Acknowledgements

We would like to take the opportunity to express my sincere thanks to my guide **Rahul R. Thavai**, Assistant Professor, Department of Mechanical Engineering, AIKTC, School of Engineering, Panvel for his invaluable support and guidance throughout my project research work. Without his kind guidance & support this was not possible.

We are grateful to him/her for his timely feedback which helped me track and schedule the process effectively. His/her time, ideas and encouragement that he gave is help me to complete my project efficiently.

We would like to express deepest appreciation towards **DR. ABDUL RAZAK HONNUTAGI**, Director, AIKTC, Navi Mumbai, **Prof. ZAKIR ANSARI**, Head of Department of Mechanical Engineering and **Prof. RIZWAN A. SHAIKH**, Project Coordinator whose invaluable guidance supported us in completing this project.

We are also very thankful to **INDIAN BIODIESEL CORPORATION**, Baramati, Maharashtra for help in extraction of biodiesel from Datura Stramonium seeds and for tremendous support.

At last we must express our sincere heartfelt gratitude to all the staff members of Mechanical Engineering Department who helped me directly or indirectly during this course of work.

SHAIKH MOHD NOORUL ISLAM ABDUL KHALIQUE
NAJMUS SAQUIB ABDUL WAHAB
HAWALE PARAG CHANDRAKANT
KHAN FARHAN ADAM

Indian Biodiesel corporation

E-mail :ibdc.bmt@gmail.com PH. 02112-221382 www.renewenergy.in

I/W.No. —
O/W 3034/.19
DT. 25/04/19

Certificate

This is to certify that following students of **B.E. (Mechanical engineering)** of **Anjuman-I-Islam's Kalsekar Technical Campus, SCHOOL OF ENGINEERING & TECHNOLOGY, MUMBAI, M.S.** has joined the company on 14/09/2018 with their request to conduct research of synthesis, analysis of biodiesel and to prepare their project report based on their findings.

We had given them to work on "**STUDY ON EFFECT OF BLENDS OF DATURA STRAMONIUM BIODIESEL ON THE PERFORMANCE AND EMISSION CHARACTERISTICS ON DIESEL ENGINE**" under the guidance of Prof. R.R. Thavai and Dr. S. N. Bobade, (IBDC, Baramati).

MR. SHAIKH MOHD NOORUL ISLAM ABDUL KHALIQUE

MR. NAJMUS SAQUIB ABDUL WAHAB

MR. HAWALE PARAG CHANDRAKANT

MR. KHAN FARHAN ADAM

We here by appreciate their efforts to handle the work and complete the analysis without any hesitation as a beginner and their keen interest shown in the complete duration of the project till its completion on 25/04/2019. Herewith we certify that they have completed the project and training successfully.

We wish them all the success in future.

Indian Biodiesel Corporation

Authorized Signatory

Biofuel.." Soil to oil Green engery project under one roof "

Project I Approval for Bachelor of Engineering

This project entitled ***'STUDY ON EFFECT OF BLENDS OF DATURA STRAMONIUM BIODIESEL ON THE PERFORMANCE AND EMISSION CHARACTERISTICS ON DIESEL ENGINE'*** by ***Shaikh Mohd Noorul Islam Abdul Khalique,Najmus Saquib Abdul Wahab, Hawale Parag Chandrakant, Khan farhan Adam*** is approved for the degree of ***Bachelor of Engineering in Department of Mechanical Engineering.***

Examiners

1. ....
2. ....

Supervisors

1. ....
2. ....

Chairman

....

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Student Name
Roll Number:

ABSTRACT

Biodiesel has been emerging as a potential source for the replacement of conventional diesel fuel. Non edible plant oil extracted from the seeds of Datura Stramonium was used as the feedstock and synthesized into biodiesel by acid catalyzed esterification and base catalyzed transesterification. Biodiesel blends of B00, B04, B08, B12, B16, B20 and B24 were prepared. Additionally, 5additive. The prepared blend range within the prescribed limits of American standard ASTM 6751. The fuels were used in Single cylinder Diesel engine with compression ratio (CR) 16.7:1. Performance parameters like Brake Power (BP), Fuel consumption, Braking Torque (BT), Brake specific fuel consumption (BSFC) and Heat Supplied were measured at different loads. Exhaust parameters Hydrocarbons (HC), Carbon Monoxides (CO), Carbon Dioxide (CO 2), Oxygen (O 2) and Nitrogen Oxides (NOx) were also measured. The vibration on the engine casing was also observed. B16 was observed to be the optimum blend among the aforementioned blends. It shows significant reduction in the emissions of HC, HC, CO 2 and NOx without any drastic change in the performance and vibration.

Keywords: Biodiesel, Datura Stramonium, Transesterification, Diethyl Ether, B16.

Contents

List of Figures

List of Tables

Chapter 1

INTRODUCTION

During the past decades worldwide petroleum consumption has permanently increased due to growth of human population and industrialization, which has caused depleting fossil fuel reserve and increasing petroleum prices. On the other hand, combustion of fossil fuels contributes most to emission of greenhouses gases, which leads to atmospheric pollution and global warming. The transport section is almost,, depends upon petroleum fuels. The increase of number on the whole planet. Therefore, at Present there is a great awareness in the diesel fuel substitution all over the world with clean, renewable fuel such as biodiesel, which has lot of technical advantages over a fossil fuel such as lower over all exhaust emission toxicity, biodegradability, derivation from renewable and domestic feedstock, negligible sulfur content, superior flash point and higher combustion efficiency. Biodiesel could be used as a pure fuel or as blend with diesel which is stable in all ratios. Biodiesel production is expected to encourage employment and development in rural areas, to develop long term replacement of fossil fuel, to reduce national dependency has a lot of advantages in related to petro – diesel, the high price of its production is main barrier to its commercial use. Biofuels are an important alternative for the current global demand for energy. Biodiesel, bioethanol and biogas have been obtained from a variety of organic materials, such as starch, oilseed, cellulose and animal fats. First generation biofuels have shown some limitations related to the resources used in competition with food applications. The conflict of using organic materials as either food or the raw material for biodiesel production has motivated investigations on the use of non-edible raw materials for producing biodiesel. Biodiesel is a renewable and biodegradable fuel and also has higher oxygen content than has petroleum diesel. in addition, the use of biodiesel results in a considerable reduction in the emission of carbon dioxide, carbon monoxide, particulate matter polyaromatics, sulfur, hydrocarbons, smoke and noise. The main problem in the Biodiesel industry is the avaibility of expensive, abundant, high quality of material. The cost of agricultural input account for between 59This cost is one of the reasons why biodiesel produced from food – grade oils is not yet economically competitive with petroleum based diesel. In response to this problem,

The use of less valuable non-edible organic material or highly acidic waste material has been gaining increasing importance. The raw material with greater potential for biodiesel production in the future will be a number of by-products, waste and organism that have not direct economic benefit for human. Producing biodiesel from non-edible oil has great possibilities. Biodiesel can be used in diesel engine without major modification.

1.1 PROBLEMS STATEMENT

Biodiesel has been accepted worldwide as an immediate solution to the heavy depence on diesel fuel. However, the prolonged reliance on edible oils as feedstock for biodiesel production has threatened the supply of edible oil to food industry and raised some environmental problems such as serious destruction of vital soil resources, deforestation and usage of much of the available arable land. Moreover, in the last ten years the prices of vegetable oil plants have increased dramatically which will affect the economic prices of biodiesel industry. Due to these factors, it is crucial to find other alternative oil feedstock to substitute edible oil in the production of biodiesel. Therefore, the main objective of this study is to synthesize biodiesel from Datura Stramonium and compare with diesel.

1.2 OBJECTIVES

- To prepare Datura Stramonium oil from dry datura stamonium seeds.
- To produce different blends of biodiesel by transetrification process.
- Performance analysis of a C.I. engine using different blends of biodiesel.
- Analysis and comparison of the performance, emission and vibration parameters of a C.I engine using both pure commercial diesel and prepared biodiesel.

Chapter 2

LITERATURE SURVEY

2.1 Litty Koria and G.Nithya .et .al[1]

Biodiesel is a mixture of fatty acid alkyl esters obtained by the reaction of triglycerides of vegetable or animal origin with alcohol in the presence of a catalyst. The fatty acid profile influences the overall properties of the biodiesel. The properties of individual fatty acid depend on the occurrence of double bonds, fatty acid chain length and branching. Better understanding of the fatty acid composition and correlating the fuel properties is of utmost importance in improving the optimal performance. In the present study, Datura stramonium biodiesel is analyzed for its fatty composition using Gas chromatography assisted with mass spectrometry. The influence of fatty acids of the fuel related properties is discussed

The study reveals that biodiesel samples with high monounsaturates mainly methyl oleate can exhibit better fuel properties in terms of ignition quality, cloud point and heating value. Engineering the fatty acid composition may offer a quality biodiesel which is yet to be explored.

2.2 Supriya B. Chavan, Rajendra Rayappa Kumbhar, Ashutosh Kumar, and Yogesh C. Sharma

This study explores the emission of different pollutants using different blends in a variable compression ratio (VCR) engine. Biodiesel synthesized from Jatropha oil using a heterogeneous catalyst was investigated for emission analysis on a single-cylinder VCR engine with various blending ratios as well as load. Blends (biodiesel + diesel) of JB00, JB10, JB20, JB30, and JB100 were prepared at 40 C. The emission parameters, such as nitrogen oxides (NOx), carbon monoxide (CO), and hydrocarbon (HC), were studied and compared to diesel fuel. Results showed that, among the blends prepared from methyl ester of Jatropha, JB30 shows reduction in emissions of CO and HC up to 43 and 50 percent , respectively, with an increment of NOx emission up to 20 percent at the lowest load and compression ratio (CR) of 15. The optimum parameter for the lowest pollutant emission for JB30 was found with a load of 6 kg at CR of 15.

The experimental analysis suggests that HC and CO emissions decrease with an increase in load and CR, whereas NOx emission increases with an increase in load and CR. The optimum blend and CR was observed as JB30 and CR of 15, respectively. The HC and CO emissions were decreased by 43 and 50 percent, respectively, whereas NOx emission was increased by 20 percent at the lowest load (0) for JB30, as compared to diesel fuel. However, with the increase of load, NOx emission got decreased up to 5 percent for JB30 at a load of 6 kg. The study reveals that, at CR of 15 and load of 6 kg for JB30, CO and NOx emissions decrease up to 50 percent and the HC emission remains constant. Therefore, the JB30 blend with a load of 6 kg at CR of 15 was found as the optimum parameters to operate a VCR diesel engine for the lowest emissions of HC, NOx, and CO gases. Moreover, at the highest CR (18) and load (612 kg), JB30 shows the lowest emission for each pollutant. The overall results affirm that JB30 is the best possible blend to be used for the lowest emissions of HC, CO, and NOx.

2.3 Gustavo M. Hobold, Alexandre K. da Silva

Multiphase flow pattern identification is of utmost importance to the energy industry, given that thermohydraulic operating conditions are drastically affected by flow and heat transfer regimes. In industrial boilers and nuclear reactors, for instance, the heat transfer coefficient – and hence the heater temperature – is significantly affected by the boiling regime, where the onset of film boiling can be catastrophic to the equipment and cause irreparable damage. In this paper, it is shown that a machine can learn from visualization and successfully classify and separate natural convection, nucleate boiling and film boiling regimes using low speed and low resolution image frames acquired from visualization of an on-wire pool boiling experimental setup (direct visualization) even when only the departed, ascending bubbles are considered – i.e., the heater is suppressed from the image (indirect visualization). While not the main objective of this paper, principal component analysis of the frames is shown to provide information regarding bubble dynamics and hence is used for dimensionality reduction. Two types of classifiers, namely support vector machines and neural networks, are shown to be able to classify pool boiling frames with over 93 percent accuracy sufficiently fast, possibly enabling real-time execution and classification, even during indirect visualization and, hence, providing a non-intrusive and low-cost pool boiling regime identification

The present paper demonstrated that fast indirect and nonintrusive boiling regime classification is possible by lowresolution, low-speed image acquisition using simple machine learning and image processing techniques. While most boiling studies rely almost exclusively on heat flux and heater temperature data, machine learning algorithms are shown to be able to predict pool boiling regimes even in the absence of thermohydraulic data. First, it was demonstrated that low frequency video acquisition – in contrast to the high speed imaging usually employed in multiphase flow investigations – are necessary for applications in machine learning techniques for boiling regime identification. Even though the present paper did not focus on boiling heat transfer physics, it is expected that the machine learning investigations conducted in this paper might motivate phenomenological investigations of fast, transient multiphase phenomena using machine learning and low speed visualization. These studies were, until now, only accessible with high speed visualization.

