International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 4 April 2023, pp: 339-345 www.ijaem.net ISSN: 2395-5252

Performance of Computerised Single Cylinder Diesel Engine with Blends of Linced Oil with Additives

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Date of Submission: 01-04-2023 Date of Acceptance: 10-04-2023

ABSTRACT: This research paper is about To form the balance of the ecosystem and reduce emissions, we must depend on the fuel of choice, which produces less carbon content and provides a good substitute for these oils. Gases produced after combustion will affect humans surrounding area and therefore the environmental ecosystem such as birds, trees, etc. the release of these gases contained in carbon directly affect the ozonosphere. This effect is extremely large and reduces the protective capacity of the ozonosphere. Most alternative solution to reduce these problems is biofuels. The world is experiencing the widespread demand for fuels for satisfy human need. Different fuel systems/modes such as petrol and diesel are becoming more and more expensive and need to be made into alternative fuels that can produce fewer emissions and make operation more efficient. Combustion engines as Conventional gasoline and diesel engines use oil for operation and, therefore, the rate of oil in the The Earth's crust is rapidly depleted. Biofuels will suffer increased green effects, with very low emissions. The temperature and, therefore, the pressure variations will also be comparatively less in these biofuels. Biofuels such as B30 canola and Flax fuels are the most types of biofuels we discuss in this article. These are the fuels obtained from the alcoholic groups, and contain a low cetane number which is only the main requirement of diesel. Fuels that are extracted Plants and other biological materials have proven to be just as effective as diesel and therefore gasoline. However Thanks to the similar chemical structure of flax fuel compared to other fuels like diesel, it is very suitable for extracting and using, which have equivalent characteristics.

Therefore, during this research, we will look at flax fuel because the main biofuel and discussion of extraction, the and therefore the advantages of Bio fuel with mathematical results. Flax seed is experimented with TiO_2, Al_2O_3 and nanoparticles. The mathematical results will give the efficiency and other properties of this biofuel compared to other fuels.

KEYWORDS: IC Engine, blended fuel, additives, Engine performance, Emissions.

I. INTRODUCTION

In this paper In recent times, the world is confronted with the twin crisis of fossil fuel depletion and environmental degradations. The situations have led to the search for an alternative fuel which should be not only sustainable but also environment friendly without sacrificing the performance. The different sources for alternative fuels are edible- and non-edible vegetable oils, animal fats and waste oil (triglycerides). Vegetable oils, being renewable, are widely available from variety of sources have low sulfur contents close to zero and hence cause less environmental damage (lower green house effect) than diesel. In the context of India, non edible oil can be the most viable alternative for petroleum fuels since there is shortage of vegtable oils to meet the domestic requirements. It has been found that neat vegetable oil can be used as a fuel in conventional diesel engines without any modification. performance problems due to higher viscosity and lower volatility. To mitigate these problems and increase performance of the engine the diesel fuel is blended with the Flax fuel(B30), additives(TiO_2, Al_2O_3).

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II. LITERATURE SURVEY

[1].the performance characteristics of single cylinder four strokedirect injection diesel engine using Neem castor oil as an alternate fuel. Here castor seed oil is used in the form of blends at various proportions with diesel. High viscosity is one important difference between Neem castor oil and commercial diesel fuel. A single cylinder, fourstroke, constant speed, water cooled, direct injection diesel engine is going to be used for the experiment. The performance characteristics of engine are determined using Neem Castor oil blends with diesel. These results are compared to those of pure diesel.The performance of the engine will be measured using Lab view software. After acquiring the experimentaldata they will be analyzed for various parameters such as brake thermal efficiency, brake specific fuel consumptions (BSFC). The engine is expected to run with reduced emission levels with acceptable engineperformance. It is concluded that Neem castor non-edible oil can beused as an alternate to diesel. This usage of Neem castor oil has a great impact in reducing the dependency of India on oil imports.

