

ANALYSIS OF OXYGENATED N PENTANOL BIODIESEL BLENDS WITH ETHYL HEXYL NITRIDE ON VCR DIESEL ENGINE

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in Mechanical Engineering

By

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(DEEMED TO BE UNIVERSITY)

Accredited with grade "A" by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafide work of PRATTIPATI CHANDU SITARAM(Reg. No. 39150709) and PETA MOHANA NAGA SUDHIR(Reg. No. 39150702) who carried out the project entitled "ANALYSIS OF OXYGENATED N PENTANOL BIODIESEL BLENDS WITH ETHYL HEXYL NITRIDE ON VCR DIESEL ENGINE" under our supervision from December 2022 to April 2023.

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ABSTRACT

Bio fuels help in lessening the reliance on unrefined petroleum and encouraging a cleaner climate. It likewise creates extra pay and work for rustic regions. This won't just assist with meeting India's rustic energy needs yet additionally satisfy the rising requests for transportation. The utilization of carbon energizes will decrease fossil fuel byproducts and meet the energy prerequisites of the 21st century.

Biodiesel is an elective fuel with developing utilization in the transportation area. In this exploration work, jojoba oil has been utilized for a diesel motor. The biodiesel mixes were BIO, B20, B25, and B30. Contrasted with different mixes, B25 powers showed better execution and diminished exhaust emanations like smoke, carbon monoxide, and unburned hydrocarbons. The B30 mixed fills higher NOX emanations than other fuel mixes. This paper gives a near benchmark to look at biodiesels with respect to fuel properties, motor execution, and outflow qualities. bio fuel are climate amicable powers and their usage would address worldwide worries about control of fossil fuel byproducts. bio fuel are gotten from inexhaustible bio-mass assets and, in this manner, give a competitive edge to elevate supportable turn of events and to enhance customary energy sources in gathering the quickly expanding necessities for transportation powers related with high financial development, just as in gathering the energy needs of India's tremendous provincial populace.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION OF BIO DIESEL

Unrefined petroleum is used to make oil-based products that we use to fuel planes, vehicles, and trucks, to heat homes, and to make drugs and plastics. Despite the fact that oil-based commodities save time, finding, creating, and stirring raw petroleum may have an impact on the climate. At the moment, the day's oil provinces are requests at the oil cost populaces increment oil requests are expanded. Oil-based commodities influence the climate and cause dangerous atmospheric deviations. The world's nations are now moving toward elective sources that are sustainable or noninexhaustible. Many countries are concentrating on biofuels, which are made from waste natural products, vegetable squanders, and vegetable seeds. Biofuels are being considered as generally accessible and least expensive materials for elective energises. Currently, India's oil prices are higher than in other countries, so we are shifting to alternative sources. Oil-based goods affect the environment by emitting gases such as HC, CO, CO₂, and NO_x. These gases influence the climate and contribute to global temperature changes.

1.2 BIOFUEL

The bio fills are environmentally friendly for all nations. They are made from vegetable waste and natural product seeds oils... For a long time, the ready availability of reasonable petrol centre distillate energises provided little incentive to explore different avenues.

In terms of alternative, long-term power sources for diesel engines. The OPEC oil embargo of the 1970s, fuel shortages, and rapidly rising fuel costs rekindled interest in gaining elective powers. Nonetheless, the achievement of oil preservation measures and the genuine possibility.

Bio fuel for diesel engines (i.e., biodiesel) is a promising alternative fuel for diesel engines that can be used after the exhaustion of petrol-powered engines. Bio fuel contains methyl esters and is derived from crude oil. They are derived from a variety of bio-sources, including vegetable oils, used cooking oils, and green growth. Many types of bio fuels can be obtained from crude bio-sources, including Jatropha oil, cottonseed oil, palm oil, used oil oils, used vehicle tyres, coconut oil, soybean oil,

rapeseed oil, microalgae, waste creature fat, Crambe oil, elastic seed oil, castor oil, and waste cooking oil. Squander biomass has also been used to produce bio ethanol or bio methane. Bio fills must have specific physical and chemical properties.