2.4 Devarapaga Madhu Supriya B. Chavan Veena Singh Bhaskar Singh Yogesh C. Sharma

Biodiesel has emerged as a prominent source to replace petroleum diesel. The cost incurred in the production of biodiesel is higher than that for refining of crude oil to obtain mineral diesel. The heterogeneous catalyst was prepared from crab shells by calcining the crushed mass at 800 C. The solid waste catalyst was characterized with XRD, XPS, BET, SEM–EDS, and FT-IR. Millettia pinnata (karanja) oilextracted from its seeds was used as a feedstock for the synthesis of biodiesel. Biodiesel was synthesized through esterification followed by transesterification in a two-step process. Characterization of biodiesel was done using proton NMR spectroscopy. Reaction parameters such as reaction time, reaction temperature, concentration of catalyst and stirrer speed were optimized. Reusability of catalyst was checked and found that there was no loss of catalytic activity up to five times.

Biodiesel from karanja oil has been synthesized using crabshells as solid catalyst. The catalyst was characterized by usingm sophisticated techniques. Karanja and biodiesel both were also characterized and a high yield (94 percent) of biodiesel was obtained.The catalyst was stable and was reusable up to five times without significant loss of activity. The optimized reaction conditions were oil:methanol molar ratio, 1:8; reaction time, 120 min; catalyst amount, 2.5 wt percent; at 65 C and 700 rpm. The fuel properties of the biodiesel were determined as per the US biodiesel standards and found to adhere to the specifications.

2.5 Supriya B.Chavan Rajendra R.Kumbhar D.Madhu Bhaskar Singh and Yogesh C. Sharma

High purity calcium oxide (CaO) was prepared from eggshell and used as a catalyst for the production of biodiesel. Non-edible oil, Jatropha curcas was used as a feedstock for the synthesis of biodiesel. High purity calcium oxide (CaO) was obtained when the eggshell was subjected to calcination at 900 C for 2.5 h. Confirmation of the catalyst was carried out by X-ray diffraction, Fourier transform infrared spectrometry (FT-IR), and differential thermal and thermogravimetric analysis (DTA-TGA). The synthesized biodiesel was characterized using 1 H NMR. Pure biodiesel was obtained in high yield by taking into account various parameters such as a proper methanol to oil molar ratio, reaction temperature and reaction time. Reusability of the catalyst was observed and the catalyst worked efficiently up to six times without significant loss of activity. Physical and chemical properties of biodiesel such as density, kinematic viscosity, cloud point, etc. were studied.

A CaO catalyst, obtained by calcination (900 C for 2.5 h) of eggshells had better activity in the transesterication of Jatropha oil for biodiesel production. A high yield of Jatropha oil methyl ester can be attained by optimization of reaction parameters such as molar ratio (oil/methanol), catalyst concentration, reaction time, reaction temperature and rate of stirring. The acid value of the crude Jatropha oil was 17.88 mg KOH per g which was lowered through acid esterication to 1.78 mg KOH per g. The different reaction parameters like methanol to oil molar ratio, catalyst loading, temperature and reaction time were optimized. The optimum oil and methanol molar ratio was 1 : 8 with 1.7 percent (v/v) H2SO4 at a temperature of 60 0.5 C for 1.3 h. The optimized parameters for the transesterication also showed oil and methanol in similar proportions with 2 wt percent of the catalyst and 2.5 h time of reaction at 65 0.5 C. The yield of the synthesized biodiesel obtained was 90 percent . The parameters of the biodiesel like the acid value, density, kinematic viscosity, ash point, re point, cloud point, pour point, cetane number and caloric value were ASTM D6751 standard. Other parameters such as water (percent), carbon (percent), oxygen (percent), hydrogen (percent) and nitrogen (percent) were also studied and were within the limit of ASTM standard. Thus, the biodiesel obtained was economically viable and possessed superior quality.

Chapter 3

CHARACTERSTICS OF ENGINE FUEL

3.1 Characterstics Of Engine Fuel

The following are the important factors, which influences the choice of fuel:

1. FFA (Free Fatty Acid)
2. Viscosity.
3. density.
4. Water and sediment present.
5. Ash content.
6. Boiling range.
7. Specific Gravity.
8. Carbon residue.
9. Ignition quality.
10. Calorific value .
11. Fire point and flash point.
12. Octane and Cetane number .
13. Storage facilities.

FFA (Free Fatty Acid) :

The amount of free fatty acid in triglyceride plays a very important role in biodiesel production. FFA acts as potential contaminant, They react with alkali catalyst to form soap. Soap can cause glycerol separation problem. FFA is the result of the breakdown of oil or biodiesel. FFA percentage is usually used to describe the FF. content of oils. Fatty acid composition of the oil is essential to determine the quality of reactants and the catalyst.

Viscosity :

The viscosity of a fluid is its resistance to shear or How, and is a measure of the fluids adhesive/cohesive or frictional properties. Viscosity refers to the thickness of the oil and is measuring the amount of time taken for a given measure of oil to pass through an orifice of a specified size. The viscosity will arise due to internal molecular friction within a fluid producing the frictional drag effect. There are two related measure of fluid viscosity known as Dynamic and Kinematic Viscosity.Fuel of low viscosity has inferior lubrication property. This will increase wear of the fuel injection pump and nozzle. Further low viscosity fuels result in greater leakage passed worm fuel injection pump plungers and injector needle valves. This in turn reduces the volume of fuel injected and also pressure build up. High viscous oils have to be heated to lower the viscosity and make them flow. A very low viscosity is dangerous as it will have very low lubricating value. Such a fuel may cause excessive wear and even seizing of the fuel pump plungers, By transesterification process the high viscosity of chicken fat oil can be brought down. After the transestrification even calorific value gets improved.

Density :

Density is the weight per volume. The symbol for density is (the lower case Greek letter rho). Oils that are denser contain more energy. For example, petrol and diesel fuel give comparable energy by weight; diesel is denser and gives more energy per liter. The higher the density the tighter the particles are packed inside the substance, Density is the physical constant at a given temperature and density can help to identify a substance. Variations in biodiesel energy density are more dependent on the feedstock used than the production process. Still these variations are less than for patrol-diesol. It has been claimed biodiesel gives better lubricity and more complete combustion thus increasing the engine energy output and partially compensating for the higher energy density of Petro-diesel.

Water and sediment present :

Gritty manner in the fuel will cause rapid wear of the injection system and cylinder bore. Sediment may cause clogging of fuel system. Water and segment content should not exceed 0.05 volume-percentages. For high speed engines, the permissible limits are 0.1 percent.

Ash content :

Ash contain in the fuel represents non-combustible material, some of which is abrasive in nature. Ash content in diesel fuel builds up deposits.

Boiling range :

Boiling range of the fuel represents the temperature range corresponding to beginning and termination of vaporization of fuel and also the quantum of fuel that will vaporize at different temperatures. Volatility is measured by 90 percent distillation temperature at which 90 percent of the fuel sample has distilled off. Lower this temperature higher is the volatility.

Specific Gravity :

The specific gravity of fuel has not directed upon the burning qualities of fuel. However, the above indicated limitations of viscosity more or less confine the limits of specific gravity to about 0.83 to 0.90 for airless injections engines, down to 0.94 for air injection engines.

Carbon residue :

Carbon residue is the carbon left after evaporation and bumming off of volatile matter from a simple of oil by heating. In indicates the tendency of the fuel to form carbon deposits on engine parts. A maximum carbon residue of 0.10 percent is allowable.

Ignition quality :

Ignition quality is a measure of the ability of fuel to ignite property after ignition A fuel, which ignites slowly, cause diesel knocks. In other sense it ensures easy starting and a progressive smooth combustion with less noise. In high speed diesel engines, time available or allowed for combustion is very short; fuel must have good ignition quality.

Calorific value :

It is the amount of heat liberated by burning unit of mass of fuel. Two types of calorific value are higher calorific value and lower calorific value.

Fire point and flash point :

Flash point: The flash point has been defined as the lowest temperature at which the lubricating oil will flash when a small flame is passed across its surface, Fire point: The fire point of a fuel is temperature at witch it will continue to burn for at least 5second after ignition by an open flame ,i.e. will ignite and burn.

Octane and Cetane number :

Both are used to measure the ignition quality of diesel fuel ;higher this number; the ensier it is to start a standard diesel engine, i.e. ability of diesel to auto- ignite or selfignite Octane number is ability to resist auto-ignition. Octane and cetane number are responsible for auto-ignition temperature, ignition delay, incomplete combustion and knocking of engine. Biodiesel has better lubricating properties and much higher cetane ratings than todays lower sulfuric diesel fuels.

Storage facilities :

In general, fuel should be stored in a clean, dry, dark environment Acceptable storage tank materials include aluminum, steel, fluorinated polyethylene, fluorinated polypropylene and Teflon. Neat biodiesel and biodiesel blends should not be stored for longer than 6 months. If it becomes necessary to store biodiesel longer than 6 months, the acid value should be monitored.

3.2 Production of biodiesel from Datura Stramonium

The seeds of Datura Stramonium were ordered from Udaipur district of Rajasthan, India and parcelled to Indian Biodiesel Corporation Ltd., Baramati. The preparation for making of biodiesel was started by first demoisturisation process of seeds. The seeds were dried in an oven for about 8 to 10 hrs and the entire moisture from the seeds was removed. Seeds were crushed in order to obtain the powder of seeds by a typical mechanical type crusher. The Oil extraction process was carried out by solvent extraction method in which n-Hexane (C6H14) was used as the solvent in order to extract the raw oil from the crushed powder. Soxhlet extractor was used in this process. The solution was left about 24 hrs in the apparatus to extract 500 gm of raw oil. Esterification process was carried out after removing the raw oil. During Esterification process 0.4 percent of H2SO4 which acts as an acid catalyst and 10 percent of CH3OH was added as a solvent to the flask. Reaction Temperature for the process was 60 , Reaction time was 60 minutes and Agitation speed was 600 rpm. A mechanical type stirrer was used for agitation. The Transesterification process was carried out, first 0.5 percent of KOH which acts as a base catalyst was taken and added to a solution of 10 percent CH3OH (percentage values are per 1000ml basis). Reaction Temperature for the process was 60, Reaction time was 45 min and the agitation speed was 600 rpm. After Transesterification, the solution was allowed to settle in a settling vessel for 8-10 hrs. During this process the biodiesel and glycerine are separated from each other. The glycerine phase is much more denser than methyl ester. The glycerin by-product contains unused catalyst and soaps that are neutralised. Once separated from the glycerin, the biodiesel was purified by washing gently with warm water to remove residual catalyst or soaps, dried, and sent to storage. This is the end of the production process resulting in a clear Golden-yellow liquid. Removal of water from Methyl ester was done by heating at 1000C temperature. Finally pure biodiesel B100 was obtained.

3.3 Transesterification Reaction

The major components of vegetable oils and animal fats are Triglycerides. To obtain biodiesel, the vegetable oil or animal fat is subjected to a chemical reaction termed transesterification.

