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A COMBUSTION CHARACTERISTICS STUDY FOR MIX BIOFUEL EXTRACTED FROM WASTE PALM AND WASTE COTTON SEED COOKING OIL BY CONSIDERING EFFECT OF COMPRESSION RATIO

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ABSTRACT

Due to the excessive use of petroleum-based fuels in industry and automobiles, the world is currently facing serious problems such as the global energy crisis, environmental pollution and global warming. As a result, there is growing global awareness of how to prevent the fuel crisis by developing alternative fuel sources for engine applications. Numerous research programs are currently underway to replace diesel with a suitable alternative fuel such as biodiesel. Non-edible sources such as Mahua Oil, Karanja Oil, Neem Oil, Jatropha Oil, Simarouba Oil, etc. are designed to produce biodiesel. Fatty acids such as stearic acid, palmitic acid, oleic acid, linoleic acid, and linolenic acid are commonly found in nonedible oils. Vegetable oils mixed with diesel fuel in various proportions have been experimentally tested by many researchers in different countries. In developing countries like India, these inedible vegetable oils are easy to grow, but it is not economically feasible to convert them to methyl esters through various chemical processes. The purpose of this article is to perform a combustion analysis of biodiesel obtained from waste palm oil and used cottonseed oil, where the two biodiesels are mixed in equal parts, i.e. a total of 10% biodiesel blended with 90% compressed diesel. Gears 17 and 18 at an engine speed of 1,500 rpm.

Keywords: Biofuel, Combustion, Waste Palm Cooking Oil, Waste Cotton Seed, Compression ratio.

1. INTRODUCTION

Substantial expand in the demand of petroleum gas raised the worries about the surroundings and its supply. This led to the search of choice fuels for its utilization in Internal Combustion (IC) engines. Research in the subject of sustainable choice fuels nonetheless faces challenges due to the fact of complexities such as greater value of production, feasibility of utilization in current engines etc. Global vehicular transportation is typically established on liquid fuels like fuel and diesel, exceptionally produced from crude oil. Bio-generated fuels such as alcohols and biodiesels have emerged as main gamers for IC engine applications. Biodiesel is favoured as sustainable diesel engine gasoline with universal decrease greenhouse gasoline (GHG) emission in contrast to mineral diesel. Lower fragrant content, inherent oxygen content, decrease sulfur awareness and particulate remember (PM) emission etc. are some of the benefits of biodiesel over mineral diesel. Biodiesel is derived from transesterification of triglycerides current in straight vegetable oil (SVO), waste cooking oil (WCO) and animal fat etc. which often comprised fatty acid alkyl esters. Tomesh Kumar Sahu et al [1] focused on effect of compression on combustion characteristics of biodiesel extracted from waste cooking oil under no load to full load condition for compression ratio of 18 and 20 and at 1500 RPM constant engine speed. Swarup Kumar Nayak et al [2] investigated the performance and emission characteristics of mahua biodiesel and using additives for 5, 10 and 15 % blending with diesel. Naveen Kumar et al [3] conducted experiment on agricultural engine to study spray, performance and emission characteristics of biodiesel blended with diesel and blending in proposition of 10%, 20%, 30%, 40% and 50% by volume. Ahmed I. El-Seesy et al [4] studied the effect of adding multiwalled carbon nanotubes to waste cooking oil biodiesel on the performance and emission characteristics of biodiesel and diesel blended with no load condition and at 1000 RPM speed. K.A. Abed et al [5] concentrated on effect of biodiesel on performance of diesel engine having capacity of 5.775 kW and running at 1500 RPM. In the present work emission, performance characteristics are observed. Selvakumar Raja et. al [6] studied the influence of compression ratio on emission characteristics of waste cooking oil extracted biodiesel operated engine, and in the present study 16.5, 17.5 and 18 these three compression ratios are considered. Ales Hribernik et al [7] evaluated performance and emission studies of indirect injected biodiesel operated engine. The injected fuel quantity was measured, and the injection pressure and injector needle lift time history were acquired. Parvaneh Zareh et al [8] carried out comparative analysis of performance and emission characteristics of castor, coconut and waste cooking based biodiesel operated engine and biodiesel is extracted as per ASTM norms. Atul Dhar et. al.[9] studied the Performance, emissions and combustion characteristics for biodiesel extracted from Karanja oil in transportation engine with 20 %biodiesel and rest of the diesel..Dhinesh Balasubramanian et al [10] focused on numerical and experimental analysis of biodiesel and biodiesel blended with diesel in B60, B40, and B20 and using exhaust gas recirculation (EGR) for B20 minimum NOx emission for 10 % EGR rate can be obtained for twin cylinder engine. M. S. Gad et al [11] investigated the effects of blending waste cooking oil (WCO) biodiesel with gasoline and kerosene on diesel engine performance, combustion characteristics and emissions compared to fossil diesel. Murat Kadir Yesilyurt [12] focused on effect of injection pressure on performance and emission outcome waste cooking oil extracted biodiesel blended with diesel and injection pressure varies between 170-220 bars and such six pressures is taking in account. M.A. Kalam et al [13] the experimental study carried out to evaluate emission and performance characteristics of a multi-cylinder diesel engine operating on waste cooking oil such as 5% palm oil with 95% ordinary diesel fuel (P5) and 5% coconut oil with 95% ordinary diesel fuel.