[2].The increase in demand for fossil fuel resources and environmental degradation has led researchers to seek a suitable substitute for fuels that are renewable and environmentally friendly. Biodiesel is one of the alternative fuels that receivedmore attention as a substitute for diesel fuel. Its ability to reduce carbon monoxide, HC and particulate matter makes it an outstanding alternate fuel. The main purpose of this paper is to review the performance, combustion, and emission characteristics of biodiesel derived from non-edible Jatropha oil. Jatropha biodiesel (JB) has been found to possess properties that are within the acceptable range as stipulated by the ASTM. The review focused on three engine performance parameters: Brake power (BP), Brake specific fuel consumption (BSFC), and Brake thermal efficiency (BTE). From the review, the diesel engine can run smoothly with Jatropha biodiesel. The observations from several researchers showed a decrease in BP, BTE,and an increase in BSFC in comparison with diesel fuel. Emission parameters like Carbon monoxide (CO), Carbon dioxide (CO2), Hydrocarbons (HC), Nitrogen Oxides (NOx), and Particulate matter (PM) were observed during the test. CO, CO2, HC, and Particulate matter were found to be lower than that of diesel fuel. However, a significant increase in NOx emission was spotted. Lower cylinder pressure, together with heat released, was evident when using Jatropha and its blends (JB20, JB40, JB80, and JB100). JB20 proved to be the best blends as it yieldedimproved and acceptable results in performance and emission as compared to 100% Jatropha biodiesel. In view of the findings of the review, it can be concluded thatJatropha biodiesel can be the alternate fuel in the near
future

[3].Kuntesh A Mithaiwala studied on Performance Improvement of IC Engine Using Blends of Ethanol. The main objective of the current work id to investigate influences of blends of ethanolpetrol blend used in IC engine performance using energy and exergy analysis. This literature study is about the changing load according for different blends of ethanol, and find the specific fuel consumption, brake power, Exhaust gas energy, Colling water energy. On this performance parameter, check the performance of the SI Engine. And proved that To blend ethanol with petrol fuel and observe the performance of I.C. Engine and improve performance of engine. To do the analysis of the Ethanol on various parameters like input parameter like load, output parameter like specific fuel consumption, brake power, and brake thermal efficiency. Experimental energy and exergy analysis on SI engine by Ethanol-Petrol blend (E0, E100, E25, E40). Ethanol. The main objective of the current work id to investigate influences of blends of ethanolpetrol blend used in IC engine performance using energy and exergy analysis. This literature study is about the changing load according for different blends of ethanol, and find the specific fuel consumption, brake power, Exhaust gas energy, Colling water energy. On this performance parameter, check the performance of the SI Engine. And proved that To blend ethanol with petrol fuel and observe the performance of I.C. Engine and improve performance of engine. To do the analysis of the Ethanol on various parameters like input parameter like load, output parameter like specific fuel consumption, brake power, and brake thermal efficiency. Experimental energy and exergy analysis on SI engine by Ethanol-Petrol blend (E0, E100, E25, E40).

[4].This paper presents the Performance Studies on Non-Edible Oil as IC Engine Fuels. The following are the observations, which can be based on the experimental results of different researchers while using non-edible biodiesel blends in CI engines the Jatropha as biodiesel blend resulted in lower BTE, higher SFC and exhaust gas temperature. Pongamia gave the best brake thermal efficiencies compared to neat diesel operation. Jatropha blend helps in reducing HC and CO emissions. However, NOx emission increases. For Calophyllum blend, a slightly lower BSFC as well as BTE was observed compared to diesel fuel. Use of Calophyllum inophyllum blend resulted in decreased CO, smoke