1.png

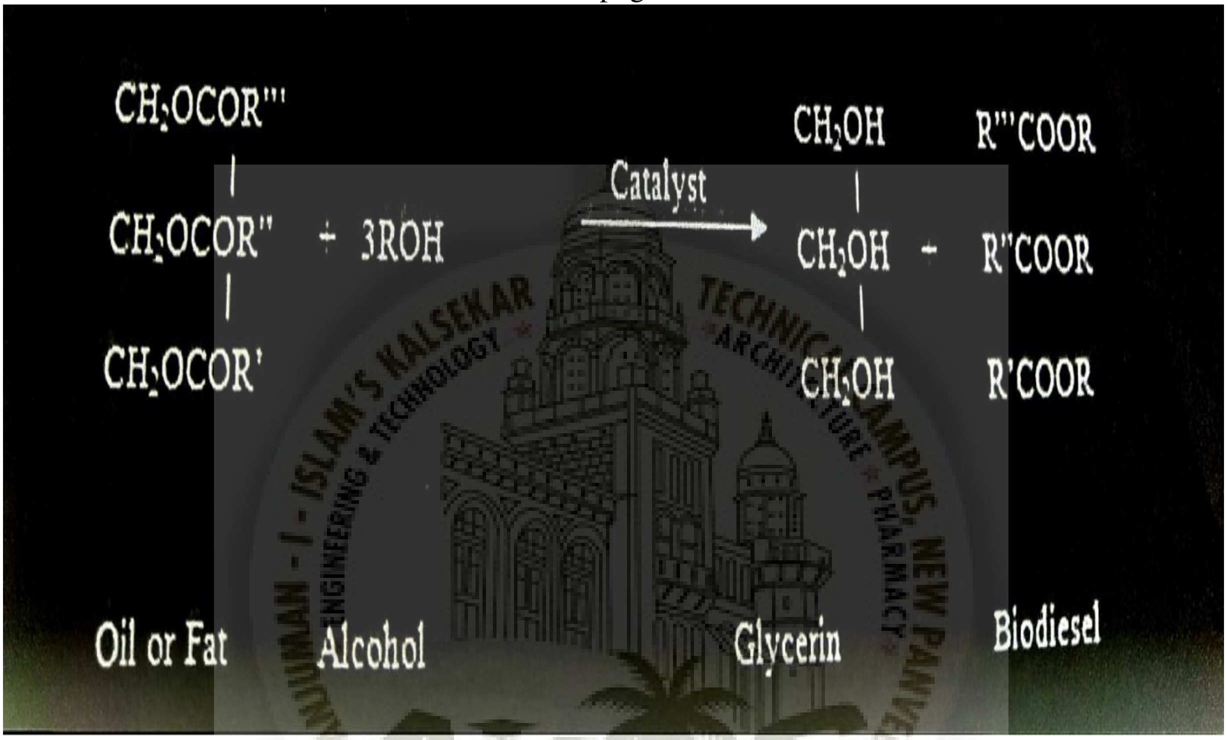

Figure 3.1: ESTERIFICATION REACTION

Filtering :

Filter the vegetable oil to remove solid particles from it. You may have to warm it up a bit first to get it to run freely; 35C should be enough. A cartridge filter is used for the same.

Removing the Water :

Heat the oil first to remove the water content. Vegetable oil will probably contain water, which can slow down the reaction and causes saponification (soap formation). Raise the temperature to 100C, hold it there and allow water contents to boil off. Run the agitator to avoid steam pockets forming below the oil and exploding, splashing hot oil. Or drain water puddles out from the bottom as they form, you can save oil that comes out with the water later. When boiling slows, raise the temperature to 130C for 10 minutes and allow cool to it.

3.4 Catalytic Reaction

Acid Catalyst Reaction:

Oil feedstock containing more than 4 percent Free Fatty Acids go through an acid Esterification process to increase the yield of biodiesel. This feedstocks are filtered and preprocessed to remove water and contaminants, and then fed to the acid Esterification process. The catalyst, sulfuric acid, is dissolved in methanol and then mixed with the pretreated oil. The mixture is heated and stirred, and the Free Fatty Acids are converted to biodiesel. Once the reaction is complete, it is dewatered and then fed to the trartsesterification processs Some feedstock must be pretreated before they can go through the trartsesterification process. Feedstock with less than 5 percent Free Fatty Acid, do not require pretreatment. When an alkali catalyst is added to the feedstocks (With FFA 5 percent), the Free Fatty Acid react with the catalyst to form soap and water as shown in the reaction below: Up to about 5 percent FFAs, the reaction can still be catalyzed with an alkali catalyst but additional catalyst must be added to compensate for that lost to soap. The soap created during the reaction is either removed with the glycerol or is washed out during the water wash. When FFA level is above 5 percent, the soap inhibits separation of the glycerol from the methyl esters and contributes to emulsion formation during the water wash. For these case, an acid catalyst such as sulfuric acid can be used to esterify the FFAs to methyl esters its shown in the following reaction.

In this process, the feedstock is reacted with an alcohol (like methanol) in the presence of a strong acid catalyst (Sulfuric Acid), converting the Free Fatty Acids into biodiesel. The remaining triglycerides are converted to biodiesel in the transesterification reaction.

2.png

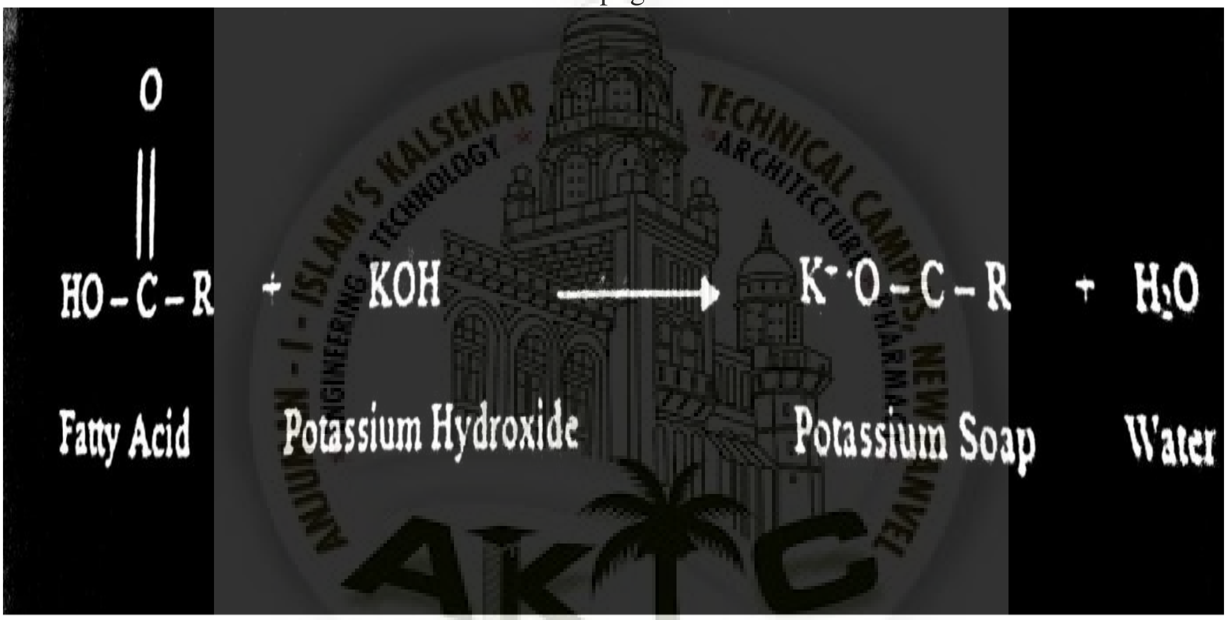

Figure 3.2: ACID CATALYATIC REACTION

Base Catalyst Reaction:

Oil feedstocks containing less than 4 percent Free Fatty Acids are filtered and preprocessed to remove water and contaminants and then fed directly to the transesterification process along with any products of the acid Esterification process. The catalyst, potassium hydroxide, is dissolved in methanol and then mixed with and the pretreated oil. If an acid Esterification process is used, then extra base catalyst must be added to neutralize the acid added in that step. Once the reaction is complete, the major co-products, biodiesel and glycerin, are separated into two layers.The base catalyzed production of biodiesel generally occurs using the following steps: Some systems recommend the reaction take place at room temperature. Excess alcohol is normally used to ensure total conversion of the fat or oil to its esters. Care roust, be taken to monitor the amount of water and free fatty acids in the incoming oil or fat, if the free fatty acid level or water level is too high it may cause problems with soap formation and the separation of the glycerin by-product downstream.

3.png

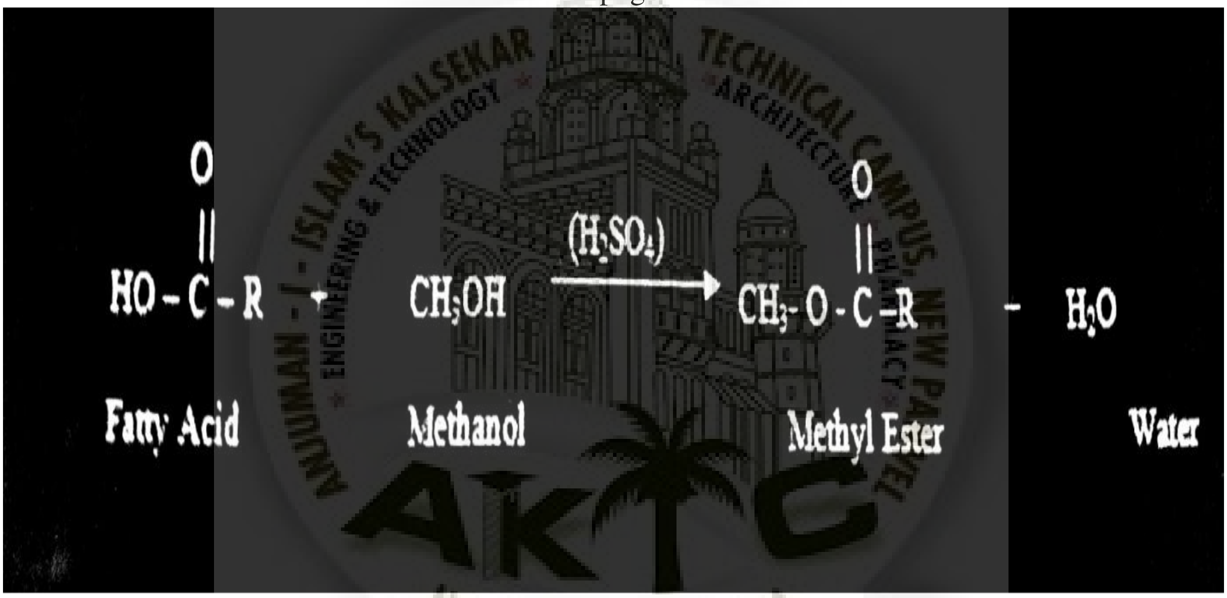

Figure 3.3: BASE CATALYATIC REACTION

Separation :

Once the reaction is complete, two major products exist: glycerin and biodiesel. Each has a substantial amount of the excess methanol that was used in the reaction. The reacted torture is sometimes neutralized at this step if needed. The glycerin phase is hutch more dense than biodiesel phase and the two can be gravity separated with glycerin simply drawn off the bottom of the settling vessel. In some cases, a centrifuge is used to separate the two materials faster.

Alcohol Removal :

Once the glycerin and biodiesel phases have been separated, the excess alcohol in each phase is removed with a flash evaporation process or by distillation. In others systems, the alcohol is removed and the mixture neutralized before the glycerin and esters have been separated. In either case, the alcohol is recovered using distillation equipment and is re-used. Care must be taken to ensure no water accumulates in the recovered alcohol stream.

Glycerin Neutralization :

The glycerin by-product contains unused catalyst and sonps that are neutralized With all acid and sent to storage as crude glycerin. In some eases the salt, formed during this Phase is recovered for use as fertilizer. In most cases the Salt is Left. In the glycerin. Water and alcohol are removed to produce 80•88 percent pure glycerin that is ready to be sold as crude glycerin. In more sophisticated operations, the glycerin is distilled to 99 percent or higher purity and sold into the cosmetic and pharmaceutical mark.

Methyl Ester Wash :

Once separated from the glycerin, the biodiesel is sometimes purified by washing gently with warm water to remove residual catalyst or soaps, dried, and sent to storage. In some, processes this step is unnecessary. This is normally the end of the production process resulting in a clear amber-yellow liquid with a viscosity similar to petro diesel. In some system.

Drying:

Removal of water from Methyl ester by heating at 100C temperature. Finally get pure biodiesel (B100).

3.5 Factor To be Considered while Biodiesel Production

Making biodiesel fuel offers many challengers. While converting one, gallon of oil into biodiesel is simple and fairly easy to learn, processing and finishing hundreds of gallons of waste fryer oil into fuel will present new challenges with each different batch of oil. Following tire some parameters to be considered while framing a production system.

Economics of biodiesel:

The byproducts of bio-diesel from waste chicken fat are the cake and glycerol witch have good commercial value- These bye-products shall reduce the cost of biodiesel depending upon the price with these products can fetch. The cost components of bio-diesel are the price of waste chicken fat collection and oil extraction, oil transesterification, transport of waste chicken fat will be recoverable to a great extent from the income of cake and glycerol witch are byproducts.

