ISSN: 0974-5823 Vol. 7 No. 1 January, 2022

International Journal of Mechanical Engineering

Performance And Emission Analysis on Four Stroke Diesel Engine by the use of Linseed Oil with Additive Particles

k.Govardhan Reddy
Research Scholar, Noida International University greater Noida Gauram Buddha Nagar, India.

Dr. BN Trippathi
Associate Professor Noida International University greater Noida Gauram Buddha Nagar, India.

Dr S. Sreenatha Reddy
Principal& Professor, Guru Nanak Institute of Technology, Hyderabad, India.

Abstract

To form the eco system balance and to lower the emissions, we've to depend upon the choice fuel, which produces less carbon content and provides good substitute for this oils. The gases produced after the combustion will affect the human surrounding and therefore the environmental eco system like birds, trees, etc. the discharge of those carbon contained gases will directly affect the ozonosphere. This effect is extremely large and reduces the protective capacity of the ozonosphere. The most alternative solution to scale back these problems is Bio fuels. The world is experiencing the wide spread demand of the fuels to satisfy the human need. The various fuels systems/modes like, petrol and diesel are becoming costlier and there's got to make some alternative fuels which can produce lesser emission and make the greater efficient operation. The combustion engines like conventional petrol and diesel engines uses the petroleum for the operation and therefore the rate of the petroleum within the earth's crust is depleting fast. The bio fuels will experience, the increased green effects, with very low amount of the emissions. The temperature and therefore the pressure variations also will comparatively less in these bio fuels. The bio fuels like Canola B30 and Linseed fuel are the most sorts of bio fuels which we are discussing during this paper. These are the fuels obtained from the alcoholic groups, and contain low Cetane number which is that the major requirement of the diesel. The fuels which are extracted from the plants and other bio matters proved to be equally efficient compared to the diesel and therefore the petrol. However, thanks to the similar chemical structure, of the linseed fuel as compared to other fuel like diesel, it's very suitable to extract and use, which possess an equivalent characteristics.

Therefore during this research we'll consider Linseed fuel because the main Bio fuel and discussion the extraction, experiment and therefore the advantages of the Bio fuel with mathematical results. The Linseed is experimented with TiO2, Al2O3 and the nano particles. The mathematical results will give the efficiency and other properties of this biofuel when compared to other fuels

Keywords—Linseed B30, Bio-fuel, TiO2,Al2O$_3$.

INTRODUCTION

The minerals which we want to extract the oil form the earth's crust are non renewable sorts of energy sources, which can get empty in near days. Forecast experts says that round the coal reserves which we are using today features a history of several lakh years and that they will last for an additional 150 years in future. So there's a necessity to develop such a fuel which can fit for the environment and renewable. The worldwide global warming is due to the excessive fuel usage from the earth's crust, and therefore the temperature is increasing by an element of 5℃ per annum. We are daily using various sorts of the energy sources. The fossil fuels are proving them as very efficient sort of resources in the world. Because the transportation is growing and therefore the automobile industry is upgrading day by day, newer sorts of the energy sources are developing to satisfy the wants of the transportation system. However, these fossil fuels are more efficient and therefore the emission rate is below 30% compared to convectional sorts of the energy sources. The technology within the petroleum and therefore the refining industry must be re created to suit for the healthy environment. So we've the choice of bio fuel to form it wide spread to reduce the longer term consequences. The rapid increase within the population also will increase the movement of individuals. This movement is predicated on the machines which uses the fuels to try to work, therefore the biologically useful fuel may somewhat reduce the consequences and make the atmosphere clean. Therefore there's a requirement for fuel which produces less carbon and contributes to the sustainable development.

There are number of bio fuels which can be developed using plants, animal matters etc, but the fuel which we are experimenting is Linseed, the fuel are going to be subjected to several experimental procedures to work out the efficiency of the fuel, emission of the carbon content, performance of the fuel, rate of temperature and pressure variations with or without additives etc. From the results, we will analyze the performance of the Linseed with TiO2, Al2O3 and the nano particles. The brake power indicated power, mechanical efficiency is calculated using the number of strokes and accordingly under different pressure levels we will conduct the experiment with varied additives.

LITERATURE REVIEW

(Ali Kahraman, 2013,)The biofuel can be produced from many other biological resources such as for example plants animals and other cooking oils waste matters vegetables and fatty acids. There are several number of methods that are used to produce the biofuels which can be divided into two types the basic method is physical and other is chemical methods, by using these two methods the experimental process of producing the bio fuel will can be progressed without change in there characteristics. The main method which is used to produce the biodiesel fuel is the physical method which can be further divided into direct and indirect method in which the mixing of the biofuel with the diesel fuel takes place with a definite proportion to get the required lesser viscosity and greater volatility of the biofuel. The chemical method involves the change in chemical properties of the bio fuel in which many unsaturated fatty acids are used and under gone for the oxidation which will cause the incomplete combustion with the release of enormous amount of carbon from the engine valves.