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and particulate matters with increasing blend ratio, whereas NOx emission increased compared to diesel engine operation. For Mahua blend, a slightly lower BSFC as well as BTE was observed compared to diesel fuel. Mahua blend helps in reducing HC and CO emissions. However, NOx emission increases. The BTE and BSFC trends for Pongamia pinnata was in-line with Mahua blend and Jatropha blend. Pongamia biodiesel blend resulted in substantial reducution in CO and smoke emissions. However, at higher loads NOx emissions increased significantly.
[5].performance test of diesel engines using jatropha-diesel fuels blends for the evaluation of the engine performance there are parameters chosen and the effect of various operating conditions, design concept and modifications on these parameters are studied.The basic performance parameters are power, mechanical efficiency, mean effective pressure, torque, and fuel consumption. In fact, the fuel quality and specifications have a major effect in the diesel engine performance beside the other factors such as the air inlet temperature, compression ratio …. Etc. This study is based on the use of jatropha oil as a replacement of diesel in the diesel engine and the purpose is to get the same better performance. atropha is one of herbal plants which its seeds can be used as a replacement for the diesel in its liquid phase. Therefore, a good effort must be exerted to take care of these plants under the concept of power growing demands. This oil can reduce the reliability on the diesel fuel. experiments have been done on a diesel engine in order to compare the performance of diesel fuel oil with jatropha oil. The blended fuel improves power and efficiencies compared with pure diesel fuel.

III. EXPERIMENTATION

Experimental study on a Computerized Single Cylinder Diesel Engine, fuelled with diesel and different percentages of non edible oil blended with diesel were investigated with respect to the performance and emission characteristics. The setup consists of computerized 4-stroke diesel engine with the facility of single cylinder and water cooling direct ignition. The crankshaft is coupled to an eddy current dynamometer with the help of flexible coupling firmly set on a concrete base. Provision is also made for interfacing airflow, fuel flow, temperatures and load measurement. The setup has stand-alone panel box consisting of air box, fuel tank, manometer, fuel measuring unit, transmitters for air and fuel flow measurements, process indicator and engine indicator. Rotameters are provided for cooling water and calorimeter water flow measurement. The setup enables study of engine performance for BP, IP, FP, BMEP, IMEP, BTE, ITE, Mechanical Efficiency, Volumetric Efficiency, SFC, AFR and heat balance. Labview based Engine Performance Analysis software package “lab view” is provided for on line performance evaluation. Initially the engine was run with pure diesel and after blends of Flax seed oil as 30%(B30) and additives(TiO_2, Al_2O_3) at different loads varying with help of loading unit. Various engine performance parameters and exhaust emission were measured with the help of digital lab viewsoftware.

Schematic Diagram of Experimental Setup

Engine Specification

PARTICULARS	SPECIFICATIONS
Type of Ignition	Compression Ignition(CI)
Rated Power(kW)	3.5
Injection opening pressure(bar)	200
Constant Speed(RPM	1500
Fuel Injection	Direct Injection
Compression ratio	5:1 to 20:1
Injection Timing(bTDC)	23^0
Dynamometer	Eddy Current Type

IV. CALCULATION

1. Indicated power

$$I.P = \frac{nP_{m_i} L\, A\, N\, K \times 10}{6}\ kW$$

Where n = number of cylinders
P_{mi} = Indicated mean effective pressure,
L = Length of stroke, (m)
A = Area of piston, (m^2)
K = for 4 stroke engine

1. Brake power

$$B.P = \frac{2\pi NT}{60 \times 1000}\ kW$$

Where N = engine speed in rpm
T = Torque at output shaft in N-m.

2. Frictional power

F.P = I.P - B.P

3. Mechanical efficiency

$$\eta_{mean} = \frac{B.P}{I.P}$$

4. Thermal efficiency

Indicated Thermal Efficiency $\eta_{th}(1) = \frac{I.P}{m_f \times C}$

Brake Thermal Efficiency $\eta_{th}(B) = \frac{B.P}{m_f \times C}$

Where,
m_f = Rate of fuel consumed (kg / sec)
C = calorific value of fuel (kJ/ kg)
I.P. = Indicated power (kW)
B.P. = Brake power (kW)