In reality, transesterification is the process by which bio fuel is produced from unrefined components. The physical and chemical properties of the bio fuel produced are influenced by the blending temperature and time, as well as the amount of impetus or the type of added substances that may be added to the delivered bio fuel. One distinguishing feature is the stream conduct in terms of fuel thickness at various shear rates (i.e., the overall speed of the oil film between the moving parts). When the fuel is infused into the ignition chamber at high tensions and temperatures, this trademark influences the shower conduct.

Furthermore, bio fuel, like diesel fuel, is dependent on the working temperature for consistency. Several previous studies anticipated determining the rheological properties of bio fuel derived from vegetable oils. Rheological properties of various bio powers derived from waste cooking oil, castor oil, and elastic seed oil have been studied. They were compared to their crude oils and were also mixed with unadulterated diesel fuel and learned at various temperatures and shear rates. The bio powers are environmentally friendly for all nations and are made from vegetable waste and natural product seeds oils. According to history, Rudolph Diesel, the inventor of the diesel engine, used vegetable oils as a fuel in his engines as early as 1900. For a long time, the ready availability of low-cost oil centre distillate energises provided little impetus to investigate alternative, inexhaustible power sources for diesel engines. The OPEC oil embargo of the 1970s, fuel shortages, and rapidly rising fuel costs rekindled interest in finding alternative fills. Regardless, the achievement of oil preservation measures and the genuine possibility.

13 MAHUA OIL

The accompanying system performed the analyses: mahua oil was added to the reactor and fitted with a reflux condenser. When the temperature was reached, the impetus, weakened in methanol, was presented in the reactor. Gas chromatography was used to investigate tests taken at normal intervals. The total response time was 60 minutes. The

accompanying factors remained constant throughout the trials: strain and impeller speed.

14 PROPERTIES OF MAHUA OIL

The Properties of jojoba oil mentioned below.

Tab 1.1 : Properties of Mahua oil

Acid Value	28.00
Iodine value	70.00
Density	918.33
Kinematic viscosity	24.66
Flash point	224.67
Fire point	234.67
Cloud point	12
Plour point	8

CHAPTER - 2

LITERATURE SURVEY

2.1 LITERATURE SURVEY

Duran Altiparmak , Ali Keskin, Atilla Koca, Metin Gürü Title as Alternative fuel properties of tall oil fatty acid methyl ester-diesel fuel blends. Tall oil methyl ester-diesel fuel blends were investigated as alternative fuels for diesel engines in this study. Tall oil methyl ester was created by optimally reacting tall oil fatty acids with methyl alcohol. Tall oil methyl ester-diesel fuel blends increased engine torque and power output by up to 6.1% and 5.9%, respectively. With the new fuel blends, CO emissions were reduced by 38.9% while NOX emissions increased by up to 30%. The opacity of the smoke did not vary significantly.

Nagarajan Jeyakumar & N Bose title as Effect of Pentanol biodiesel blends on performance and emission characteristics of diesel engine The development of next-generation biofuels such as Pentanol has emerged as a viable solution to

the increased demand for alternative energy sources. The current study investigates the impact of Pentanol addition at various concentrations to Mahua oil biodiesel on the performance and emission characteristics of diesel engines. Soo-Young No title as Utilization of Pentanol as Biofuels in Compression Ignition

Engines

The fundamental combustion study of pentanol will be limited to the chemical kinetics of pentanol combustion in this section. The detailed and reduced (skeletal) kinetic mechanisms of the chemical kinetic model can be distinguished. Sarathy et al. (2014) provided a comprehensive review of the fundamental combustion and chemistry of alcohols, but the studies related to pentanol were not fully discussed.

A.S.Huzayyin A.H.Bawady M.A.Rady A.Dawood Title as Experimental evaluation of Diesel engine performance and emission using blends of jojoba oil and Diesel fuel. Blending of jojoba oil with gas oil has been exhibited to be a convincing technique to lessen engine issues related with the high thickness. Exploratory

assessments of different execution limits of a lone chamber, regularly suctioned, direct implantation, Assessments of engine execution limits at different weight conditions over the engine speed range have normally shown an insignificant loss of engine power, a slight development in brake express fuel use and a diminishing in engine NOX and dregs outpouring using blends of jojoba oil with gas oil when diverged from gas oil. The decline in engine debris surge has been seen to augment with the augmentation of jojoba oil rate in the fuel blend.