Costs to consider in determining the economies of small scale biodiesel production include:-

• Capital investment in equipment this may include purchasing new equipment and acquiring a location to produce and store the biodiesel capital cost may be negligible if production primarily uses recycled material in an existing well-ventilated space.
• Feedstock acquisition procuring the oil, whether fire for pickup or

purchased.

- Chemicals these may be bought in bulk or small quantity.
- Disposal cost of by-products,
- Permit fees.

Feedstock availability :

finished gallon of biodiesel produced will require slightly over one gallon of fccdstock, either new vegetable oil or filtered waste fryer oil from restaurants. As production volumes increase, the logistics of collecting large amounts of waste fryer oil may become more cumbersome In addition, as more people produce bodiless, there may be competition for waste fryer oils, Lastly, it should be noted that working with used cooking oil is somewhat more complicated than virgin oils, due to varying acidity, moisture content and quality of used oil.

Time Commitment:

While biodiesel that is made from free used cooking oil has a reduced materials cost, the time commitment for processing should be overlooked To responsibly operate a small-scale biodiesel facility, you should allow time for all of the following;

- Fabrication and maintenance of biodiesel equipment.
- Oil collection
- Securing chemicals
- Fuel consumption
- Methanol recovery
- Water washing of the fuel or other finishing technique

- Quality testing
- Disposal of waste products

Storage handling of bio-diesel :

As a general rule blends of bio-diesel and petroleum diesel should be treated like petroleum diesel. Though the flash point of biodiesel is high, still storage precaution petroleum diesel. Though the flash point of biodiesel is high, still storage precaution somewhat like that in storing the diesel fuel need to be taken. Based on experience so far, it is recommended that biodiesel can store up to a maximum period of 6 months.

Biodiesel methyl ester contains no volatile organic compounds that can give rise to poisonous of noxious fumes. There is no aromatic hydrocarbon or chlorinated noxious fumes. There is no lead or sulfur to react and release any harmful or corrosive gases. However in case of biodiesel blends significant fumes released by benzene and other aromatizes present in the base diesel fuel can continue. It was observed that when the biodiesels of different oils were stored. their FFA as well as viscosity increased. However, FFA remained below 1 percent even after one and a half year of storage. During storage. during Storage, the bio-diesels also gained some weight. It may be mainly due to reaction with oxygen in the air.

Handling of By-Products :

Biodiesel process generates substantial quantities of crude glycerol by-product (about one gallon of waste product containing glycerol for every five gallons of biodiesel produced. Most processor also use waster for fuel purification and may generates as much as three gallons of waste water for each gallon of fuel produced. Both glycerol and waste water require handling and disposal consideration.

Engine Development and Modifications :

The use of unrefined oil leads to poor fuel atomization due to high viscosity resulting poor combustion and also more gum formation in fuel injector liner etc, The results of emissions of using unrefined chicken fat oils were unfavorable nod wear also accompanied by deposit formation, Therefore, it is necessary to esterify the chicken fat oil for using engines.

SR. NO.	Components	Unit	Quaintly Taken	Unit Price	Total Rs. (For 1.0 Ltr.)
I.	Raw Material	Kg			
1	Datura oil	ltr	2	12	30.50
2	Methanol	Ltr	1	20	20.00
3	CaO	Gm	1	0.1	2.00
	Total				52.50
II.	Pro-duction				
1	Oil Expelling	Kg			4.00
2	Trans-esterification	Ltr			5.00
3	Total				9.00
	Production cost Total				59.00
III.	Recovery				
1	Price of recycle waste	Kg		0	00
2	Glycerol	Ltr		6	6
3	Total				6.00

Figure 3.4: COST ESTIMATION

Indian Biodiesel corporation
E-mail :ibdc.bmt@gmail.com PH. 02112-221382 www.renewenergy.in

TEST REPORT

Name - Mr. Noorul Md. Islam
Instt.-Kalsekar COE, Mumbai
Reference- Analysis of Dhatura oil biodiesel and its blends with DEE as an additive
Services Required- on ph. Call

Sample No. 30327/19
Date- 01/04/2019
Sample qty - 500 ml

Sr.	Test Description	Ref. Std. ASTM 6751	Reference		Diesel	Dhatura oil biodiesel blends with 5% DEE as an additive					
			Unit	Limit	B00%	B4%	B8%	B12%	B16%	B20%	B24%
1	Density	D1448	*gm/cc*	0.800-0.900	0.832	0.833	0.834	0.835	0.837	0.838	0.841
2	Calorific value	D6751	*MJ/Kg*	34-45	42.50	42.40	42.22	42.09	41.90	41.77	41.55
3	Cetane no.	D613	-	41-55	49.00	49.45	49.73	49.90	50.13	50.29	50.51
4	Viscoisity	D445	*mm2/s ec*	3--6	2.700	-	-	-	-	2.80	-
5	Moisture	D2709	*%*	0.05%	0.030	NA	NA	NA	NA	NA	NA
6	Flash point	D93	^oC	-	64	67.00	76.00	86.00	95.00	102.00	107.00
7	Fire point	D93	^oC	-	71	-	-	-	-	111.000	-
8	Cloud point	D2500	^oC	-	-4	-	-	-	-	2.000	-
9	Pour pont	D2500	^oC	-	-9	-	-	-	-	-1.000	-
10	Ash	D	*%*	-	0.05	-	-	-	-	0.050	-

Lab Chemist :________ Verified By:---------
(IBDC- Q.C.Dept.)

X
Dr.Mrs.Supriya Bobade
Q.C.Incharge

Terms

1 Sample will be preserve for 30 days w.e.f today, afterwards it will be destroyed immediately.
2 This test report is prepared for research work lab.testing & not for any commercial purpose or contineous production work.
3 This report is limited for the quantity of Sample only & not for any tanker size dispatch or commercial trade.
4 IBDC is solely private institute involve in Nuresery raising, large scale Plantation of non edible oil seed, seeds, oil & Fat testings & Production of Biodiesel for research purpose only.

Biofuel.." Soil to oil Green engery project under one roof "

Office.: Near Balak Mandir School, at Bhigwan Chowk, Baramati, Dist.Pune - 413 102
Works: gate No. 611/2, behind NIAM Campus, Near Tukai Temple, at Malegaon BK, Tal. Baramati, Dist.Pune - 413 115 Maharashtra - India.
R&D DIVISION

Chapter 4

EXPERIMENTAL SETUP OF ENGINE

It consists of a test bed, a diesel engine, rope break dynamometer, an operational panel, exhaust gas analyzer, sensor to measure temperature. Two filter are installed, one at exit of tank and other at fuel pump. Fuel is fed to the pump under gravity. The cooling water temperature is maintained constant throughout, the research work by controlling a flow rate of water. The exhaust gas composition was analyzed by using exhaust gas analyzer.

The engine was tested at constant speed of 1550 rpm throughout its power range using chicken fat biodiesel blends B00, B04, B08, B12, B16, B20, B24 and B00 again as B00'. The engine performance, emission and vibrations characteristics were investigated.

The tests were conducted with diesel, Datura Stramonium biodiesel with increasing load steps. The engine was coupled with dynamometer to provide break load. The performance parameters evaluated are Brake power, Fuel consumption, Brake specific fuel consumption (BSFC), Heat supplied and the emissions measured were Hydrocarbons (HC), Carbon Monoxide (CO), Carbon Dioxide (CO2), Oxygen (O2) and Nitrogen Oxide (NOx) by using exhaust gas analyzer. Vibration was also investigated. From investigating it can be concluded that biodiesel can be used as an alternative to diesel in a compression ignition engine without any engine modification.

4.1 Test Procedure

1] The fuels used in this study include diesel fuel and biodiesel blends. The experiments were carried out by using neat diesel fuel as the base line (denoted as B00), 4 percent biodiesel +91 percent diesel fuel with 5 percent Diethyl Ether (denoted as B04), 8 percent biodiesel +87 percent diesel fuel with 5 percent DEE (denoted as B08), 12 percent biodiesel +83 percent diesel fuel with 5 percent DEE (denoted as B12), 16 percent biodiesel +79 percent diesel fuel with 5 percent DEE (denoted as B16), 20 percent biodiesel +75 percent diesel fuel with 5 percent DEE (denoted as B20), 24 percent biodiesel +71 percent diesel fuel with 5 percent DEE (denoted as B24).

2]Initially the diesel filled in fuel tanks then started the engine and warmed up to obtain its base parameters. For each test fuel and four loading conditions three times readings were taken. When the engine reaches the stabilized working conditions

3] parameters like fuel consumption and load were measured. the fuel consumption was measured with burette and a stopwatch. the exhaust gas temperature was measure with a K-type thermocouple located on the exhaust pipeline.

4] The performance and emission parameters of biodiesel blends B04, B08, B12,B16, B20 and B24
on with baseline. Performance parameters namely Brake power, Fuel consumption, Brake specific fuel consumption (BSFC), Heat supplied were computed. Similarly exhaust emissions like Hydrocarbons (HC), Carbon Monoxide (CO), Carbon Dioxide (CO2), Oxygen (O2) and Nitrogen Oxide (NOx), were measured using exhaust gas analyzer.

5] To ensure the accuracy of measured value to be high, the gas analyzer were calibrated with standard gases and zero gas before each test. The test engine was loaded by rope break dynamometer.

Chapter 5

OBSERVATIONS

After transesterification, fuel properties like kinematic viscosity, calorifc value, density, flash point and fire point gets improved. The calorific value of methyl ester is lower than because of its oxygen content. The flash point and fire point temperature is higher than the pure diesel. the high flash of chicken fat biodiesel is a beneficial safety feature, as the fuel can be safely stored and transported at the room temperature.

Observation table :

T1 - Water inlet temperature to exhaust gas calorimeter.

T2 - Water outlet temperature to exhaust gas calorimeter.

T3 - Exhaust gas outlet temperature from engine.

T4 - Exhaust gas inlet temperature to calorimeter.

T5 - Exhaust gas outlet temperature from calorimeter.

T6 - Water inlet temperature to engine.

T7 - Water outlet temperature from engine.

BLENDS	LOAD APPLIED (N)	SPEED (RPM)	Time Regulated For 125cc Fuel Consumption (sec.)	TEMPERATURE					
				T1	T2	T3=T4	T5	T6	T7
B00	**0**	1550	121	38	42	835	610	43	45
	4	1550	117	38	41	915	630	41	46
	8	1550	156	39	40	1166	720	40	45
	12	1550	136	39	41	1250	980	41	45
BO4	**0**	1550	127	39	41	840	625	42	46
	4	1550	120	39	41	915	690	42	46
	8	1510	117	39	41	1150	730	42	47
	12	1550	127	39	40	1240	990	44	43
B08	**0**	1530	131	39	40	840	615	41	43
	4	1510	122	39	40	915	670	40	43
	8	1500	125	39	40	1160	760	41	43
	12	1530	121	39	40	1250	970	40	43
B12	**0**	1530	114	39	40	920	640	41	43
	4	1535	107	39	40	1170	680	40	44
	8	1534	58	39	40	1240	780	41	45
	12	1532	105	39	42	1280	990	42	49
B16	**0**	1531	117	40	41	840	620	42	48
	4	1530	111	40	41	950	650	41	49
	8	1530	106	40	40	1150	760	40	48
	12	1525	105	40	42	1260	960	42	49
B20	**0**	1535	124	39	41	840	610	42	46
	4	1535	113	140	41	930	680	41	47
	8	1530	114	39	41	1160	760	42	47
	12	1523	111	39	41	1270	980	42	49
B24	**0**	1490	127	38	42	850	610	41	46
	4	1480	124	38	42	970	680	42	47
	8	1470	127	38	42	1140	760	42	47
	12	1460	123	38	42	1280	980	42	48

Figure 5.1: TABLE:- OBSERVATION TABLE

Chapter 6

FORMULAE

1) Brake power (kw) :

Brake Power = 3.14DNW/60000

2) Fuel consumption (kg/s) :

F.C. = (volume of flow (10cc)/ time required in sec) x density of fuel (gm/cc)

3) Heat supplied by the fuel :

QS = fuel consumption x calorific value of fuel

4) Brake torque :

T = (BPx60) / (2x3.14XN)

5) Brake Thermal Efficiency :

BTE = (BP /heat supplied) x 100

6) Brake Specific Fuel Consumption (kg/k-W-hr):