5. Specific fuel consumption

$$S.f.C = \frac{m_f}{B.P.} kg/kWhour$$

6 Volumetric efficiency

$$\eta_v = \frac{Actual\ volume\ of\ charge\ suxked\ at\ 'NTP'}{Swept\ volume}$$

7. Specific output

$$Specific\ Output = \frac{B.P}{A \times L} = Constant \times P_{mb} \times N$$

8 Indicated mean effective pressure

$$P_{mi} = \frac{net\ area\ of\ diagram\ in\ mm^2}{length\ of\ diagram\ in\ mm} \times sprins\ constant\ in\ bar\ per\ mm$$

Observation Table

Linseed Oil B30 16CR at 240 bar

Load KG	Massfuel Consumption Kg/Sec	Brake Power KW	Indicated Power KW	Fuel Consumption Kg/KW	Thermal Efficiency %	Mechanical Efficiency %
6	324.65×10^{-6}	2.139	12.50	0.1590	16.76	17.21
12	450.29×10^{-6}	4.56	18.96	0.355	24.38	24.05

Linseed Oil B30 TiO2 in terms 100 ppm at 240 bar

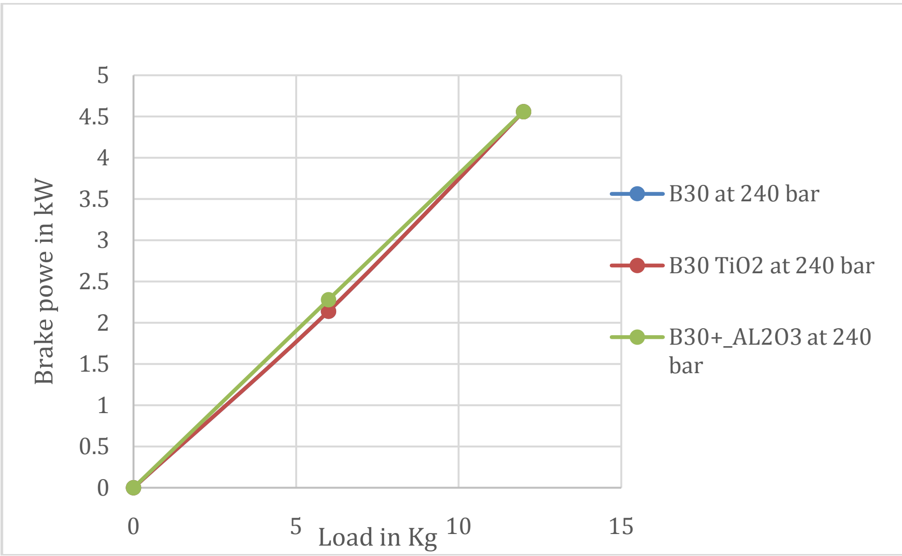
Load KG	Massfuel Consumption Kg/Sec	Brake Power KW	Indicated Power KW	Fuel Consumption Kg/KW	Thermal Efficiency %	Mechanical Efficiency %
6	324.58×10^{-6}	2.139	12.50	0.157	16.91	17.11
12	500.9×10^{-6}	4.56	18.96	0.355	24.38	24.05

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

Load KG	Massfuel Consumption Kg/Sec	Brake Power KW	Indicated Power KW	Fuel Consumption Kg/KW	Thermal Efficiency %	Mechanical Efficiency %
6	324.58×10^{-6}	2.28	12.50	0.512	16.91	18.2
12	500.9×10^{-6}	4.56	18.80	0.395	21.94	24.5

V. RESULTS

Variation Of Brake Power With Load



The influence of load on brake power for different fuels is found to be is brake power increases with load for all samples of fuels. this is due to increase is torque with load. when the brake power produced by the engine at constant loads for different mixtures of dual fuel is compared graph 5.1, it is found that the brake power increases same for all blends. in case of B30+Al203 brake power is increases at low load and then it decreases at high load. when compared the brake power for with other duel fuel, it is observed that B30+Al203 have higher values than diesel. for B30 and B30+TiO2 is nearly equal. while considering the variation of brake power with compression ratio, it is found that at higher compression the brake power is also higher.