Smokers. R Smit. R Title as Compatibility of pure and blended biofuels with respect to engine performance, durability and emissions. The report discusses the effects of a brief writing review (quick output) on the similarity of pure and mixed bio powers in terms of motor execution, strength, and emanations. More explicitly, data is gathered and analysed to find indicators for anticipated issues (or benefits) related to the accompanying inquiries: Will vehicles that use biofuels, either alone or in combination, be able to meet as far as possible.

Have the bio powers, whether pure or mixed, the option particulars? Can the use of additional substances address potential issues? Will biofuels continue to

benefit from petroleum products in terms of ozone depleting substance discharges in the future? The review has been completed.

Obed M. Ali, Rizalman Mamat Title as Improving Engine Performance And Low Temperature Properties Of Blended Palm Biodiesel Using Additives. The world's vast agrarian terrains are not completely benefited. As a result, cultivating should include the production of nonfood items that are appropriate to the climate states of these grounds. This motivates the development of biodiesels as an inexhaustible fuel for the domestic energy market in order to reduce reliance on petroleum derivatives. Biodiesel has gotten a lot of attention from researchers in the last couple of years, with the main motivation being the growing concern about ozone harming substance impacts and ecological guidelines. Numerous exploratory studies are being conducted to assess the impact of various added substances.

Xichao Chen 1, a, Yan Yang 2,b , Fanghua Yin 3,c,* , Ran Xu 4,d and Longyao Wang 5,e title as Experimental research of the 2-ethylhexyl nitrate with Micro-channel reaction production technologyThe paper is about synthesizing the

2-ethylhexyl nitrate(2-EHN) with nitric acid and 2-Ethyl hexanol as raw materials and sulfuric acid as catalyst in a micro-channel reactor. The best synthetic conditions were determined under experiments: 1 :2 for the mole ratio of nitric acid and sulfuric acid; 1 :1 for the mole ratio of nitric acid and 2-Ethyl hexanol, the optimal liquid hourly space velocity is obtain as 4000h⁻¹. In this condition, The yield and purity of EHN are Relatively high. This method is simple in process, mild conditions, safe, reliable and low energy consumption, providing the theory basis for industrialized production.

Purnachandran Ramakrishnan^{1,2} & Ramesh Kasimani³ & Mohamed Shameer Peer⁴ & Sakthivel Rajamohan title as Assessment of npentanol/Calophyllum inophyllum/diesel blends on the performance, emission, and combustion characteristics of a constant-speed variable compression ratio direct injection diesel engineThe performance, emission, and combustion characteristics of the pentanol, biodiesel, and diesel blends in a computerized singlecylinder variable compression ratio DI diesel engine were experimented at constant speed, high load, and varying compression ratio conditions. The results were compared with those of neat diesel fuel and C120 fuel blend.

Prabhu & M. Venkata Ramanan title as Emission and performance analysis of pentanoldiesel blends in unmodified diesel engine.

The inclusion of pentanol to diesel and its effects on emission and performance parameters have been studied experimentally and compared with neat

diesel. The observed details from the experimental work have been summarised here. • Diesel and pentanol blends have higher BTE compared to neat diesel fuel. However, BTE of diesel-pentanol blends is marginally lower than neat diesel at all loads. • The inclusion of pentanol to diesel reduces its energy content and specific fuel consumption due to its enhanced oxidation effect. • Higher calorific value and the effect of oxidation of pentanol put into augments oxidation capacity of fuel blend and it reduces the NO_x, HC and CO emissions.