G.R. Kannan et al [14] worked on production of biodiesel from waste cooking oil using response surface method and using such biodiesel engine is operated at 100 % load and at 1500 RPM. WCO-ME exhibited lower heat release rate, shorter ignition delay of 10.90CA and slightly longer combustion duration of 54.40 CA when compared to diesel at same load condition. Esmail Khalife et al [15] investigated experimentally the effect of presence of low water level in waste cooking oil biodiesel on full load by varying engine speed I which 5 % biodiesel and 2,3 and 4 % water is mixed with diesel. Senthilkumar Masimalai et al [16] studied the effect of oxygen enrichment in performance waste cooking oil operated engine for different oxygen concentrations such as 21% (WCO+21%O2), 23% (WCO+23%O2), 24% (WCO+24%O2) and 25% (WCO+25%O2) by volume. The lowest smoke (50%) was found with WCO+25%O2 at the maximum power output. Hydrocarbon and carbon monoxide emissions were considerably reduced with all concentrations of oxygen in the intake air. Yahya Ulusoy et al [17] targeted on waste cooking oil methyl ester as gasoline in diesel engine and studied thermal, combustion and emission traits of point out gasoline thinking about two speeds of 1800 and 2800 RPM with 10, 20, 30 and forty percent blending. Nik Nur Fatin Amiera Nik Aziz et al[18] acquired effects emission consequences from 10 and 30 % blended waste cooking oil biodiesel with diesel and It was once determined that the for 30 % biodiesel emits decrease emission in contrast to diesel however at the equal time generates a decrease temperature profile. X. J. Man et al [19] centered on the impact of waste cooking oil biodiesel on the particulate mass, wide variety concentration, nanostructure, and oxidative reactivity below one of a kind engine speeds and engine loads. Sang Hyuck Park et al [20] carried out factors and residences of the biodiesel have been characterized through gasoline chromatography− mass spectrometry (GC−MS), Fourier radically change infrared spectroscopy (FT-IR). Souvik Barman et al [21] developed pilot plant to produce the waste cooking biodiesel and estimated the manufacturing value of identical to set up the business viability of biodiesel. Mohammed Abdul Raqeeb et al [22] suggested the bodily and chemical residences of waste cooking oil, Esterification, Transesterification and manufacturing of Biodiesel from waste cooking oil by using a number of techniques and catalysts. Ales Hribernik et al [23] studied have an effect on of waste cooking oil blended with diesel and its impact on combustion overall performance in case of gasoline injection tactics of an oblique injected diesel engine. Jeewan VachanTirkey et al [24] performed experiments the use of biodiesel extracted from waste oil and combined with diesel oil at 10, 20, 30, zero and 50% through volume. . K. Muralidharan et al [25] conducted tests on a single cylinder -stroke variable CR multi-fuel engine fueled with waste cooking oil methyl ester and its 20%, 0%, 60% and 80% blends with diesel engines. T. D. Tsoutsos et al.