BSFC = Fuel Consumption / BP

Chapter 7

RESULT AND DISCUSSION

7.1 Result tables of Datura Stamonium oil :

BRAKE POWER VS LOAD :

vs 1.png

Brake Power vs Load

B00		B04		B08		B12	
Load (N)	BP (KW)	Load (N)	BP (KW)	Load (N)	BP (KW)	Load (N)	BP (KW)
2.69	0.0546	3.48	0.071	6.47	0.13	2.01	0.04
45.81	0.92	42.42	0.86	46.45	0.91	40.41	0.81
77.89	1.57	79.16	1.56	83.67	1.64	78.57	1.57
115.02	2.33	115.41	2.26	121	2.39	108	2.16
B16		**B20**		**B24**		**B00'**	
Load (N)	BP (KW)	Load (N)	BP (KW)	Load (N)	BP (KW)	Load (N)	BP (KW)
7.06	0.14	4.13	0.083	4.65	0.14	6.96	0.06
46.35	0.92	41.93	0.84	42.75	0.84	46.25	0.91
78.38	1.56	78.48	1.57	79.57	1.53	80.83	1.59
115.31	2.3	115.51	2.35	117.47	2.26	118.06	2.35

Figure 7.1: TABLE:- BRAKE POWER VS LOAD

BRAKING TORQUE VS LOAD :

BT.png

Braking Torque vs Load							
B00		B04		B08		B12	
Load (N)	BT (N-m)	Load (N)	BT (N-m)	Load (N)	BT (N-m)	Load (N)	BT (N-m)
2.69	0.000345	3.48	0.000437	6.47	0.00081	2.01	0.000249
45.81	0.00566	42.42	0.00529	46.45	0.00575	40.41	0.005039
77.89	0.00967	79.16	0.00986	83.67	0.0104	78.57	0.00977
115.02	0.01435	115.41	0.01436	121	0.01491	108	0.01346
B16		B20		B24		B00'	
Load (N)	BT (N-m)	Load (N)	BT (N-m)	Load (N)	BT (N-m)	Load (N)	BT (N-m)
7.06	0.000879	4.13	0.000516	4.65	0.000877	6.96	0.00037
46.35	0.00574	41.93	0.00524	42.75	0.00538	46.25	0.00573
78.38	0.00973	78.48	0.00976	79.57	0.00988	80.83	0.01055
115.31	0.0144	115.51	0.0141	117.47	0.01468	118.06	0.01476

Figure 7.2: TABLE:- BRAKING TORQUE VS LOAD

FUEL CONSUMPTION VS LOAD:

FC.png

Fuel Consumption vs Load							
B00		B04		B08		B12	
Load (N)	FC (Kg/s)	Load (N)	FC (Kg/s)	Load (N)	FC (Kg/s)	Load (N)	FC (Kg/s)
2.69	0.128	3.48	0.119	6.47	0.114	2.01	0.141
45.81	0.135	42.42	0.13	46.45	0.127	40.41	0.155
77.89	0.089	79.16	0.135	83.67	0.122	78.57	0.179
115.02	0.108	115.41	0.119	121	0.128	108	0.16
B16		B20		B24		B00'	
Load (N)	FC (Kg/s)	Load (N)	FC (Kg/s)	Load (N)	FC (Kg/s)	Load (N)	FC (Kg/s)
7.06	0.135	4.13	0.124	4.65	0.12	6.96	0.106
46.35	0.147	41.93	0.143	42.75	0.125	46.25	0.113
78.38	0.158	78.48	0.141	79.57	0.12	80.83	0.114
115.31	0.16	115.51	0.147	117.47	0.119	118.06	0.114

Figure 7.3: TABLE:- FUEL CONSUMPTION VS LOAD

BSFC VS LOAD :

bsfc.png

BSFC vs Load							
B00		B04		B08		B12	
Load (N)	BSFC (KG/KW-HR)	Load (N)	BSFC (KG/KW-HR)	Load (N)	BSFC (KG/KW-HR)	Load (N)	BSFC (KG/KW-HR)
2.69	2.34	3.48	1.67	6.47	0.876	2.01	3.525
45.81	0.146	42.42	0.151	46.45	0.139	40.41	0.191
77.89	0.057	79.16	0.086	83.67	0.074	78.57	0.114
115.02	0.046	115.41	0.052	121	0.053	108	0.074
B16		B20		B24		B00'	
Load (N)	BSFC (KG/KW-HR)	Load (N)	BSFC (KG/KW-HR)	Load (N)	BSFC (KG/KW-HR)	Load (N)	BSFC (KG/KW-HR)
7.06	0.964	4.13	1.493	4.65	0.857	6.96	1.766
46.35	0.159	41.93	0.17	42.75	0.148	46.25	0.124
78.38	0.101	78.48	0.089	79.57	0.078	80.83	0.071
115.31	0.069	115.51	0.062	117.47	0.052	118.06	0.048

Figure 7.4: TABLE:- BSFC VS LOAD

HEAT SUPPLIED VS LOAD:

HS.png

Heat Supplied vs Load							
B00		B04		B08		B12	
Load (N)	HS (KJ/s)	Load (N)	HS (KJ/s)	Load (N)	HS (KJ/s)	Load (N)	HS (KJ/s)
2.69	0.544	3.48	0.45	6.47	0.4736	2.01	0.59
45.81	0.573	42.42	0.551	46.45	0.527	40.41	0.65
77.89	0.8	79.16	0.572	83.67	0.507	78.57	0.753
115.02	0.46	115.41	0.504	121	0.532	108	0.673
B16		B20		B24		B00'	
Load (N)	HS (KJ/s)	Load (N)	HS (KJ/s)	Load (N)	HS (KJ/s)	Load (N)	HS (KJ/s)
7.06	0.57	4.13	0.518	4.65	0.499	6.96	0.451
46.35	0.62	41.93	0.597	42.75	0.52	46.25	0.48
78.38	0.66	78.48	0.59	79.57	0.54	80.83	0.484
115.31	0.67	115.51	0.61	117.47	0.4944	118.06	0.51

Figure 7.5: TABLE:- HEAT SUPPLIED VS LOAD

HC VS LOAD:

HC.png

HC vs Load

B00		B04		B08		B12	
Load (N)	HC (ppm)	Load (N)	HC (ppm)	Load (N)	HC (ppm)	Load (N)	HC (ppm)
2.69	0	3.48	11	6.47	8	2.01	20
45.81	18	42.42	0	46.45	32	40.41	33
77.89	27	79.16	5	83.67	25	78.57	22
115.02	3	115.41	0	121	33	108	56
B16		**B20**		**B24**		**B00'**	
Load (N)	HC (ppm)	Load (N)	HC (ppm)	Load (N)	HC (ppm)	Load (N)	HC (ppm)
7.06	0	4.13	34	4.65	0	6.96	15
46.35	0	41.93	18	42.75	26	46.25	6
78.38	0	78.48	43	79.57	26	80.83	4
115.31	31	115.51	75	117.47	30	118.06	9

Figure 7.6: TABLE:- HC VS LOAD

CO VS LOAD :

co.png

CO vs Load							
B00		B04		B08		B12	
Load (N)	CO (%)	Load (N)	CO (%)	Load (N)	CO (%)	Load (N)	CO (%)
2.69	0.008	3.48	0.014	6.47	0.054	2.01	0.033
45.81	0.02	42.42	0.005	46.45	0.062	40.41	0.06
77.89	0.044	79.16	0.01	83.67	0.057	78.57	0.059
115.02	0.004	115.41	0.004	121	0.055	108	0.081
B16		B20		B24		B00'	
Load (N)	CO (%)	Load (N)	CO (%)	Load (N)	CO (%)	Load (N)	CO (%)
7.06	0	4.13	0.067	4.65	0.048	6.96	0.038
46.35	0	41.93	0.036	42.75	0.075	46.25	0.023
78.38	0	78.48	0.049	79.57	0.057	80.83	0.018
115.31	0.02	115.51	0.083	117.47	0.057	118.06	0.029

Figure 7.7: TABLE:- CO VS LOAD

CO2 VS LOAD :

co2.png

CO vs Load							
B00		B04		B08		B12	
Load (N)	CO (%)	Load (N)	CO (%)	Load (N)	CO (%)	Load (N)	CO (%)
2.69	0.008	3.48	0.014	6.47	0.054	2.01	0.033
45.81	0.02	42.42	0.005	46.45	0.062	40.41	0.06
77.89	0.044	79.16	0.01	83.67	0.057	78.57	0.059
115.02	0.004	115.41	0.004	121	0.055	108	0.081
B16		B20		B24		B00'	
Load (N)	CO (%)	Load (N)	CO (%)	Load (N)	CO (%)	Load (N)	CO (%)
7.06	0	4.13	0.067	4.65	0.048	6.96	0.038
46.35	0	41.93	0.036	42.75	0.075	46.25	0.023
78.38	0	78.48	0.049	79.57	0.057	80.83	0.018
115.31	0.02	115.51	0.083	117.47	0.057	118.06	0.029

Figure 7.8: TABLE:- CO2 VS LOAD

O2 VS LOAD :

O2.png

O2 vs Load							
B00		B04		B08		B12	
Load (N)	O2 (%)	Load (N)	O2 (%)	Load (N)	O2 (%)	Load (N)	O2 (%)
2.69	22.01	3.48	22.12	6.47	22.23	2.01	22.6
45.81	23.34	42.42	22.63	46.45	22.44	40.41	21.83
77.89	21.88	79.16	22.15	83.67	22.39	78.57	21.9
115.02	22.19	115.41	22.33	121	22.26	108	21.7
B16		B20		B24		B00'	
Load (N)	O2 (%)	Load (N)	O2 (%)	Load (N)	O2 (%)	Load (N)	O2 (%)
7.06	22.65	4.13	21.63	4.65	21.9	6.96	22.29
46.35	22.6	41.93	22.27	42.75	22.4	46.25	22.36
78.38	22.19	78.48	21.71	79.57	22.24	80.83	22.39
115.31	21.1	115.51	22.52	117.47	22.24	118.06	22.58

Figure 7.9: TABLE:- O2 VS LOAD

NOx VS LOAD :

NOx.png

NOx vs Load							
B00		B04		B08		B12	
Load (N)	NOx (ppm)	Load (N)	NOx (ppm)	Load (N)	NOx (ppm)	Load (N)	NOx (ppm)
2.69	96	3.48	51	6.47	188	2.01	412
45.81	106	42.42	54	46.45	263	40.41	480
77.89	86	79.16	54	83.67	213	78.57	435
115.02	0	115.41	0	121	207	108	493
B16		B20		B24		B00'	
Load (N)	NOx (ppm)	Load (N)	NOx (ppm)	Load (N)	NOx (ppm)	Load (N)	NOx (ppm)
7.06	49	4.13	347	4.65	296	6.96	153
46.35	54	41.93	300	42.75	250	46.25	110
78.38	52	78.48	170	79.57	196	80.83	111
115.31	35	115.51	159	117.47	1.81	118.06	134

Figure 7.10: TABLE:- NOx VS LOAD

VIBRATION VS LOAD :

vibration.png

Vibration vs Load							
B00		B04		B08		B12	
Load (N)	Vibration (HZ)	Load (N)	Vibration (HZ)	Load (N)	Vibration (HZ)	Load (N)	Vibration (HZ)
2.69	226	3.48	355	6.47	270	2.01	228.5
45.81	298	42.42	263	46.45	186	40.41	303.5
77.89	225	79.16	356	83.67	301	78.57	313.5
115.02	306	115.41	276	121	419	108	314.5
B16		B20		B24		B00'	
Load (N)	Vibration (HZ)	Load (N)	Vibration (HZ)	Load (N)	Vibration (HZ)	Load (N)	Vibration (HZ)
7.06	364	4.13	370	4.65	404	6.96	375.5
46.35	406	41.93	439	42.75	437	46.25	352
78.38	316	78.48	423	79.57	309	80.83	336
115.31	306	115.51	330	117.47	332	118.06	369

Figure 7.11: TABLE:- VIBRATION VS LOAD

7.2 Analysis of Result:

Brake power vs load :

The Brake power of the blends increase with increase in the loads. It has been observed that higher the concentration of Biodiesel increases, the Brake Powers slightly keep on increasing at high loads.