R. Mohsin, Z.A. Majid ft , A.H. Shihnan, N.S. Nasri, Z. Sharer title as Effect of biodiesel blends on engine performance and exhaust emission for diesel dual fuel engine

This study focused on investigating the exhaust emission and engine operation reliability test on a 6-cylinder, 6278 cc HINO H07C dual fuel engine using CNG and biodiesel fuelling. This test was conducted to discover the improvement of the exhaust emission and engine performance. Several types of emitted pollutant gases had been investigated, including NO_x, carbon monoxide (CO), CO₂, and unburned hydrocarbons (UHC). Meanwhile, the measured parameters to represent the engine performance were engine power and engine torque.

CHAPTER - 3

AIM AND SCOPE OF WORK

3.1 AIM

The aim of conducting this experimental study is to find the performance for the diesel engine using mahua oil mixture of diesel.

3.2 SCOPE OF THE WORK

The bio fuel is experimenting with different mixing proportions as well as the execution of a single chamber diesel engine. The test can be directed with a mixture of diesel and mahua oil. The oil blends contain BIO, B20, B25, and B30. The fills are used to reduce the need for diesel. Vegetable oils are widely available in the world

and can be used in transportation and vehicles. The dwindling of petroleum

derivatives, rising energy demands, and the development of ozone-harming substance discharges all have an impact on the importance of considering biodiesel. Normal diesel energizers are only available in certain parts of the world. All nations are pursuing easily accessible oils for biofuel energy. Biodiesel is created by combining liquor (typically methanol) with vegetable oil, animal fat, or recycled cooking oils. It is commonly used as an additive to reduce vehicle emissions (typically by 20%) or in its pure form as a sustainable alternative fuel for diesel engines. As global energy demands change and evolve, it is critical that all aspects of the bio energy production process are smoothed out and improved, from the design of more efficient bio treatment facilities to research into bio hydrogen as an energy transporter. To meet the guarantees of biomass for power age, current energy foundations should be adjusted and changed. Bio energises hosts a discussion for all bio energy partners. including audit articles, original research, analyses, news, innovative work spotlights, interviews with key assessment pioneers, and much more, with the end goal of establishing a global network of bio energy correspondence.