[26] investigated the conversion of used cooking oils (UCO) to biodiesel for fuel and the biodiesel chain. Shiv Kumar Sharma at el [27] conducted tests on six biodiesel-diesel blends to evaluate the performance characteristics and the main conclusion is that due to high viscosity and density and low calorific value of biodiesel. Abdullah Al-Ghafisst al [28] focused on the effect of injection pressure on thermal efficiency and emission characteristics using a mixture of 10, 20 and 30% waste cooking oil in diesel oil with a compression ratio of 17.5. Haseeb Yaqoob et al [29] carried out a detailed review of waste cooking oil biodiesel, where various parameters of compression ignition engine emissions, heat and combustion efficiency were considered to take into account technical, economic and environmental impacts. Hoi Nguyen Xa and others [30] conducted experiments to collect biodiesel from waste cooking oil using a catalyst and start an engine with biodiesel mixed with commercial diesel. Prajapati P.A et al [31, 32,33] labored on performance, emission and combustion traits for biodiesel extracted from waste cooking cotton seed oil and waste palm cooking oil at 1500 and 1700 RPM for compression ratio 17 and 18. The studies from [34] [35] Nikul K Patel et al. [36] SK Singh et al. summarize biofuel extracted from non-edible seeds and cotton waste. Biofuel are integrated with various applications in an hybrid applications such as heat exchanger [37-40] Patel Anand et al. and solar air & water heater [41-53] Anand Patel et al. to increase energy efficacy and renewability.

2. EXPERIMENTAL SETUP

A schematic representation of the test setup, together with the necessary measuring devices, is shown in Table 1. In order to determine the braking power of the motor when driven by an external load group in electrically variable operation, an AC generator with a maximum output of 4.5 kW was directly connected. This test was conducted to investigate the combustion of a diesel engine fueled with a 10% by volume blend of conventional diesel fuel W(C+P)BD on a single cylinder compression ignition engine under five load conditions (no load, 25th % , 50%, 75% and 100% The engine has the ability to measure fuel consumption and engine speed. The engine received air through an air box fitted with a port to measure air consumption. A pressure differential meter was used to measure the pressure difference between them. In the current factory, the engine speed and compression ratio are kept at 1500 rpm, i.e. 17 and 18 respectively.