Variation of specific fuel consumption with load

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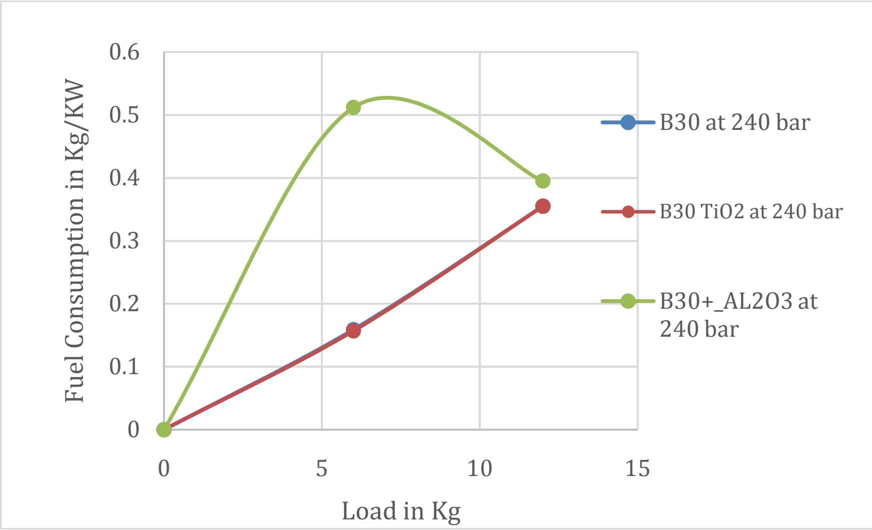
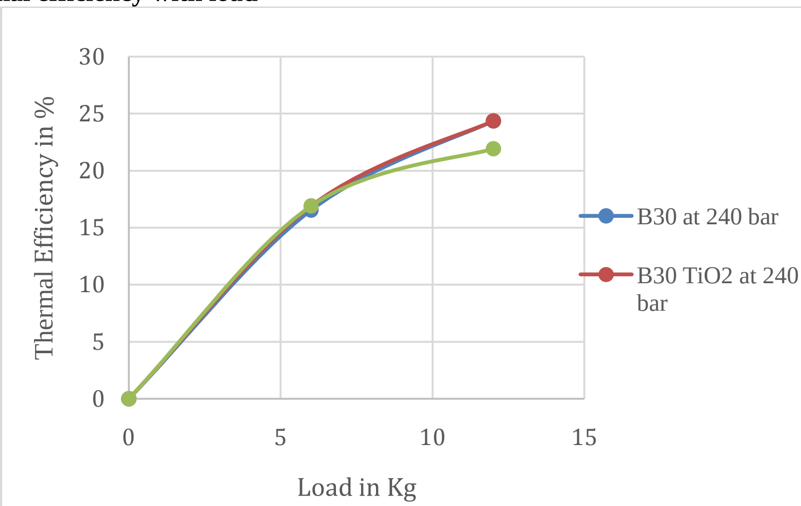


Specific fuel consumption is the consumption rate of fuel per power produced. This criterion helps determine how much fuel is consumed and compares to the power produced Various tests have been conducted with different blends of Linseed oil and diesel. These tests were done at different loads. Higher proportion of linseed oil results in higher viscosity which causes poor atomization. Poor atomization led to increase in specific fuel consumption. However, when 30% linseed oil (B30) and 30% linseed oil + Titanium dioxide (B30+TiO2) is mixed with diesel fuel positive results are evident. B30+Al2O3 led to specific fuel consumption is hier than the other two blends.

variation of thermal efficiency with load



Brake thermal efficiency is a performance parameter which is used to evaluate how well an engine converts the heat from a fuel to mechanical energy. From graph 5.3 it is clear that B30 and B30+TiO2 blended fuels thermal efficiency increases with load and B30+AlO3 is perform less. it can be concluded that among all tested fuels B30 and B30+TiO2 has the highest value of brake thermal efficiency at all loads. Graph 5.3 curves are plotted showing variation of brake thermal efficiency with blends. Each curve represents variation of thermal efficiency with load.