vs load.png

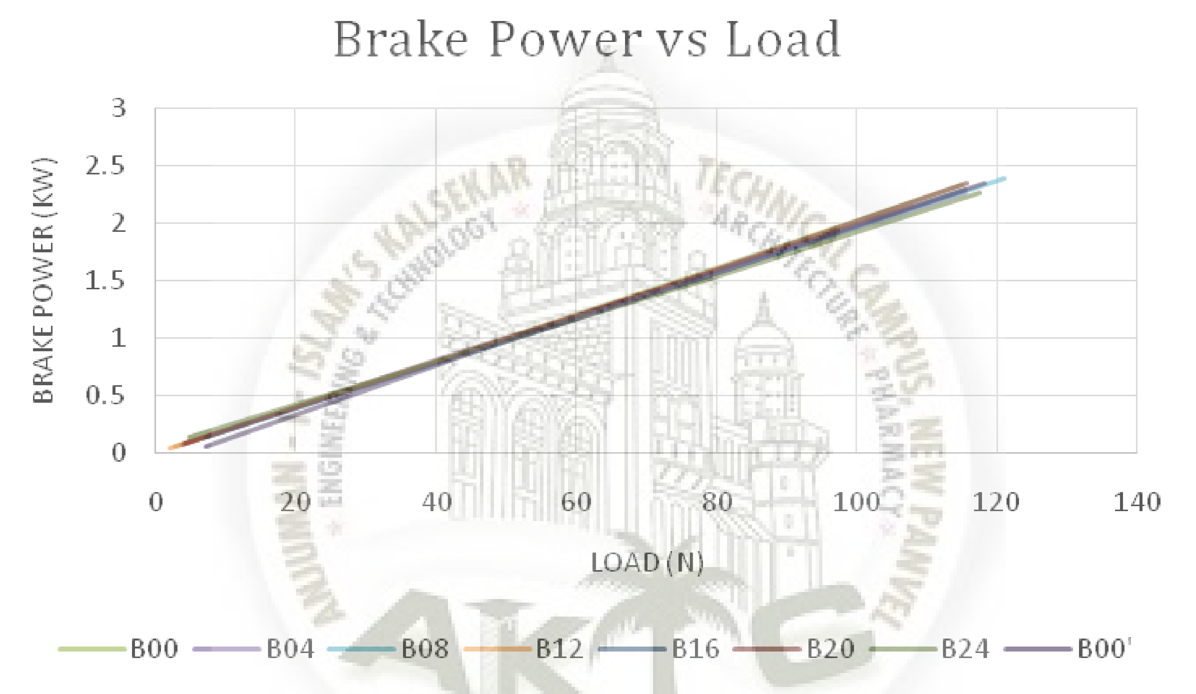

Figure 7.12: BRAKE POWER VS LOAD

Braking torque vs load :

The Braking Torque of the engine running on the Fuels justifies the given result as shown in fig.

vs l.png

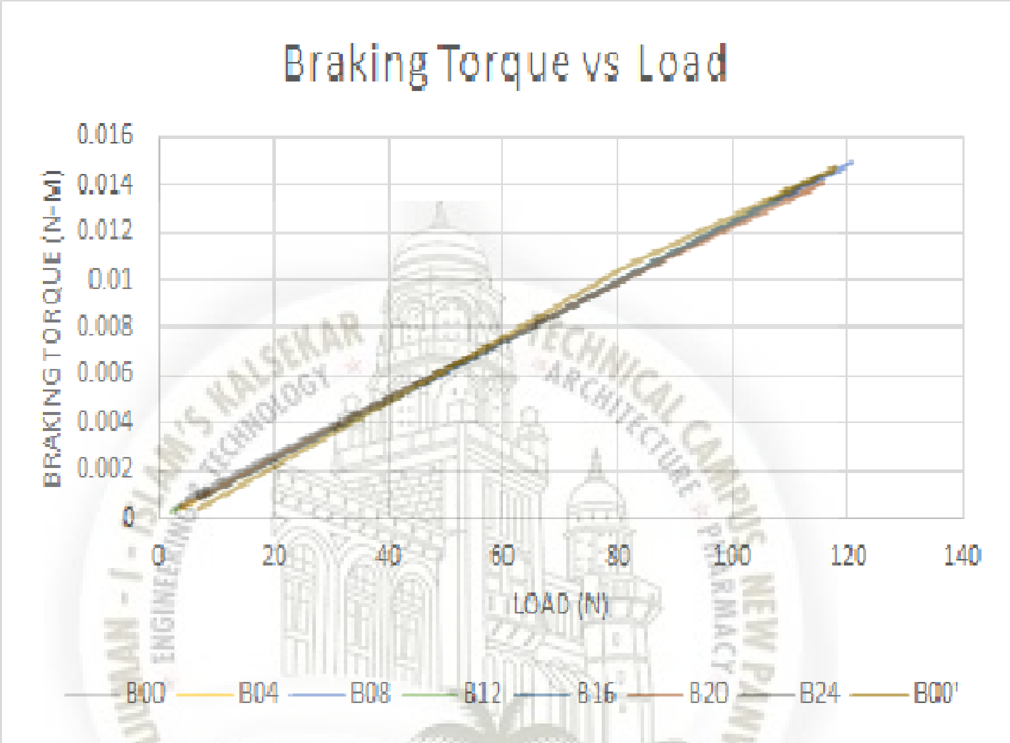

Figure 7.13: BRAKING TORQUE VS LOAD

Fuel consumption vs load : The Biodiesel blends consume more fuel than diesel at low speed while the fuel consumption decreases with increase in Biodiesel concentration at high speeds.

vs lpng.png

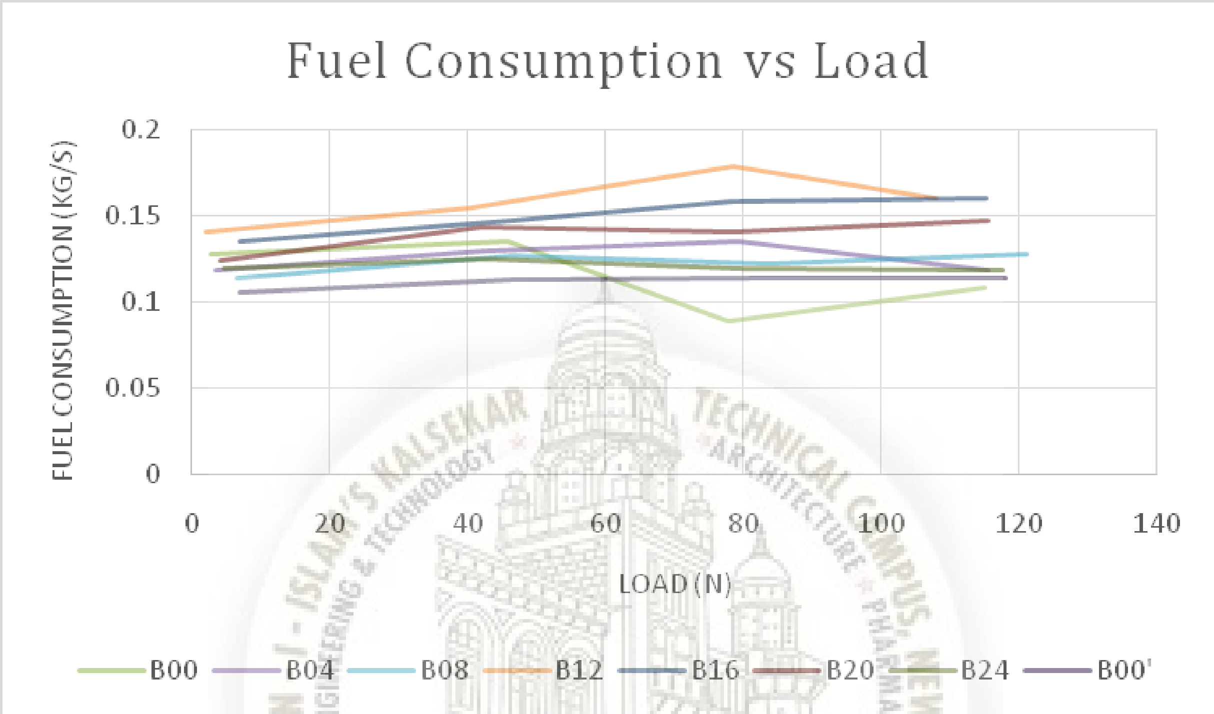

Figure 7.14: FUEL CONSUMPTION VS LOAD

BSFC vs load :

Brake Specific Fuel Consumption (BSFC) were higher at low load but drastically reduced at higher loads.

vs l.png

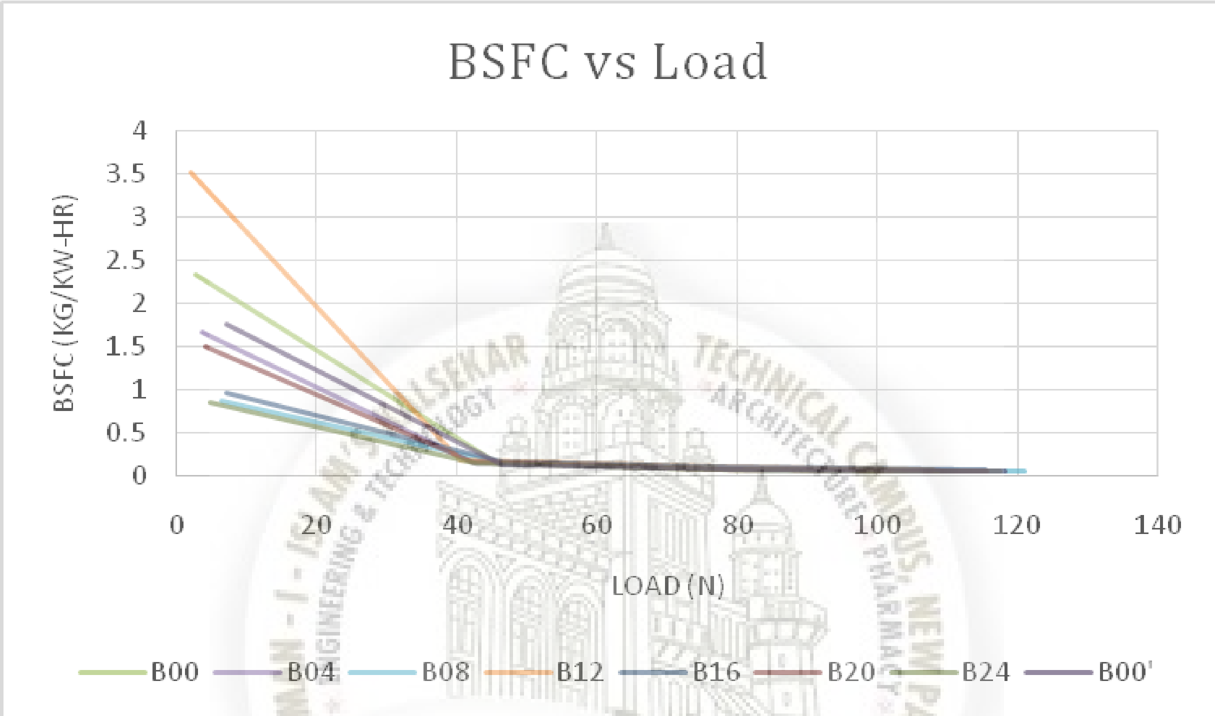

Figure 7.15: BSFC VS LOAD

Heat supplied vs load :

With the increase in concentration of Biodiesel Methyl ester, the heat supplied to the engine was increased. The heat supplied by pure diesel increased with increase in lad while the Biodiesel blends gave almost same heat at different loads.