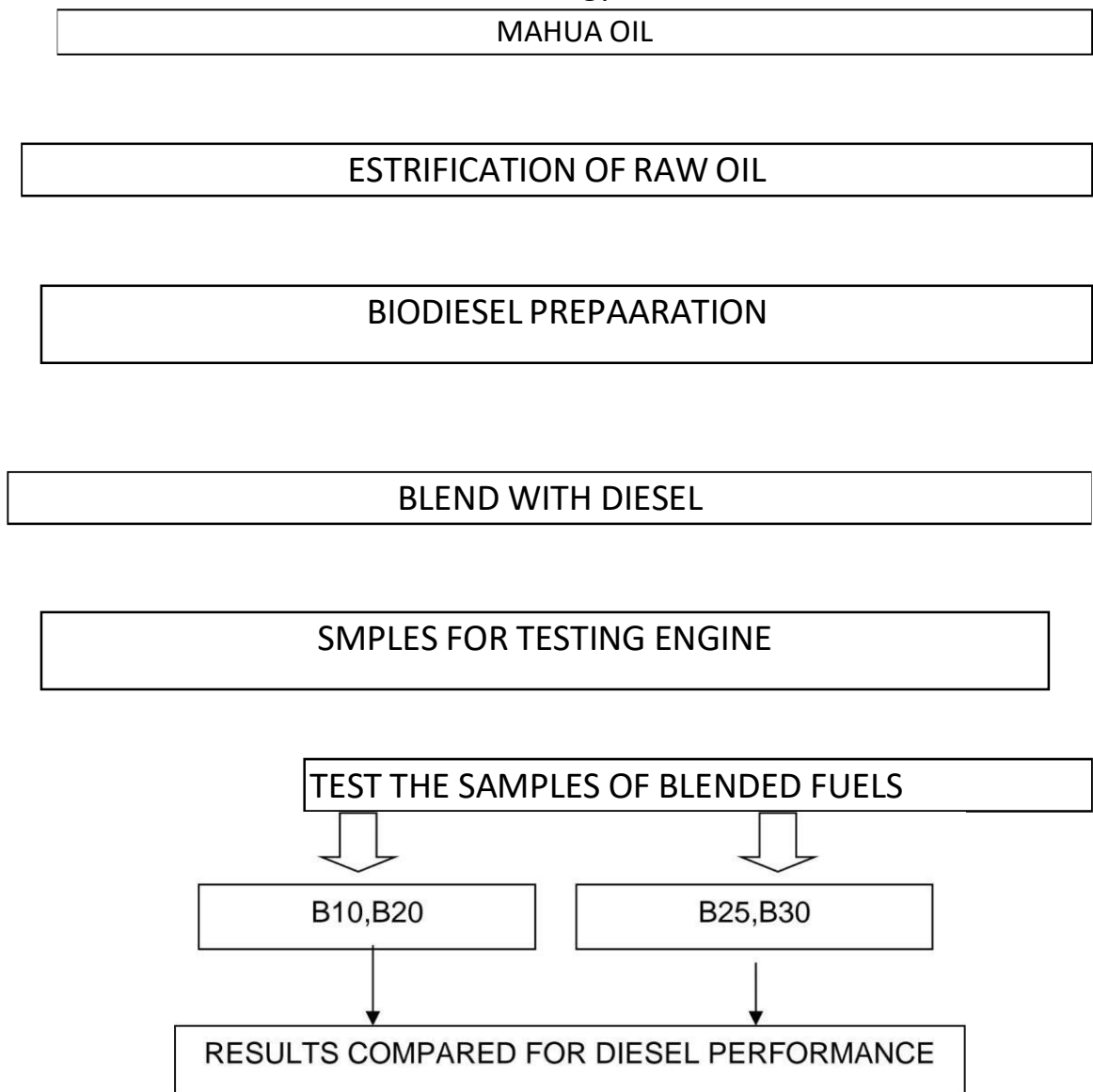
CHAPTER - 4

METHODOLOGY, EXPERIMENTAL SETUP AND EQUIPMENTS

4.1 METHODOLOGY

Process flow chart mentioned below.

Tab 4.1 : Methodology flow chart



4.2 EXTRACTION OF RAW OIL

4.2.1. Catalyst preparations

Expulsion of sulfur- and nitrogen-containing compounds present in fuel oils is critical because it can cause a variety of environmental issues as well as catalyst deactivation. Because of the limitations of other desulfurization catalysts and adsorbents, a new type of carbon material, graphitic carbon nitride (g-C₃N₄), has emerged. It has a two-dimensional structure similar to graphene and a band gap of 2.7 eV and is an appealing catalyst due to its intriguing properties such as high intrinsic photoresponsiveness and photoabsorption, semiconductive properties, and better stability. There is a wealth of literature on the use of g-C₃N₄ in the desulfurization and denitrogenation of fuel oils. Boron nitrides (BN) are also important due to the analogy of boron with carbon materials.

The dissemination cycle of dissolvable extraction of grape seed oil is accomplished by drenching the seed in dissolvable or permeating dissolvable through a bed of seeds. An evaporator recovers soluble from the oil-dissolvable mixture and returns it to the cycle. To determine the impact of the dissolvable, looked at hexane, CH₃)₂CO; however, its use was rejected due to its high as an extraction specialist. It was also discovered that the use improved the oxidation security of the separated grape seed oil, resulting in higher cancer prevention agent content in those cases. To connect the two effects, solvent blends were tested, and a combination of hexane/CH₃)₂CO 1 :1

(v/v) yielded the highest oil yield (18.5%) and oxidation steadiness (16.3 h).

4.2.2. Catalyst Characterization

The basic compound creations of the material were broke down by X-beam fluorescence spectroscopy (XRF - Oxford). The microstructure of the calcined CLR was seen by Tescan Vega3 XMU filtering electron magnifying instrument. Because of the beginning of the coralline limestone rock, the radioactivity of the impetus was concentrated by HPGe Gamma Spectrometry.