(Novel, 2016)After the death of Dr Diesel in 1913, petroleum fuels were used as in the engine due to their non-economic production for commercial purposes, and vegetable oils and ethanol tended to be expensive. However, his ideology to run the engine on vegetable oil accentuates the use of these renewable fuels to have a cleaner environment. During the 1970s, the popularity of biofuels surged due to energy crises, fossil fuels becoming less abundant and strict implementation of emission standards along with enhanced fuel economy.(Dilip Kumar Bora, 2009)The research in the Biofuels is characterized based on their focus on usage and their source of production. First generation biofuels concentrated on producing them from feedstock like agriculture and forest biomass resources. The people in the modern era are using the petrol and diesel as main forms of energy resources to run the vehicles in addition to compressed natural gases. Many cities now a days playing important role to minimize the fuel consumption there by increasing the electrical form of vehicles. Some of the biofuels which are produced at room temperature will be in the liquid form due to their greater unsaturated fatty acids content and which can directly be used in the diesel engines or can also be mixed with the other fuel forms without any chemical. The main advantage of using the biofuels are the production cost of the biofuel is very less and the maintenance will be at lesser cost. with convenient operations and the biofuels will give greater efficiency.

(I.M. Atadashi, 2012)The oil resources are widely used and to increase the economy of the respective countries, the utilization and the exploitation of the natural resources are taking place. The major development in the automobile industry paved the way for the newer generation vehicle, and the engine development form the BS4 to BS6 now, reduced the emission and the refinement of the engine also. (Jawad Nagi, 2008)The newer option of the engine will let the specific fuel consumption low thereby contributing to the best efficient fuel forms.. The practical aim of the biofuels is to provide economical energy resources to meet the demand and a cleaner energy production by their combustion to reduce the usage of tetraethyl lead and benzene compounds, an octane enhancing additives which are health hazardous.

METHODOLOGY

The Linseed oil is obtained from the specific plant, which is an edible oil and the industrial oil also can be produced using this raw material. The plants in the canola contains the acidic content which is low. The seeds from the canola plants will be used to extract the oil, the oil should have less than 2% of erucic acid and the remains should have after the oil is extracted should not contain more than 30 micromoles of aliphatic glycosylates per gram. The Linseed oil is extracted and can be prepared in various forms of the fuel which are environmentally green and produce lesser rate of emission. The emission produced will be 85% low as the conventional fuels such as diesel, petrol, kerosene. Linseed B30 with TiO2 had the highest average volumetric efficiency of 32% and Linseed B40 with TiO2 had the brake thermal efficiency when compared to diesel, Linseed diesel and Linseed metal oxide blends.

Figure 1. Linseed plants and Oil

EXPERIMENTAL PROCEDURE AND SETUP

As for Linseed blends, all of them had lower pollutants and particulate emissions from the exhaust gases to diesel. Al_2O_3 blends attained the least NOX emissions when compared to TiO_2 mixtures and Linseed B30 Al_2O_3 at 240bar having the least CO% emission. The heated terms of the canola seeds are known as the cake, and they are cooked to 80 – 105c for 15 – 20 minutes by rapidly increasing the temperature to 80c in a heat exchanger. This is done to rupture oil cells to reduce oil viscosity, increase the diffusion rate of the oil cake, reduce moisture and denature hydrolytic enzymes. Then the baked cake is pressed in a screw conveyor to extract the oil from the seeds and using the remains of the pressed cake for solvent extraction. This process retrieves about 50 – 60% of oil from the cake.

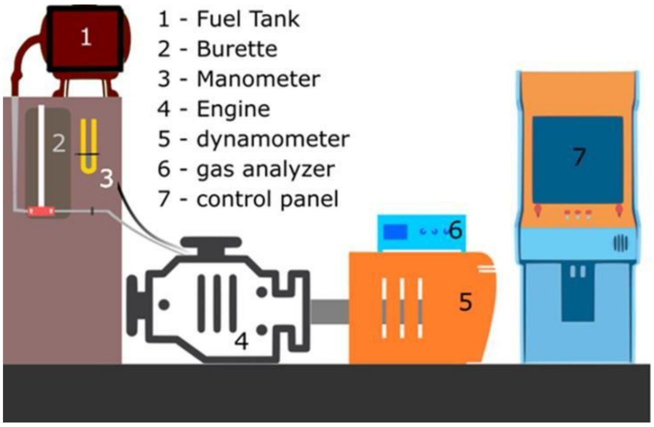
The pressed cake still contains 20% of oil which is fed to an extractor and spray nozzles are used to spray solvent like N- hexane over the cake. The solvent by gravity percolates though cake bed, saturating the pressed cake pieces bringing the oil along with it. Then the solvent leaves the solvent extractor and is recaptured again. In this device the solvent is passed through a series of steam-heated plates at 95 – 115c for 90 minutes to remove a majority of solvent from the oil. The crude Linseed oil thus produced is refined using water precipitation or organic acid to remove phospholipids, mucilaginous gums, color pigments, fine cake particles, free fatty acids. Finally, the oil is steam distilled to eliminate odour.

Biodiesel from refined Linseed oil is synthesised by reacting the oil with methyl ester with potassium hydroxide as a catalyst in a batch type reactor. The catalyst added is 1%, and methanol is of 6:1 molar ratio of oil. After the reaction is completed, glycerol formed as by-product precipitates due to its insoluble nature to the bottom of the vessel by gravity. The canola methyl ester formed is then removed from the vessel and is washed with hot water to remove the catalyst. The properties of Linseed oil are listed Table 2. The experimental setup to evaluate the performance and emission parameters is setup with necessary equipment's arranged at Lords Engineering College. The experimental layout and its view are shown in fig 4.

A 4-stroke engine with the facility of single cylinder and water cooling direct ignition system is taken in this experiment. The crankshaft is coupled to an eddy current dynamometer with the help of flexible coupling firmly set on a concrete base. The engine setup is completely interfaced to a control box and measuring devices consisting fuel tank, manometer, orifice, Temperature indicators, burette, a gas analyser in separate panel to record the input and output parameters from the engine.