vs l.png

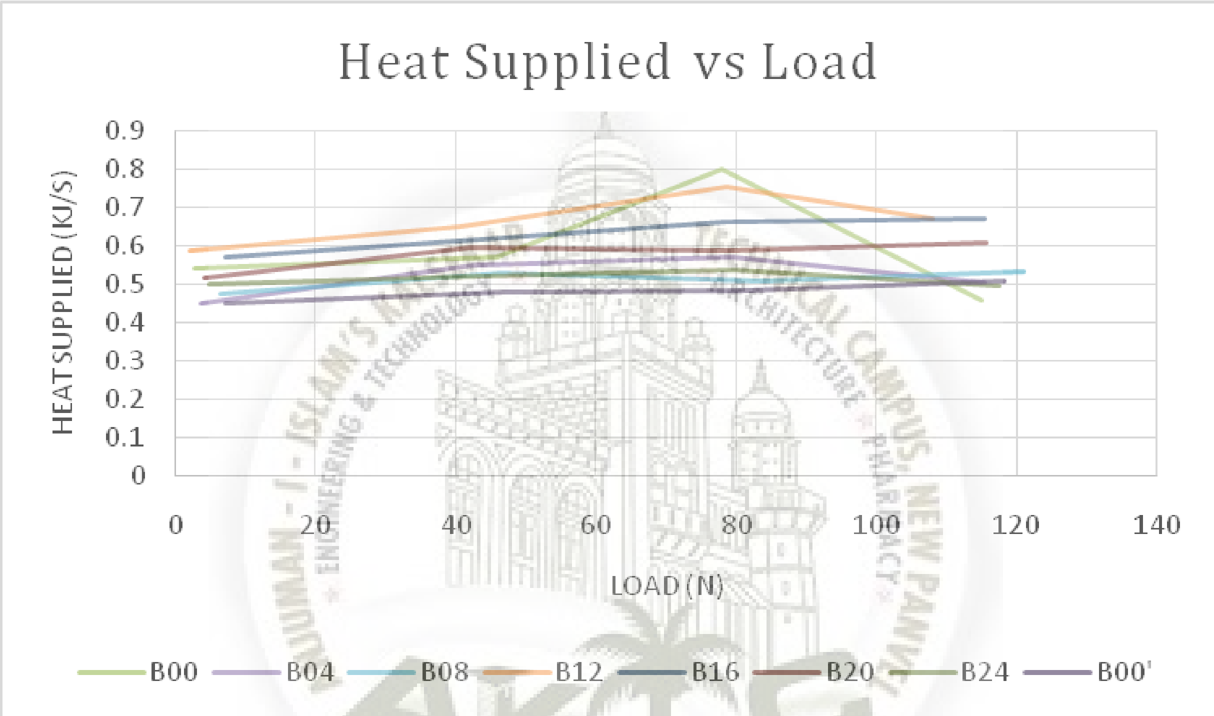

Figure 7.16: HEAT SUPPLIED BRAKE POWER VS LOAD

CO2 vs load :

CO_2 emissions were lower for blend B16 on all loads but there was slight increase after the load of 80 N while B12 recoded the highest CO_2 emissions on all loads among all blends. As shown in fig.

vs l.png

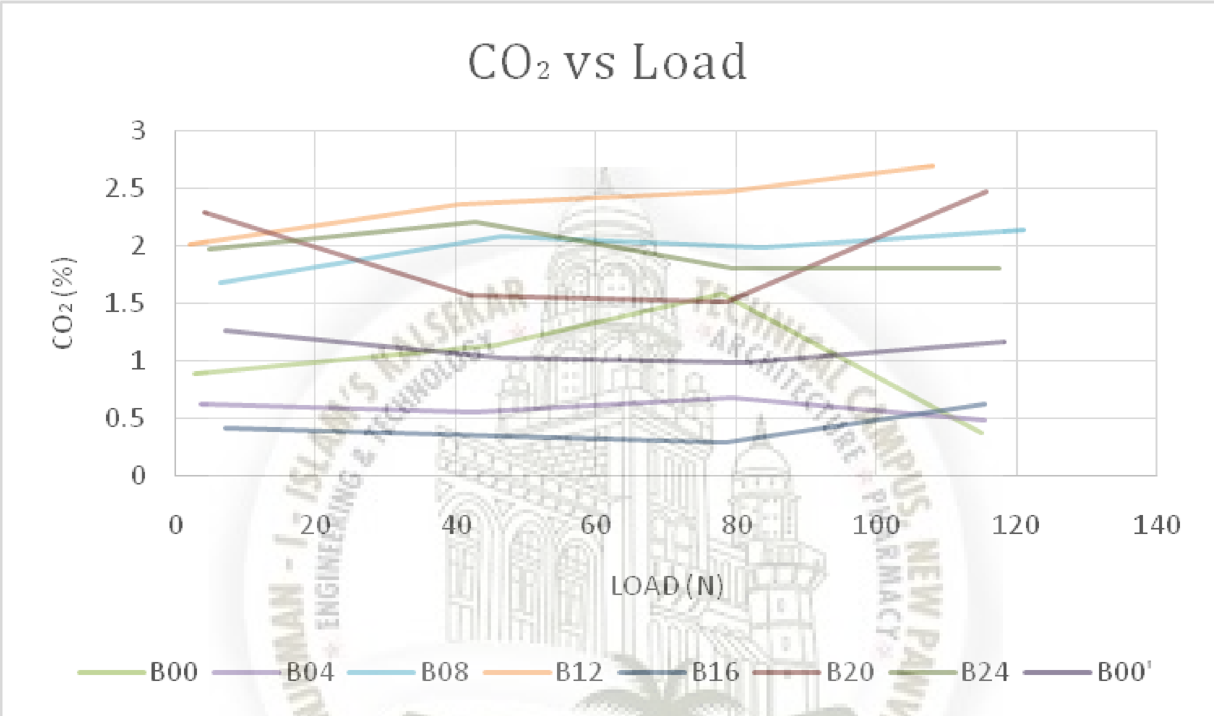

Figure 7.17: CO2 VS LOAD

HC vs load:

The HC emissions for B00,B08,B12 and B24 blends initially increases as the load was increased but after a load of 40 N there was a notable decrease for further loads, while for B04, B20 and B00' blends there was an initial reduction in HC emissions and later there was significant increase after a load of 80N. B16 showed the lowest emissions of HC on all loads. As shown in fig.

vs l.png

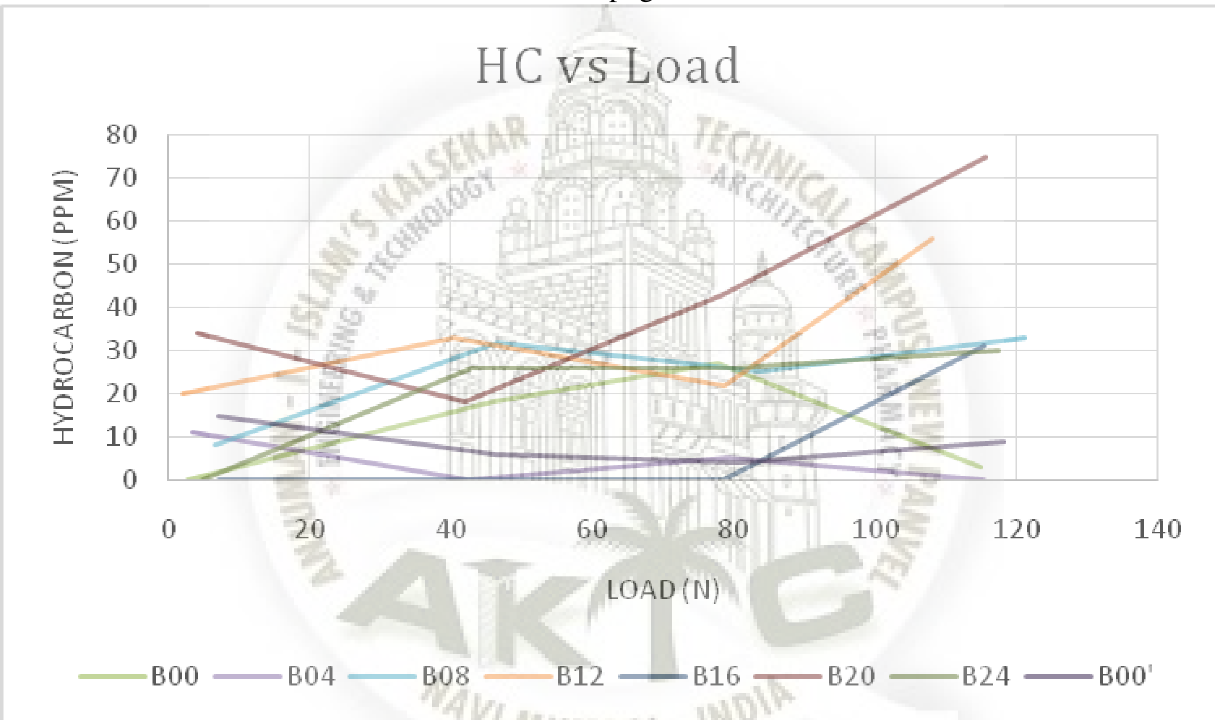

Figure 7.18: HC VS LOAD

O2 vs load :

B00 showed the highest oxygen content in the exhaust gas emission at al load of 40N while B16 was lowest after 100N load .As shown in fig.

vs l.png

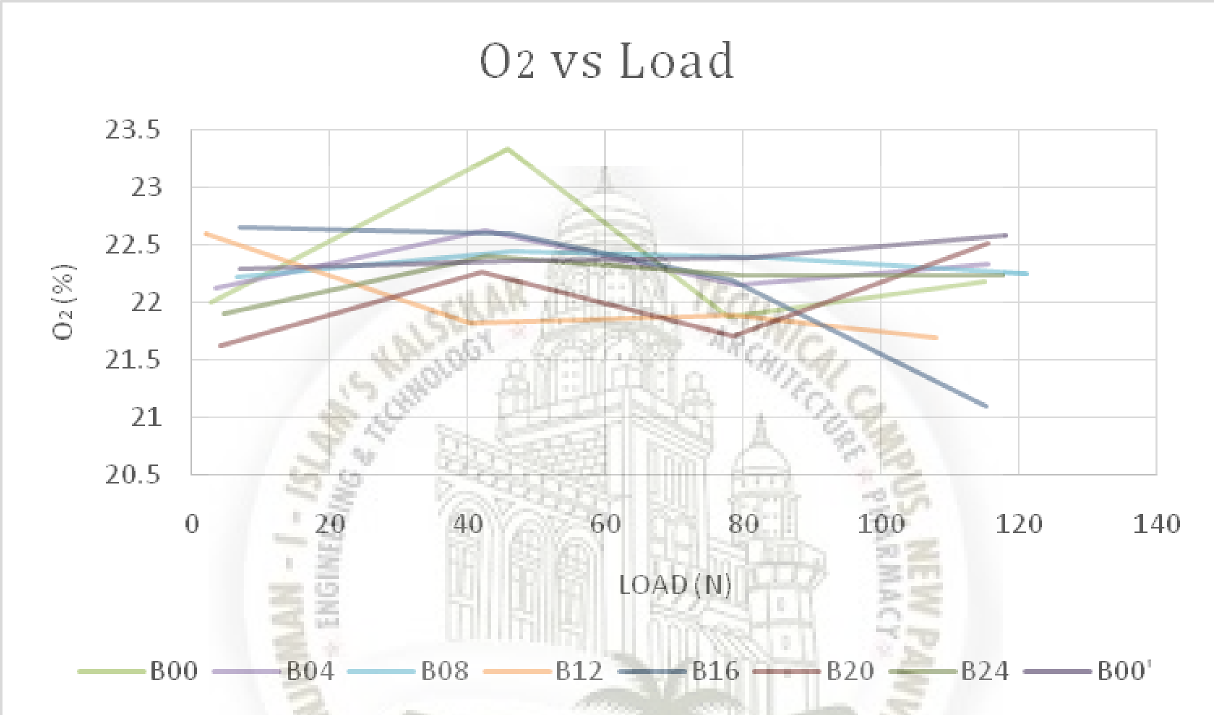

Figure 7.19: O2 VS LOAD

CO vs load :

The CO emissions for the blend B16 was lowest for all loads while the blend B24 showed the highest CO emissions at a load of 40N. As shown in fig.