Transesterification responses comprises of the heavy drinkers of a fatty substance to frame esters and glycerol. To further develop the response rate and yield, an impetus is typically utilized. As the response is restricted by a harmony, abundance of liquor is utilized to improve the creation of esters. Among the alcohols that can be utilized during the transesterification cycle, methanol and ethanol are the most productive and generally utilized ones

4.3 EXPERIMENTAL SET UP AND EQUIPMENTS

4.3.1 EXPERIMENTAL SET UP

A solitary chamber has 4-stroke, direct infusion Kirloskar TV 1 diesel motor with a most extreme appraised yield of 5.20 kW at 1500 rpm was used to acquire the arrangement of exploratory information required. The motor has a pressure proportion of 17.5. The motor has a cleared volume of 661.45 (cc), bore measurement of the motor is 87.50 mm and stroke length of 110.00 mm. Infusion pressure is 210 bar kept up with continually all through the cycle.



Fig 4.1 : Experimental machine setup

4.3.2 VCR ENGINE TEST SETUP-PERFORMANCE TEST RIG

The arrangement includes single chamber, four stroke, VCR (Variable Compression Ratio) Electric turn over Diesel motor related with vortex stream type dynamometer for stacking. The strain degree can be changed perpetually the motor and without changing the devouring chamber assessment by exceptionally masterminded altering chamber block course of movement. Game-plan is furnished

with key instruments for devouring strain and wrench point evaluations. These signs are interfaced to PC through motor pointer for PV diagrams. Game-plan is also made for interfacing wind stream, fuel stream, temperatures and weight appraisal.

The plan engages examination of VCR engine execution with EGR for brake power, exhibited power, frictional power, BMEP, IMEP, brake warm efficiency, shown warm adequacy, Mechanical capability, volumetric capability, unequivocal fuel use, A/F extent and hotness balance. Lab see based Engine Performance Analysis programming pack "Engine fragile" is obliged on line execution appraisal.

Features of VCR are mentioned below.

- Without stop the engine change CR
- No change in Combustion chamber geometry
- Water cooled EGR
- Start with Electric battery and charger
- Arrangement of blend test
- Tabulated results for PÉ-PV plots and performance plots
- Data logging, editing, printing and export, Configurable graphs
- IP, IMEP, FP indication, combustion analysis

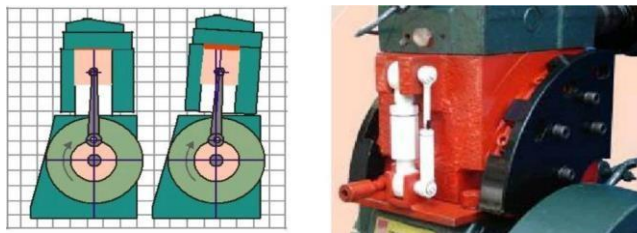


Fig 4.2 Engine valve

4.3.3 RANGE OF EXPERIMENTS

Experiment range is mentioned below. • Learning of VCR engine performance (Computerized mode)

- Revise of emissions with EGR variation
- Study of combustion with different fuel blends
- Reading of pressure volume plot and indicated power

4.3.4 UTILITIES REQUIRED e

- Electric Supply • Water supply • Computer
- Software

Electric supply

230 +/- 10 VAC, 50 Hz, 1 phase

Water supply

Continuous, clean and soft water supply @ 1000 LPH, at 10 m. head. Provide tap with 1" BSP size connection

Computer

IBM compatible with standard configuration

4.3.5 SPECIFICATIONS OF ENGINE

Engine specifications are mentioned below.