The experiment is progressed using the 4 stroke direct injection single cylinder engine, and which is water cooled and naturally aspirated. The engine is generated with the power output of the of 3.5KW at 1500RPM, the engine specifications are listed below in table 1. And the experimental procedures will be shown in the coming chapter. The figure 4, shows the experimental setup. The control panel interfaced to the engine is made to calculate the fuel rate flow, Engine RPM temperatures of the water at different parts of the engine, manometer to record the amount of air consumed by the engine. The performance parameters like brake power, volumetric efficiency, specific fuel consumption, thermal brake efficiency were determined from the above-recorded data during the experiment.

The volume consumption of the fuel is taken down and the amount of the engine fuel consumption is measured using the watch which is set to account the time of consumption. The increased revolution per minute is calculated using the tachometer fitted at the flywheel of the engine.



Product	Research Engine test setup 1 cylinder, 4 stroke, Multi-fuel VCR with open ECU for petrol mode (Computerized)
Product code	240PE
Engine	Type 1 cylinder, 4 stroke, water cooled, stroke 110 mm, bore 87.5 mm. Capacity 661 cc. Diesel mode: Power 3.5 KW, Speed 1500 rpm, CR range 12:1-18:1. Injection variation:0- 25 Deg BTDC ECU Petrol mode: Power 4.5 KW @1800 rpm, Speed range 1200-1800 rpm, CR range 6:1-10:1

Dynamometer	Type eddy current, water cooled, with loading unit
Propeller shaft	With universal joints
Air box	M S fabricated with orifice meter and manometer
Fuel tank	Capacity 15 lit, Type: Duel compartment, with fuel metering pipe of glass
Calorimeter	Type Pipe in pipe

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
ECU software	peMonitor & peViewer software.
Rotameter	Engine cooling 40-400 LPH; Calorimeter 25-250 LPH
Pump	Type Mono block
Overall dimensions	W 2000 x D 2500 x H 1500 mm

Piezo sensor	Combustion: Range 5000 PSI, with low noise cable Diesel line: Range 5000 PSI, with low noise cable
Crank angle sensor	Resolution 1 Degree, Speed 5500 RPM with TDC pulse.
Data acquisition device	NI USB-6210, 16-bit, 250kS/s.
Piezo powering unit	Make-Apex, Model AX-409.
Engine control unit	PE3 series ECU, full build potted enclosure.
Sensors for ECU	Air temp, coolant temp, Throttle position and trigger.
Engine Control hardware	Fuel injector, Fuel pump, ignition coil, idle air
Digital voltmeter	Range 0-20V, panel mounted
Temperature sensor	Type RTD, PT100 and Thermocouple, Type K
Temperature transmitter	Type two wire, Input RTD PT100, Range 0–100 Deg C, Output 4–20 mA and Type two wire, Input Thermocouple, Range 0–1200 Deg C, Output 4–20 mA

PREPARATION OF FUELS

The oil which is obtained in the yellow color is from the dried seeds and the oil is called as the flax oil. The oil which is obtained in the yellow color is from the dried seeds and the oil is called as the flax oil. The plant which is used to extract this flax oil contains acidic character and it is called as linum plant. The seeds which are ripened is used to produce this oil using the method of pressing. The oil solvent is extracted using these seeds and the flax oil or linseed oil is type of oil which gets dried, this oil which is flax oil has a property to convert and polymerize into the solid form greatly. The property of the oil is used as the bio fuel and can be extracted easily. The substitute is known as the fossil fuels. The property of forming the linseed oil is used to make the different combination of the bio fuel with additives like the nano materials, titanium oxide and the aluminum oxide. This fuel is substitute for many bio fuels, the polymerization property is used to make the blender with oils, resins etc therefore the extracted oil can be used for the glazing of furniture's, and the small content in the oil paints.

The great size of the oil molecules present in the vegetable oil will possess the oxygen content which can be used for the fuel properties. The vegetable oils are considered to be the form of the bio fuels but they are different from the carbon forming compounds such as the hydrocarbon fuels. The Linseed oil will be combined with the glycerides and other acids such as the oleic acid. The property which is physically noted in the oil is the viscosity. The viscosity of the produced oil as a bio fuel possess less as 25-30mm2/second at 50ºC. The property of the oil which is the viscosity will perform differently when there is higher range of molecules and the differed chemical structure.

The methodology adopted in the experimental work is given below, Check the fuel Linseed blend (Linseed oil + Diesel) level in the fuel tank

1) Allow fuel, start the engine by hand cranking.
2) The engine is set to the speed of say 1500-1600 RPM.
3) Apply the load by switching the mains from the dynamometer loading unit at range 6 – 12 KG.
4) Allow some time so that the speed stabilizes.
5) Note down the manometer readings.
6) Now take the time taken for 20cc consumption of fuel and note down the time.
7) Repeat the procedure for (3) to (6) for different loads and different Injection opening pressures.
8) Tabulate the readings as shown in the enclosed list.
9) After the experiment is finished the load is gradually reduced at kept at zero position.
10) The fuel supply is controlled after the experiment is over.