Figure 1: Experimental Set up

3. RESULTS AND DISCUSSION

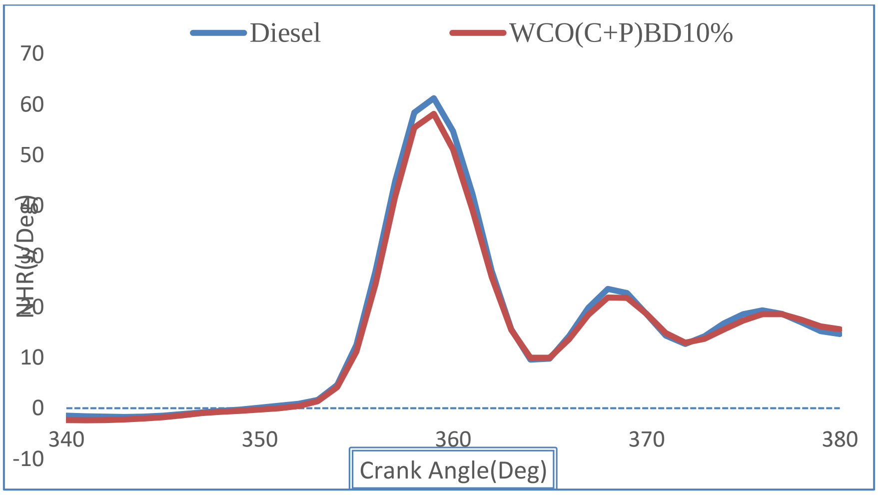

Figure 2: Net heat release Vs Crank angle for 1500 RPM and for CR 17

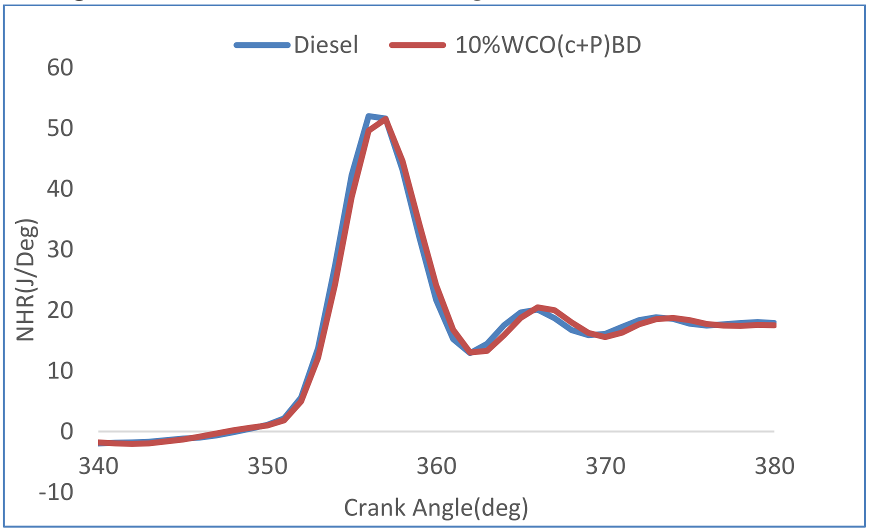

Figure 3: Net heat release Vs Crank angle for 1500 RPM and for CR 18

Fig 2 and Fig 3 indicate net heat release with variation in crank angle at 1500 RPM and for compression ratio s are 17 and 18 for 10 % blending of mixed biodiesel extracted from waste cooking cotton oil seed and waste cooking palm oil and to obtain better results here effective crank angle should be between 340^0-380^0 and 355^0-360^0 for compression ratio of 17 and 18 respectively. In case of 10% the peak values and overall heat release lower than diesel in case of both compression ratios.