Tab 4.2 Specifications of engine

Product	VCR Engine test setup 1 cylinder, 4 stroke, Diesel with EGR (Comp.)
Product code	234
Engine	Make Kirloskar, Type 1 cyl., 4 stroke Diesel, water cooled, power 3.5kW at1500rpm, stroke 1 10mm, bore 87.5mm. 661 cc, CR17.5, Modified to
	VCR engine CR 12 to 18. With electric start arrangement, battery and charger
Dynamometer	Type eddy current, water cooled
Propeller shaft	With universal joints

Air box	M S fabricated with orifice meter and manometer
Load indicator	Digital, Range 0-50 Kg, Supply 230VAC
Load sensor	Load cell, type strain gauge, range 0-50 Kg
Fuel flow transmitter	DP transmitter, Range 0-500 mm WC
Air flow transmitter	Pressure transmitter, Range (-) 250 mm WC
Software	"Engine Soft" Engine performance analysis software
Rota meter	Engine cooling 40-400 LPH; Calorimeter 25-250 LPH
Pump	Type Mono block
Overall dimensions	W 2000 x D 2500 x H 1500 mm
Optional	Computerized Diesel injection pressure measurement with injection variation 0-25 deg BTDC
Fuel tank	Capacity 15 lit with glass fuel metering column
Calorimeter	Type Pipe in pipe
EGR	Water cooled, SS, Range 0-15%
Piezo sensor	Range 5000 PSI, with low noise
	cable

Crank angle sensor	Resolution 1 Deg, speed 5500 RPM with TDC pulse.
Piezo powering unit	Model AX-409.
Temperature sensor	Type RTD, PTIOO and Thermocouple, Type K
Temperature transmitter	RTD PTIOO, Range 0-1 00OC,3 Nos; Thermocouple, Range 0-1200 oC, 2 Nos
Product	VCR Engine test setup 1 cylinder, 4 stroke, Diesel with EGR (Comp.)
Product code	234
Engine	Make Kirloskar, Type 1 cyl., 4 stroke Diesel, water cooled, power 3.5kW at1500rpm, stroke 1 10mm, bore 87.5mm. 661 cc, CR17.5, Modified to VCR engine CR 12 to 18. With electric start arrangement, battery and charger

4.4 SAMPLE PREPARATION



Fig 4.8 Sample Oil

Sample 1:90% Diesel+10% Mahua oil

Sample 2:80% Diesel + 20%Mahua oil

Sample 3:75% Diesel & 25% Mahua oil

Sample 4:70% Diesel + 30% Mahua oil

4.5 TRANSESTERIFICATION PROCESS:

The primary goal of the work is to optimise the transesterification process for biodiesel production in order to produce biodiesel with the best properties such as viscosity, cetane number, flash point, fire point, and calorific value. Biodiesel was created using jatropha oil (a non-edible vegetable oil). The base fuel for comparing the above properties of biodiesel was conventional diesel fuel. The effect of methanol and sodium hydroxide concentrations, as well as reaction time, were investigated in order to optimise the esterification process. In a twin-cylinder, water-cooled, four-stroke direct injection diesel engine, diesel, biodiesel blends, and neat biodiesel were tested. The engine's performance and emissions with conventional diesel fuel served as the basis for comparison.

4.6 EXPERIMENTAL WORK

The biodiesel blends was prepared and samples are ready for testing. The samples of biodiesel are connecting with venturimeter to diesel pump and testing the fuel to engine. The testing was conducting and readings are taken for one by one samples. The emission testing was conducting The engine was conduct on various load tests and readings are taken. All the readings exports from the system software reading are taken from engine system and gas analyzer meter. Prepared samples are tested by the engine and v

CHAPTER - 5

RESULTS AND DISCUSSIONS

5.1 RESULTS

The Mahua oil biodiesel arranged in the four examples and they were individually filled a compartment which is appended to the venturimeter toward the front of motor siphon. The venturimeter shows the measure of fuel precisely shipped

off the motor. The exhaust is connected with smoke meter to get the measure of

poisons delivered. The outcomes got from every one of the mix are analyzed in a graphical arrangement.

CHAPTER - 6

SUMMARY AND CONCLUSIONS

6.1 SUMMARY

The transesterification process is successfully completed with positive results..

6.2 CONCLUSIONS

By using the above process. We can obtain the purest form of biodiesel by using of transesterification process through various temperatures, used to check the performance of engine.

CHAPTER - 7

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15. Performance and exhaust emission characteristics of variable compression ratio diesel engine fuelled with esters of crude rice bran oil.

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Sumeet Sharma² , S. K. Mohapatra² and

Krishnendu Kundu