LINSEED B30 BIO FUEL WITH TiO2:

When we see the periodic table, the position of the oxygen and the titanium can be seen in the block D and P respectively. This material is also called as flamenco, titanium oxide and dioxotitanium. The titanium is then extracted from its ore by sulphuric acid called sulphate process or chlorine called process of chloride. In the process using the sulphuric , the ore of limonite is made to sink in the sulphuric acid to form a mixture of sulphate compounds. The resultant mixture after the dissolution is hydrolysed to give, insoluble dioxide of titanium. Then the titanium dioxide which is hydrolyzed is treated with heat in calciner to remove water and sulphuric acid from the solid. The resulted in solid turns to seed crystals that can be milled to nanoparticle size range.Chloride process produces purer titanium oxide with close tolerances to the particle sizes and is considered as cleaner than sulphate process as it does not require any acid treatment. In this process, the ore is fed to fluid bed preheated chlorinator along with coke and chlorine. The heat of the bed makes the ore to react with chlorine and coke to form titanium chloride which is then oxygenated to form titanium dioxide in the combustible gas. The gases are then filtered out to collect titanium dioxide crystals.

LINSEED B30 BIO FUEL WITH Al2O3 PROCESS :

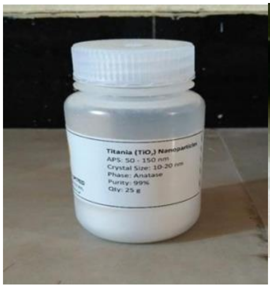
Alumina or Aluminium oxide is produced by Bayer process. In the initial stage, the bauxite ore is crushed in mills, washed and then dried. Next, the bauxite ore is heated with moderately concentrated NaOH solution of 150 – 250 ºC. At this temperature, the ore reacts with NaOH to form sodium aluminate. The reaction is done in a pressure vessel ranging up to 35atm to keep the water in NaOH in aliquid state.

Al2O3(ore)+ 2 NaOH + H2O ------------------ 2 NaAl(OH)4

The reaction will not progress as the bauxite ore must be pure and will not combine with the hydroxide of the sodium so it will not be change during the reaction. All these unreacted solids are filtered out which are called as red mud.

The sodium aluminate solution formed is cooled, pure aluminium hydroxide gets precipitated. Then the resultant product asNaOHis calcined with the heat of nearly 1100 - 1200ºC.

2Al(OH)3 → Al2O3 + 3H2O

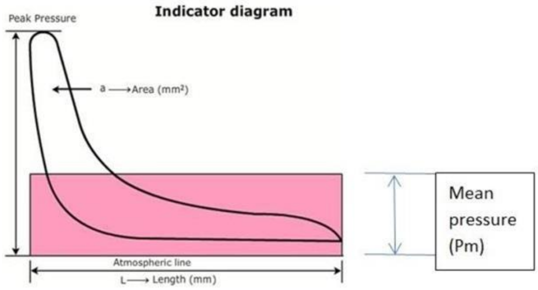


LINSEED B30 BIO FUEL WITH NANO PARTICLES PROCESS :

One-step and two-step methods can be used to prepare nanofluids. However, atwo-step method is applied as it is cheaper and can Nanofluids can be produced on a large scale. In two-step method, first nanoparticles are prepared by physical or chemical methods, e.g., laser ablation, grinding, sol-gel processing etc., and the prepared nanoparticles are suspended in fuel by mechanical stirring or ultrasonic agitation. This process agglomerates nanoparticles to its nanometer range.

A surfactant is a material which lowers the surface tension between the liquid or solid and to increase the charge of the nanoparticles. This charge induced will make the fuel molecule to form a layer on the nanoparticle. However, not every surfactant can be used to stabilise the nanofluid. The choice of surface energy depends on the surface energy, nonmaterial type and the charge induced by surfactant type. At the time of combustion, nanoparticles encapsulated by the fuel undergo micro explosionat high temperature and forming smaller fuel particles distributed across the engine cylinder leading to homogeneous energy distribution resulting in pure combustion

PERFORMANCE ANALYSIS AND CALCULATIONS OF CANOLA B30 BIO FUEL



The area under the curve can be measured by an instrument called "Planimeter" or by using the ordinates rule; we can calculate the area and apply the formulae. The graphical area can be now divided into the different measures vertically to calculate the height. When this H is taken as the product of the scale and H of the graph will get the pressure which is called as pressure effective. The average, pressure can be used to calculate the total work done by the assumed cylinder .

Area of the indicator = a (mm2)

Height of PV diagram = a (mm2)/ l(mm)

Average indicated pressure (IP) = a (mm2)/l(mm) * k(bar/mm) P = (a/l)*k

Work done = IP * Area* stroke length

= IP * A*L

Peak pressure for canola B30, using the data source, we get the peak pressure = 119.2bar The mean pressure is 240 bar , we are taking using graph for the calculation

Therefore

Peak pressure / mean pressure

= 119.2/240

= 0.497mm2

From the diagram A= 0.497mm2 l = 185cm

Brake Power (BP) = 2πNT / 60

= 2πN(W x R) / 60

=2πN (m x 9.81)x Arm length / 60 N = 2 for 4 stroke

N = 1 for 2 stroke

Mass of Fuel consumed (mfc) = Density of fuel(ρ) x V

= ρ x fuel consumed(20ml)/time taken

Brake Specific Fuel Consumption = Mass of the fuel consumed/Brake power Indicated power will be taken using the PV Diagram. Mechanical Efficiency = Brake power (BP)/ Indicated power Brake Thermal efficiency =
Brake power *100/(Mass of fuel consumed * Calorific value)

Indicated power is calculated by using the PV diagram curve, in which the top dead centre and the bottom dead centre is noted as h2 and h1 respectively, then the area is calculated by taking the the difference
h2-h1 = 100-35 = 65.