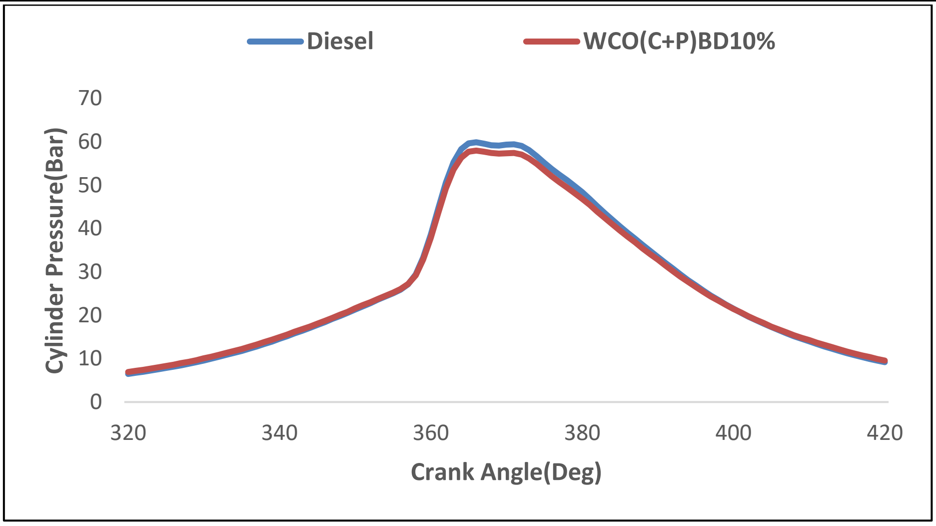

Figure 4: Cylinder Pressure Vs Crank angle for 1500 RPM and for CR 17

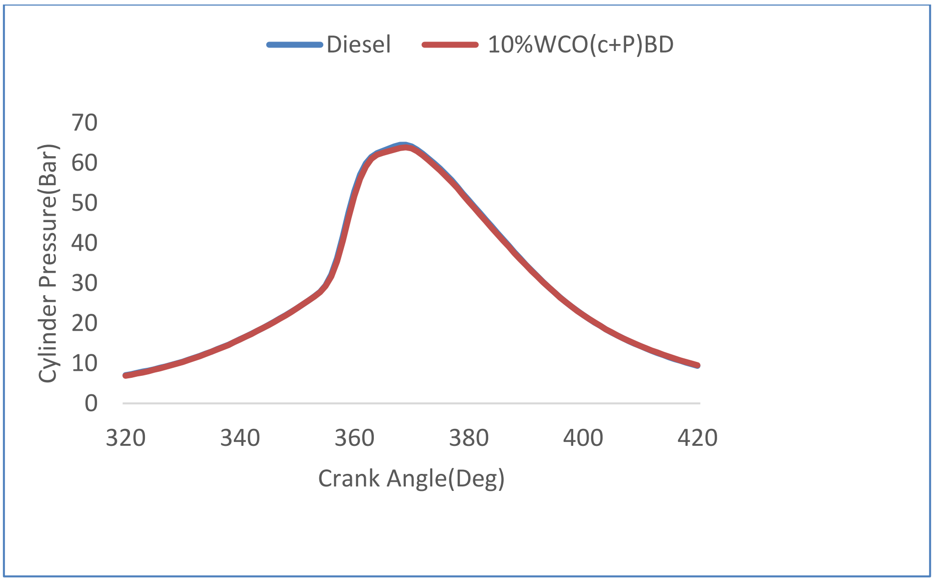

Figure 5: Cylinder Pressure Vs Crank angle for 1500 RPM and for CR 18

Fig 4 and Fig 5 show cylinder pressure with variation in crank angle for diesel and blending of a biodiesel obtained from waste cooking cotton seed oil and palm oil and mixing of both equal proportion of 10% with 90 % diesel in case of compression ratios 17 and 18. It is clearly observed from Fig 3 and Fig 4 that with rises in compression ratio the peak is shifted towards left and at compression ratio 18 cylinder pressures almost overlap over diesel cylinder pressure profile.

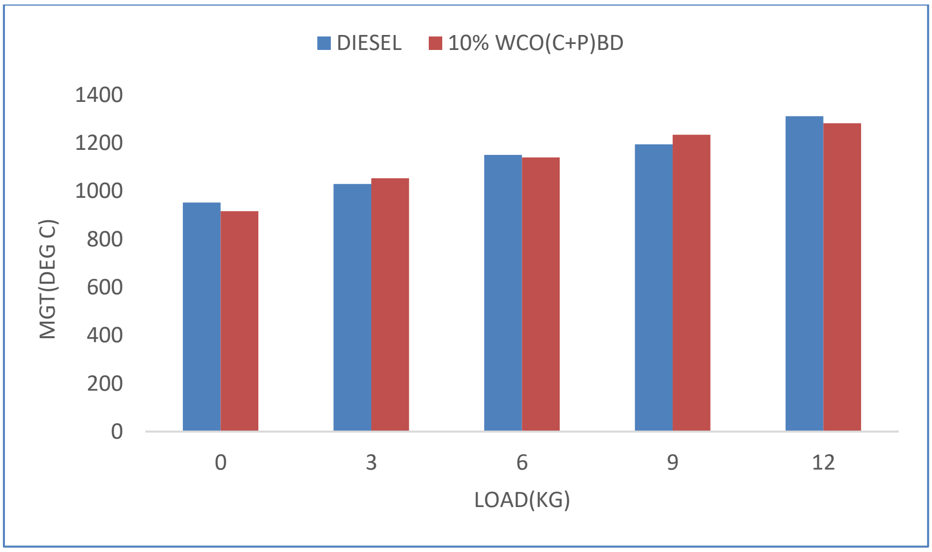

Figure 6: Mean Gas Temperature (MGT) Vs Load for 1500 RPM and for CR 17

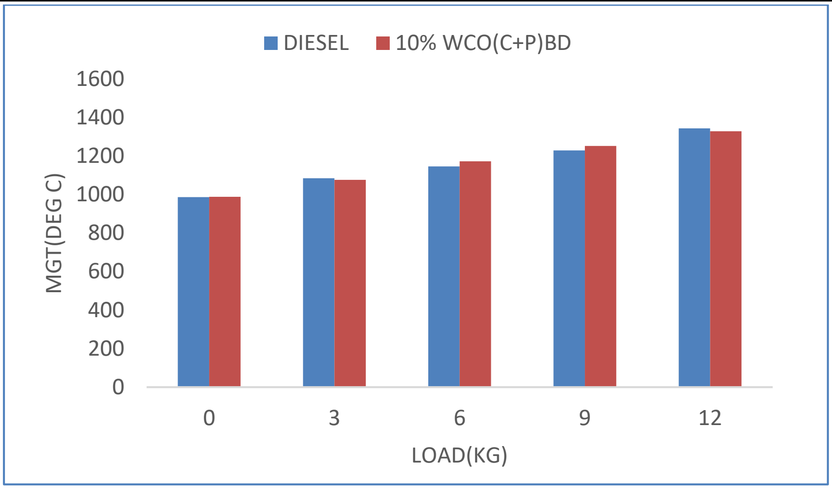

Figure 7: Mean Gas Temperature (MGT) Vs Load for 1500 RPM and for CR 18

Fig 6 and Fig 7 show mean gas temperature (MGT) variation for diesel blended biodiesel of mixture of both biodiesel with speed 1500 rpm CR 17 and CR 18. From Fig 5 and Fig 6 it is clear that similar trends are found in case of both compression ratio but for CR 18 over entire load variation MGT in case of diesel and Bio diesel blending are almost same.