vs l.png

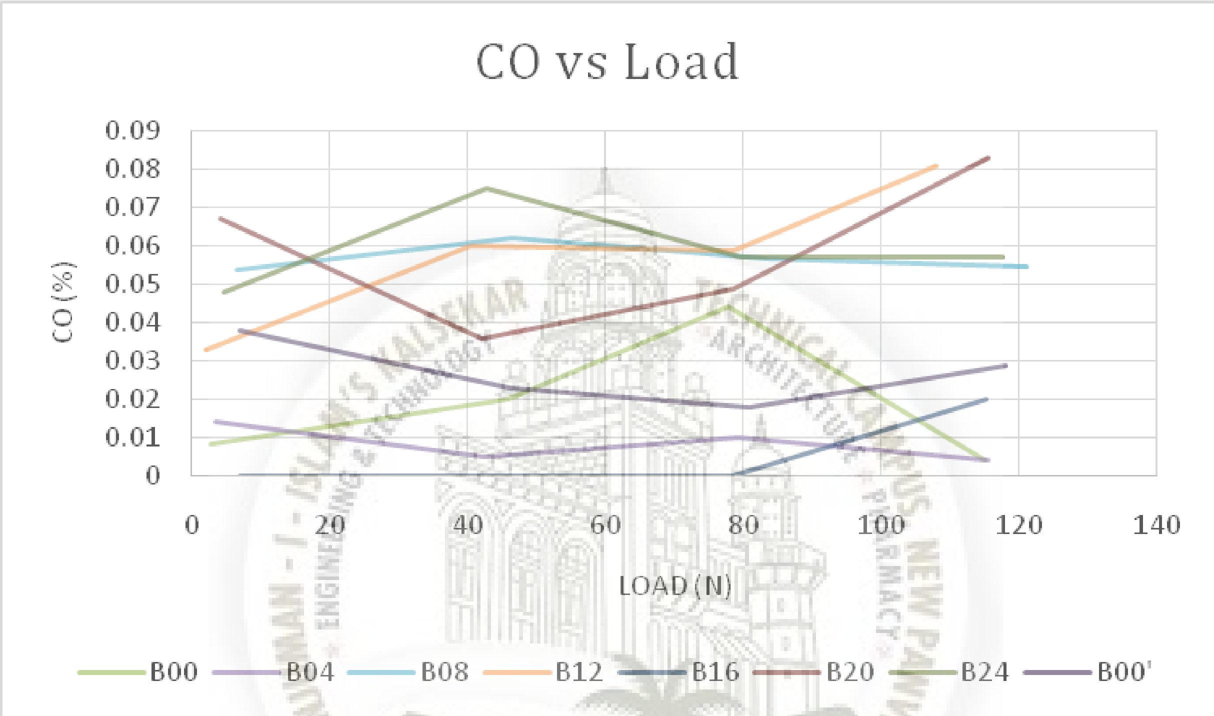

Figure 7.20: CO VS LOAD

NOx vs load :

The blend B12 showed the highest Nox emissions for all loads among all blends,while NOx emissions for B16 and B00' were nearly identical for loads upto 80 N. As shown in fig.

vs l.png

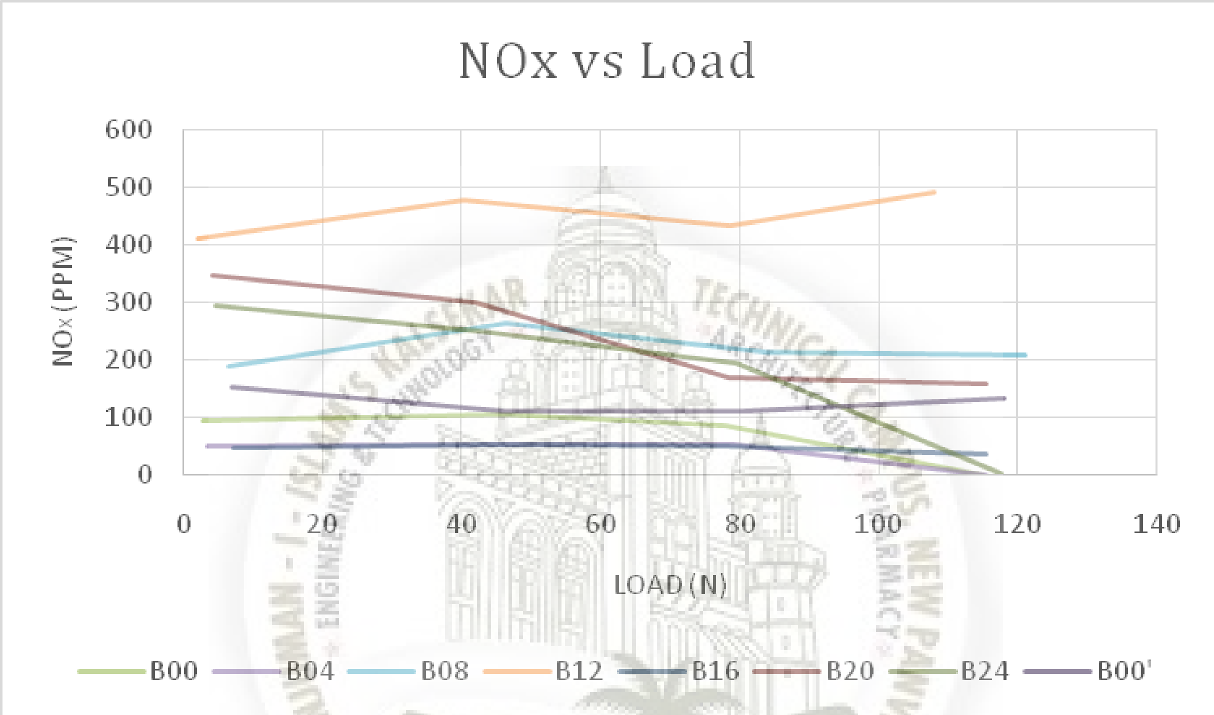

Figure 7.21: NOx VS LOAD

Vibration vs load :

Blend B08 intially showed the reduction in vibrations as the load was increased,but there was significant increase in vibrations after the load of 40 N.B20 showed the highest vibrations for all loads among all blends. As shown in fig.

vs load.png

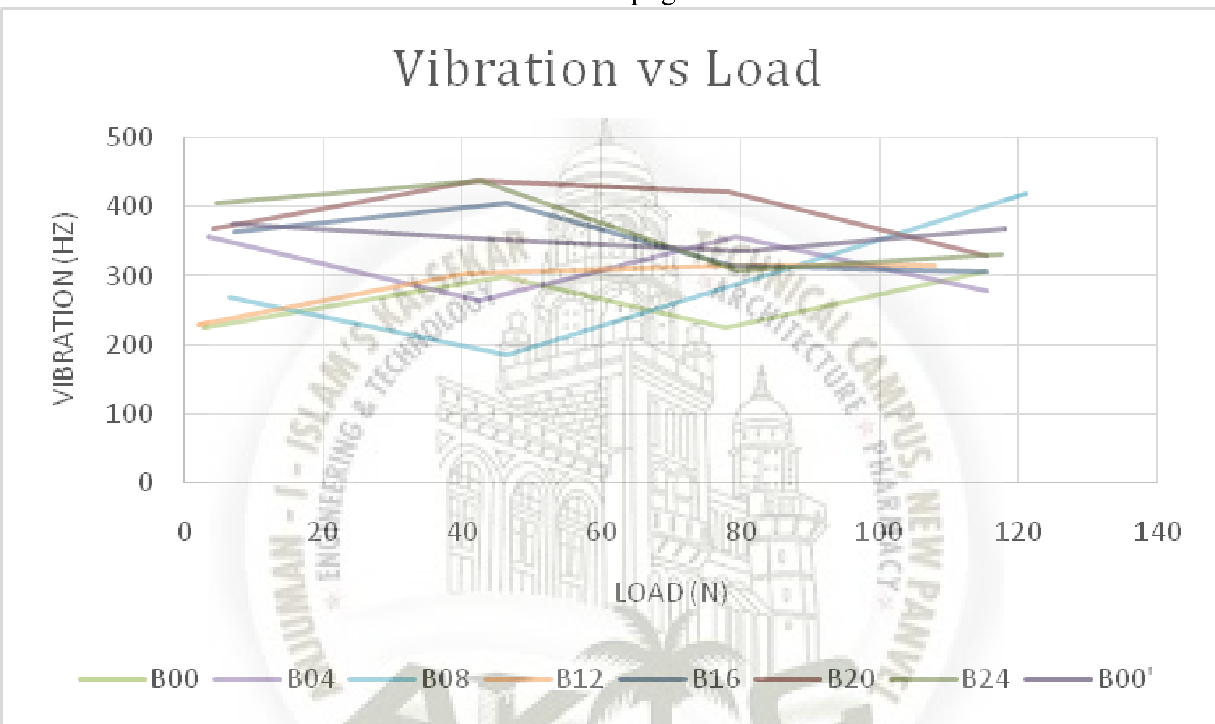

Figure 7.22: VIBRATION VS LOAD

Chapter 8

Screenshots of Project

Figure 8.1: EXPERIMENTAL SETUPS

Figure 8.2: EXHAUST ANALYZER SETUPS

Chapter 9

Conclusion and Future Scope

9.1 Conclusion

The experimental analysis conducted on various blends of biodiesel extracted from Datura Stramonium signify that performance characteristics such as Brake power and Brake thermal efficiency increases as the load on engine is increased, whereas BSFC decreases as the load was increased. Fuel consumption initially increases for all blends as load increases and B12 showed the highest fuel consumption while B00 showed the lowest fuel consumption at a load of 80N. The optimum fuel consumption was seen for blend B16 on all loads. The emission characteristics of the test suggests that HC and CO emissions decreases with increase in load, whereas NOx emissions increases as the load is increased. Among all blends, B16 is observed to be optimum in terms of performance and emissions. The BSFC for B16 was reduced upto 40 percent as compared to pure diesel on load conditions. The HC and CO emissions were negligible for B16 as compared to B00 upto loads of 80N and reduction upto of 50 percent was observed at a load of 120 N. The NOx emissions were seen to be decreased by 50 percent at a load of 40N and 40 percent on load of 80N.The vibrations were found to be same as B00 on full load condition of 120 N. Therefore overall results justifies that B16 is the best possible blend to be used for the lowest emissions of HC and CO, and NOx.

.

9.2 Future Scope

The various scopes for Datura Methyl Ester in the future are:-

- Datura Stramonium Biodiesel is economical
- It is abundantly available and can be cultivated throughout the year.
- It will partially or completely replace the use of diesel fuel which is a non renewable source of energy.
- It will help in promoting sustainable development.
- Different blend compositions are yet to be explored.

References

(1)S.B Chavan.; R.R Kumbhar.,; Ashutosh Kumar.; Energy fuels,2015,29,4393-4398.

(2)Sharma,Y. C.; Singh, B. ; Renewable Sustainable Energy Rev,2009,131646-1651.

(3)Nagarhalli, N.V.; M. V. Int . J. Agric. For. Sci. 2013 2320, 6063

(4) (29) Raheman, H.; Phadatare, A. Biomass Bioenergy 2004, 27, 393397.

(5) Agarwal, A. K.; Dhar, A. Renewable Energy 2013, 52, 283291.

(6) Devarapaga Madhu.; Supriya B. Chavan.;

Bioresource Technology 214 (2016) 210–217.

(7) Devarapaga Madhu.; Supriya B. Chavan.; RSC Adv., 2015, 5, 63596–63604.

(8) Bobade S.N.; Kumbhar R.R. and Khyade V.B.3.; Res. J. Agriculture Forestry Sci.,Vol. 1(2), 12-19, March (2013)

(9) Chavan S.B., Kumbhar R.R. and Deshmukh R.B. .;Res. J. Chem. Sci. Vol. 3(11), 24-31, November (2013).

(10) Chavan S. B., Kumbhar R. R. and Sharma Y. C. Adv. Appl. Sci. Res., 2014, 5(3):10-20.

(11) Chavan Supriya Baburao et al. International Review of Mechanical Engineering, Vol. 9, N. 3.

(12)Chavan S. B.; Wabale R. M.; Kumbhar. R. R; Res. J. Engineering Sci. Vol. 5(7), 56-61, July (2016)

(13) Supriya B. Chavan,; Meena Yadav,; Reena Singh,; Veena Singh,; Rajendra R. Kumbhar,; and

Yogesh C. Sharma.; Environmental Progress Sustainable Energy (Vol.00, No.00) 2017.

(14)Litty Koria.; G. Nithiya.; Journal of Phytoloogy,2012, 4(1): 06-09.

(15)B. D. Phapane .; R. Gontse.; T. Francis.; Int. J. Adv. Res. 5(7), 1911-1917.

Achievements

1. Publications
   (a) *STUDY ON EFFECT OF BLENDS OF DATURASTRAMONIUM BIODIESEL ON THE PERFORMANCE-AND EMISSION CHARACTERISTICS ON DIESELENGINE*; SHAIKH MOHD NOORUL ISLAM ABDUL KHALIQUE, NAJMUS SAQUIB ABDUL WAHAB, HAWALE PARAG CHANDRAKANT, KHAN FARHAN ADAM, RAHUL THAVAI, Journal of Energy Institute, April 2019 (Publication under process)