Canola oil B30 at 240bar Compression Ratio = 16 Density – 829 kg/m3 Crank Angle = 23^0 Before Top Dead Centre

Indicated power is calculated by using the PV diagram curve, in which the top dead centre and the bottom dead centre is noted as h2 and h1 respectively, then the area is calculated by taking the the difference .
Canola oil B30 at 240bar Compression Ratio = 16 Density – 829 kg/m3 Crank Angle = 23^0 Before Top Dead Centre

Observations:

Table: Linseed Oil B30 16CR at 240 bar

Observations Load = 6kg	Load = 12kg
h1 = 35mm	h1 = 35.5mm
h2 = 100mm	h2 = 100mm
T = 51.1sec	T = 33.00sec

Emissions:

Table: Linseed Oil B30 16CR at 240 bar

CO	01.287%
CO2	10.12%
HC	0008ppm
O2	05.58%
NOx	01420ppm
□	0.290

Performance:

Table: Linseed Oil B30 16CR at 240 bar

Load KG	Mass fuel Consumption Kg/sec	Brake Power KW	Indicated Power KW	Fuel Consumption Kg/KW	Thermal Efficiency %	Mechanical Efficiency %
6	324.65x 10-6	2.139	12.50	0.1590	16.76	17.21
12	450.29x 10-6	4.56	18.96	0.355	24.38	24.05

Linseed oil B30+ TiO2 at 100 ppm 240 bar
Compression Ratio = 16CR Density = 829 kg/m3 Calorific Value = 41542 KJ/Kg

Observations:

Table: Linseed Oil B30+ TiO2 at 100 ppm at 240 bar

Observations Load = 6kg	Load = 12kg
h1 = 34mm	h1 = 35mm
h2 = 100mm	h2 = 100mm
T = 51.08sec	T = 33.13sec

Emissions:

Table: Linseed Oil B30+ TiO2 in terms of 100 ppm 240 bar

performance:

Table: Linseed Oil B30+ TiO2 in terms 100 ppm at 240 bar

Load KG	**Mass fuel Consumption Kg/sec**	**Brake Power KW**	**Indicated Power KW**	**Fuel Consumption Kg/KW**	**Thermal Efficiency %**	**Mechanical Efficiency %**
6	324.58x 10-6	2.139	12.50	0.157	16.91	17.11
12	500.9x 10-6	4.56	18.80	0.395	21.94	24.5

Linseed oil B30+AL_2O_3 at 100 ppm 240 bar
Compression Ratio = 16CR Density = 829 kg/m3 Calorific Value = 41542 KJ/Kg

Initial parameters:

Load = 6kg	Load = 12kg
h1 = 33mm	h1 = 34.5mm
h2 = 100mm	h2 = 100mm
T = 51.08sec	T = 33.13sec

Emission:

Table: Linseed Oil B30+ AL_2O_3 in terms of 100 ppm at 240 bar

CO	01.576%
CO2	10.48%
HC	0029ppm
O2	04.99%
NOx	01500ppm
□	1.203

Performance:

Table: Linseed Oil B30+ AL_2O_3 in terms of 100 ppm at 240 bar

Load Kg	**Mass fuel Consump tion Kg/sec**	**Brake Power KW**	**Indicated Power KW**	**Fuel Consumption Kg/KW**	**Thermal Efficiency %**	**Mechanical Efficiency %**
6	324.58 x 10-6	2.28	12.50	0.512	16.91	18.2
12	500.45 x 10-6	4.56	18.80	0.395	21.94	24.5

PERFORMANCE

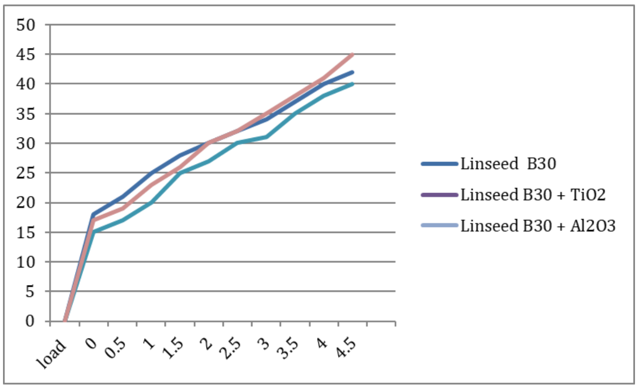


Figure 5. Load v/s volumetric efficiency at 240bar pressure

The volumetric efficiency having an increasing tendency at both the pressures. Linseed B30 showed the least value at 220bar but has the highest value at 240bar concerning volumetric efficiency. WVO B30 showed highest volumetric efficiency at both the pressures to which it was equal with linseed B30 at 240bar.