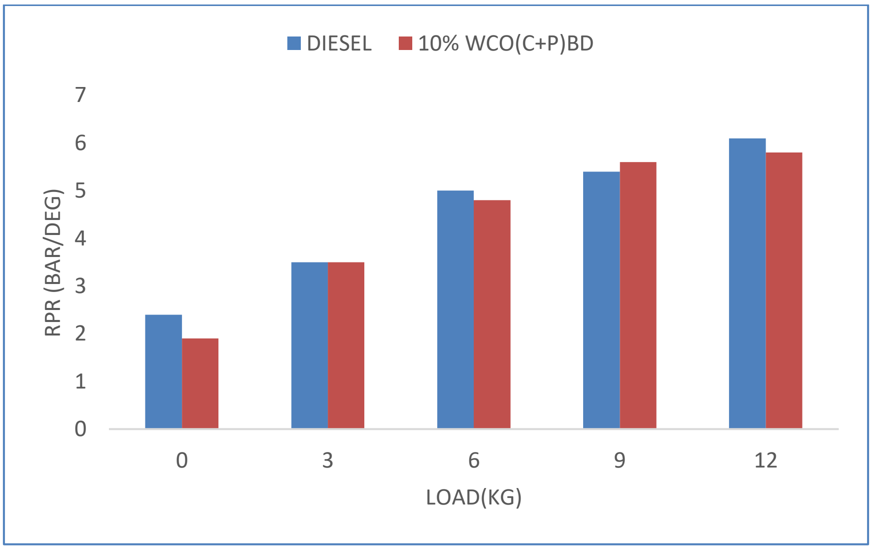

Figure 8: Rate of Pressure Rise Vs Load for 1500 RPM and for CR 17

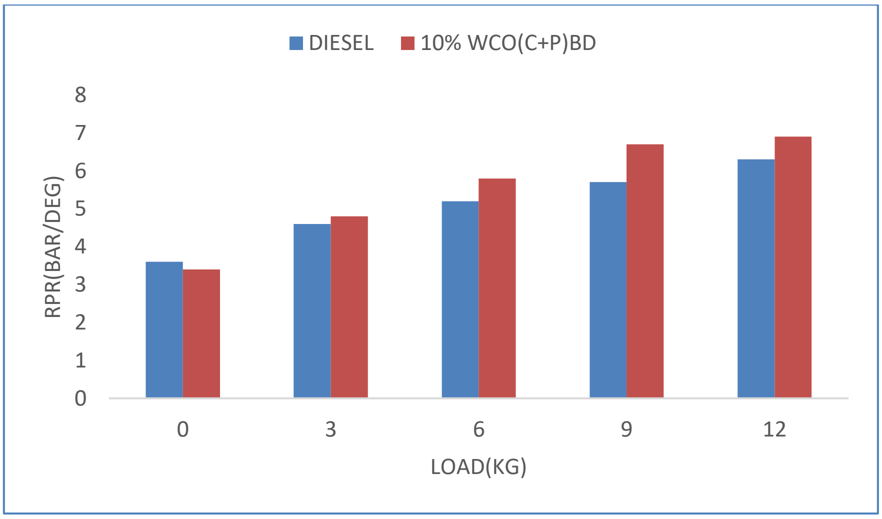

Figure 9: Rate of Pressure Rise Vs Load for 1500 RPM and for CR 18

Fig. 8 and Fig 9 show Rate of Pressure Rise (RPR) with load incase WCO(C+P)BD with diesel in 10%, for 1500 rpm at CR 17 and 18. Compare to compression ratio 17 with increment in compression ratio 18 the values of RPR increases over entire load range.

4. CONCLUSION

The major outcome of present work is that the compression ratio is highly influencing parameter in case of combustion studies for bio diesel operated engine.

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