Emissions

Emissions	B30	B30+Al_2O_3	B30+TiO_2

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CO	1.287%	1.576%	1.676%
CO_2	10.12%	10.48%	10.58%
HC	0008ppm	0029ppm	30ppm
O_2	5.58%	4.99%	4.70%
NOx	1500ppm	1500ppm	1553ppm

Compared to that of diesel, most of the blends of linseed oil emits lesser NOx.Among the blends, the B30+AlO3 blend emits out least NOx compared to B30 and B30+TiO2 blends. And the concentration of emissions increases with increase in percentage of diesel blends fuel. Hence we can say that the neither the fuel should fully comprise of diesel nor it should comprise larger amounts of blend oil.

VI. CONCLUSIONS

For all the fuel samples tested, torque, brake power and brake thermal efficiency reach maximum values at load of 12kg.

Brake specific fuel consumption of all blends was found lower than that of diesel. Among all fuel tested B30 and B30+TiO2 has the lowest value of BSFC. for B30+Al2O3 increases with increases load. The BSFC of B30 and B30+TiO2 is reduced by as compared to BSFC of B30+Al2O3. Brake thermal efficiency for B30 and B30+TiO2 is increased with the load than that of B30+Al2O3.

All the blends of biodiesel emit CO, CO2 and HC lower than that of diesel. B30 and B30+TiO2 has the lowest emission of all fuel tested. Emission by B30+Al2O3 is slightly higher than that of B30 blends. CO, CO2 and HC emission nearly same un all blends.

The linseed oil blend can be a superior choice for use in the diesel engines without making any engine modifications. Also the cost of blend can beconsiderably reduced than petro diesel.

REFERENCES

[1]. Performance Testing On IC Engine Using Diesel Mixed With Neem Castor Oil (ISSN: 2248-9622, Vol. 11, Issue 7, July 2021) www.ijera.com

[2]. Performance and Emission Characteristics of Diesel Engine using Alternative Fuels. (Impact Factor (2015): 6.391, Vol. 5, Issue 7, July 2016) ISSN (Online): 2319-7064

[3]. Experimental Study of a Diesel Engine Performance Running on Waste Vegetable Oil Biodiesel Blend (DOI: 10.1115/1.4006655, September 2012) https://www.researchgate.net/publication/261253050

[4]. Performance Improvement of IC Engine Using Blends of Ethanol fuel (p-ISSN: 2395-0072, Vol. 04 Issue. 04, Apr -2017)

[5]. Performance analysis of IC engines with bio-diesel jatropha methyl ester (JME) blends (DOI : 10.5897/JPTAF09.13, Vol. 4(5), pp. 90-93, May, 2013)

[6]. Performance Analysis of single Cylinder Diesel Engine, Using Diesel Blended with Thumba Oil. (ISSN: 2231-2307, Volume-4 Issue-1, March 2014)

[7]. PERFORMANCE TEST OF DIESEL ENGINES USING JATROPHA-DIESEL FUELS BLENDS. (ISSN 2320-7345, Vol.7 10 January 2019)

[8]. Performance Testing on Diesel Engine Using Diesel & Biodiesel. (ISSN 2229-5518, Volume 7, Issue 2, February-2016).

[9]. PERFORMANCE TEST OF DIESEL ENGINES USING JATROPHA-DIESEL FUELS BLENDS http://www.journal-ijeee.com/content/4/1/6

[10]. Performance Testing of Diesel Engine using Cardanol-Kerosene oil blend (Volume 144 (2018) 144 (2018) 04005)

[11]. https://www.intechopen.com/chapters/58813

[12]. https://www.researchgate.net/publication/334163587_PERFORMANCE_TEST_OF_DIESEL_ENGINES_USING_JATROPHA-DIESEL_FUELS_BLENDS#fullTextFileContent

[13]. https://en.wikipedia.org/wiki/Internal_combustion_engine

[14]. https://en.wikipedia.org/wiki/Internal_combustion_engine

[15]. https://dieselnet.com/tech/diesel_fundamentals.php