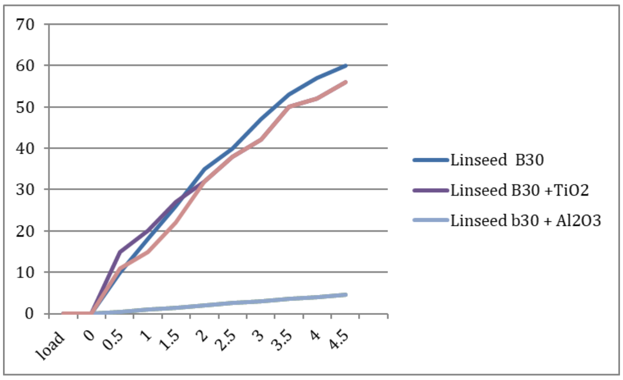


Figure 6. Load and vol. efficiency at 220 bar pressure

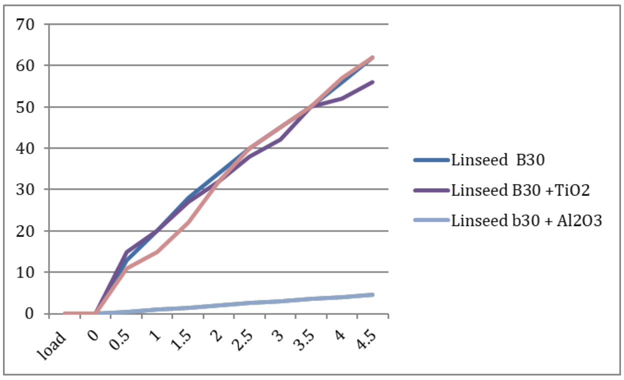


Figure 7. Load v/s efficiency 200 bar pressure

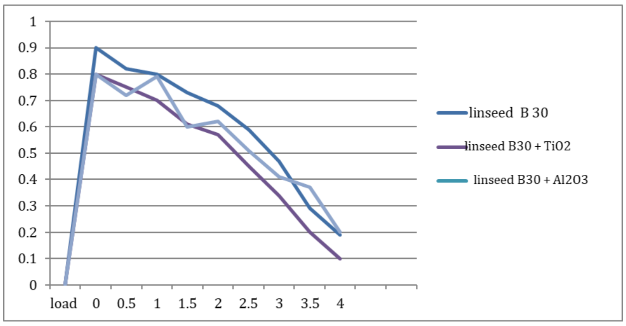


Figure 8. Load v/s specific fuel consumption at 240 pressure

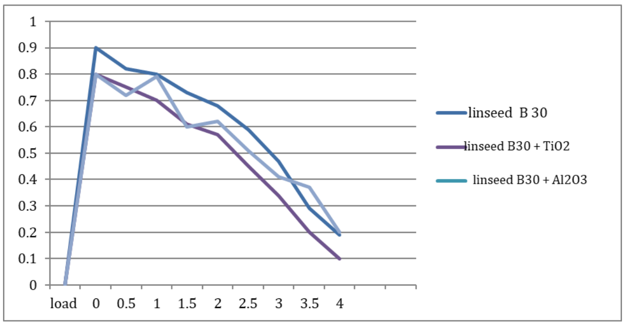


Figure 9. Load v/s Specific fuel Consumption at 220 pressure.

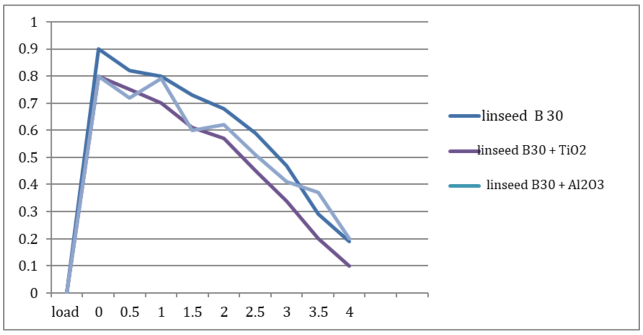


Figure 10. Load v/s Specific fuel Consumption at 200 pressure.

The specific fuel consumption remained to be same for all the fuels; however, Linseed B30 showed least specific fuel consumption on an average at both the pressures.

EMISSIONS

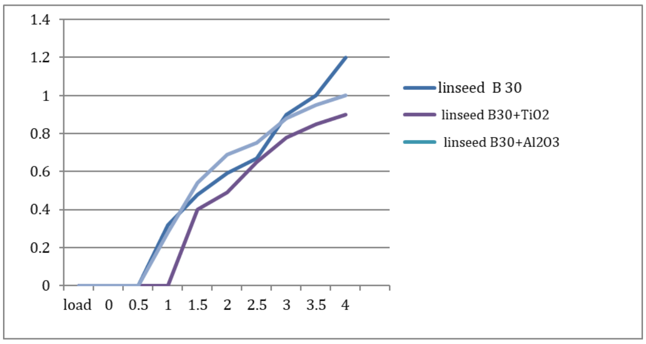


Figure 11. Load v/sCO2& NoX at 240 bar pressure.

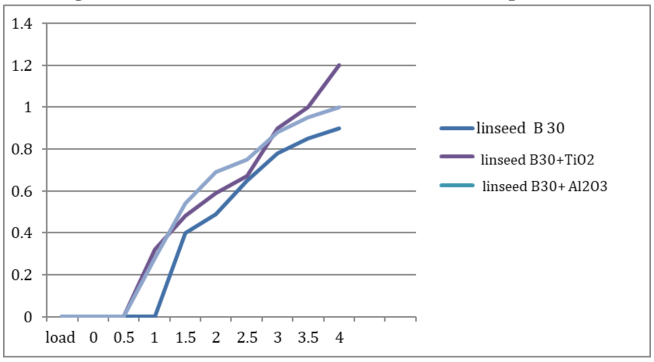


Figure 12. Load v/s CO2 & NOX at 220 bar pressure.

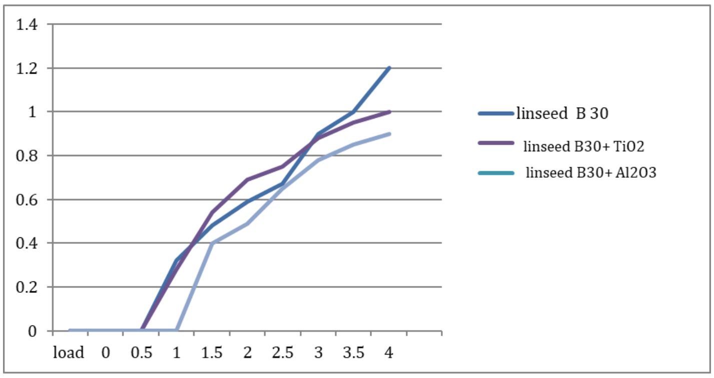


Figure 13. Load v/s CO2 & NOX at 200 pressure.

The highest value at 240bar at all loads, linseed B30 at 220bar and its nano blend at 240bar had least CO%. Linseed B30 Nano showed least average CO % emissions at both the pressures. WVO B30 at 240bar had least NOX emissions on an average at all loads. Linseed B30 Nano had highest NOX percentage of emission at both the pressures on an average.

CONCLUSION

The volumetric efficiency having an increasing tendency at both the pressures. Linseed B30 showed the least value at 220bar but has the highest value at 240bar concerning volumetric efficiency. WVO B30 showed highest volumetric efficiency at both the pressures to which it was equal with canola B30 at 240bar. Linseed B30 had the highest average brake thermal efficiency at all loads when compared to others at 220bar. The calculation shows that the specific fuel consumption remained to be same for all the fuels however, Linseed B30 showed least specific fuel consumption on an average at both the pressures. It can be observed that WVO B100 Nano shows highest CO% emissions at 220bar whereas WVO B40 shows the highest value at 240bar at all loads, Linseed B30 at 220bar and its nanoblend at 240bar had least CO%. Canola B40 Nano showed least average CO % emissions at both the pressures.
NOX has varied to a large extent at both the pressures for all fuel blends shown at which WVO B100 Nano at 220bar and WVO B40 at 240bar had least NOX emissions on an average at all loads. Linseed B30 Nano had highest NOX percentage of emission at both the pressures on an average.

REFERENCES

[1].Bobade S.N., Khyade V.B., “Preparation of Methyl Ester (Biodiesel) from Kananja (Pongamia Pinata)”, International Science Congress Association, 2012, pp. 43 – 50.
[2]. Akhihiero E.T., Oghenejoboh K.M., Umukoro P.O., “Effect of Process Variables on Transesterification Reaction of Jatropha Curcas Seed Oil for the Production of Biodiesel”, International Journal of Emerging Technology and Advanced Engineering, 2008, pp. 388-393.
[3]Ali Kahraman, Hidayet Oguz, IIker Ors, Ozgur Solmaz, “Effect of Cottonseed oil Methyl ester on the Performance and Exhaust Emissions of a Vehicle”, International Journal of Automotive Engineering and Technologies, 2013, pp. 104 – 110.
[4]U. Santhan Kumar, K. Ravi Kumar, “Performance, Combustion and Emission Characteristics of Corn oil blended With Diesel”, International Journal of Engineering Trends and Technology (IJETT) – Volume 4 Issue 9-Sep 2013, pp. 3904 -3908.
[5]P.Sreenivas, Venkata Ramesh Mamilla, K.Chandra Sekhar, “Development of Biodiesel from Castor oil”, International Journal of Energy Science, 2011, pp.192-197.
[6] Sandeep Kumar Duran, Maninder Singh, Hardeep Singh, “Performance and Combustion Characteristics of Single Cylinder Diesel Engine Fuelled With Blends of Karanja Biodiesel and Diesel”, International Journal of Mechanical Engineering and Technology (IJMET), Volume 5, Issue7, July (2014), pp.160-170.
[7] Sandeep Kumar Duran, Maninder Singh, Hardeep Singh, “Karanja and Rapseed Biodiesel: An Experimental Investigation of Performance and Combustion Measurement for Diesel Engine”, International Journal of Science & Engineering Research, Volume 6, Issue 1, January-2015, pp. 295 – 299.
[8]D. Subramaniam, A. Murugesan, A. Avinash, “Comparative estimation of C.I. engine fuelled with methyl esters of punnai, neem and waste cooking oil”, International Journal of Energy and Environment, Volume 4, Issue 5, 2013 pp.859-870.
[9] I.M. Atadashi, M.K. Aroua, A.R. Abdul Aziz, N.M.N. Sulaiman, “Renewable and Sustainable Energy Reviews”, Elsevier, 2012, pp. 3275-3285. [20]. Nor Hazwani Abdullah, Sulaiman Haji Hasan, and Nurrul Rahmash Mohd Yusoff, “Biodiesel Production Based on Waste Cooking Oil (WCO)”, International Journal of Materials Science and Engineering Vol. 1, No. 2, 2013, pp. 94 – 99.
[10] Jawad Nagi, Syed Khaleel Ahmed, Farrukri Nagi, “Palm Biodiesel an Alternative Green Renewable Energy for the Energy Demand of the Future”, ICCBT 2008, pp. 79 – 94.
[11] Suman Singh, P.K. More, Kirtiraj Gaikwad, “Standardization of Process Parameter for Neem Oil & Determination of Properties for Using as a Fuel”, Journal of Chemical and Pharmaceutical Research, 2013, pp. 1-7.
[12] Sanjay Basumatary, “Transesterification with Heterogeneous Catalyst in Production of Biodiesel”, Journal of Chemical and

Pharmaceutical Research, ISSN: 0975-7384, CODEN (USA): JCPRC5, 2013, pp. 1-7.
[13]M. Abdel fatah, H.A. Farag, M.E. Ossman, "Production of Biodiesel from Non – Edible Oil and Effect of Blending With Diesel on Fuel properties", International Journal (ESTIJ), ISSN: 2250 – 3498, 2012, pp. 583 – 591.
[14]Dilip Kumar Bora, L.M Das, M.K.G Babu, "Storage Stability of Mahua Oil Methyl ester", Journal of Science & Industrial Research, 2009, pp. 149 – 152.
[15]. V. Rambabu, Dr. V.J.J. Prasad, K. Prasada Rao, "Performance and Emission Analysis of DI – Diesel Engine Using Neat Linseed Methyl Ester Along With Methanol as Dual Fuel", 2012, pp. 35 -39.
[16]N.P. Rathod, S.M. Lawankar, "Comparative Study on Use of Biodiesel (Methyl Ester Kusum oil) and Its Blends in Direct Injection CI Engine – A Review", International Journal of Emerging Technology and Advanced Engineering, 2013, pp. 254 – 259.
[17]Murari Mohon Roy, Majed Alawi and Wilson Wang, "Effects of Canola Biodiesel on a DI Diesel Engine Performance and Emissions", International Journal of Mechatronics Engineering IJMME-IJENS Vol:13 No:02, 2013, pp.46-53.
[18]Allakhverdiev SI, Kreslavski VD, Thavasi V, Zharmukhamedov SK, Klimov VV, Nagata T, et al. Hydrogen photoproduction by use of photosynthetic organisms and biomimetic systems. Photochem Photobiol Sci 2009;8:148e56.
[19]Razzak SA, Hossain MM, Lucky RA, Bassi AS, de Lasa H. Integrated CO2 capture, waste water treatment and biofuel production by microalgae culturing-a review. Renew Sustain Energy Rev 2013;27:622e53.
[20]Voloshin RA, Kreslavski VD, Zharmukhamedov SK, Bedbenov VS, Ramakrishna S, Allakhverdiev SI. Photoelectrochemical cells based on photosynthetic systems: a review. Biofuel Res J 2015;6:227e35.
[21]Dragone G, Fernande B, Vicente AA, Teixeira JA. Third generation biofuels from microalgae. In: Mendez-Vilas A, editor. Current research, technology and education topics in
applied microbiology and microbial biotechnology. Formatex; 2010. p. 1355e66.
[22]Demirbas A. Political, economic and environmental impacts of biofuels: a review. Appl Energy 2009;86:S108e17.
[23]Cha M, Chung D, Elkins JG, Guss AM, Westpheling J. Metabolic engineering of Caldicellulosiruptor bescii yields increased hydrogen production from lignocellulosic biomass. Biotechnol Biofuels 2013;6:85.
[24]Poudyal RS, Tiwari I, Koirala AR, Masukawa H, Inoue K, Tomo T, et al. Hydrogen production using photobiological methods. In: Subramani V, Basile A, Veziroglu TN, editors.
Compendium of hydrogen energy: hydrogen production and purification. Woodhead Publishing Limited; 2015a. p. 289e317.
[25]Razaghifard R. Algal biofuels. Photosynth Res 2013;117:207e19.
[26]Singh A, Nigam PS, Murphy JD. Renewable fuels from algae: an answer to debatable and based fuels. Bioresour Technol 2011;102:10e6.
[27]Atsumi S, Higashide W, Liao JC. Direct photosynthetic recycling of carbon dioxide to isobutyraldehyde. Nat Biotechnol 2009;27:1177e80.
[28]Tran NH, Bartlett JR, Kannangara GSK, Milev AS, Volk H, Wilson MA. Catalytic upgrading of biorefinery oil from micro-algae. Fuel 2010;189:265e74.
[29]Gronenberg LS, Marcheschi RJ, Liao JC. Next generation biofuel engineering in prokaryotes. Curr Opin Chem Biol 2013;17:462e71.
[30]Hasunuma T, Okazaki F, Okai N, Hara KY, Ishii J, Kondo A. A review of enzymes and microbes for lignocellulosic biorefinery and the possibility of their application to consolidated bioprocessing technology. Bioresour Technol 2013;135:513e22.
[31]Senthilkumar, P. "Environmental Effect Of Using Diesel On Waste Plastic Oil Fueled In Diesel Engine." International Journal of Mechanical Engineering (IJME) 7. 3, (2018) 1-8.
[32]Irfan, Osama Mohamed. "Influence Of Specimen Geometry And Lubrication Conditions On The Compressionbehavior Of AA6066 Aluminum Alloy." International Journal of Mechanical Engineering (IJME) 5.1 (2015): 14-24.
[33]Reddy, P. RAVINDER, and M. Saikiran. "Aerodynamic Analysis of Return Channel Vanes in Centrifugal Compressors." International Journal of Mechanical Engineering (IJME), 5.1 (2016) 73-82
[34]El-Shennawy, M., et al. "Effect of boron content on metallurgical and mechanical characteristics of low carbon steel." International Journal of Mechanical Engineering (IJME) 5.2 (2016): 1-14
[35]El–Shennawy, M., et al. "Heat treatment effect on micro–alloyed low carbon steel with different Boron content." International Journal of Mechanical Engineering (IJME) 5.4 (2016): 9-20.
[36]Naik, R. T., and Nilesh Chavan. "Emission Characteristics of a High Speed Diesel Engine." International Journal of Mechanical Engineering (IJME) 5.4 (2016): 29-36.