IFERP
connecting engineers... developing research

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)

Vol 4, Issue 6, June 2018

Influence of Hybrid Nanoparticles and Performance Characteristics of Three Different Combination of Diesel Blends on Single-Cylinder Ci Engine

[1] M. Velliangiri, [2] M. Karthikeyan, [3] G.Sureshkannan

[1][2] Assistant Professors Department of Mechanical Engineering, Coimbatore Institute of Technology- Coimbatore – Tamilnadu, India
[3] Associate Professor, Department of Mechanical Engineering, Coimbatore Institute of Technology- Coimbatore - Tamilnadu- India
Email: [1]velliangiri.m@cit.edu.in, [2]karthikeyan.m@cit.edu.in, [3] sureshkannan@cit.edu.in

***Abstract*-— In-Cylinder pressure, heat release rate concerning CA, ignition delay and in-cylinder peak pressure compared with 500 cycles of D100, CEO125COB175, CEO150COB150 and CEO175COB125, and comparison of its performance and emission characteristics for various loads and its results are discussed. This research addresses the experimental results, comparison with various load conditions with three different nanoparticle combinations, namely Cobalt Oxide (COB) + Cerium Oxide (CEO) combinations, such as CEO1250COB175, CEO150COB150 and CEO175COB125, and discusses their performance parameters like BTE, SFC and its emission parameters such as CO, HC, NOx and PM compared with variable loads. The importance of standard deviation and covariance of the 500 cycles of CEO1250COB175, CEO150COB150 and CEO175COB125, and this chapter also focused. Importance of Performance and emission characteristics of a variable load diesel fuel engine and contrasted to different compression ratios discussed in this paper.**

***Index Terms*— Hybrid NanoParticles, Combustion, Performance , Ignition Delay, Performance , Emission Characteristics**

I. INTRODUCTION

Detailed Information and importance of experiments and simulation results for four different hybrid nanoparticle performance and its configurations discussed and addressed the influences of properties of the nanoparticle combinations and its combustion efficiency[1][2][3]. The following combinations, namely, CEO1250COB175, CEO150COB150 and CEO175COB125, are predicted by experiments and compared with different compression ratios[4]. Experiments estimate the ID, and it ranges predicted for varies compression ratios, and it varies from 15 to 19:1. The compression ratio is highly influenced, and the predicted positive effect of performance and its emissions, such as CO, UBHC, NOx and PM, discussed, and a comparison graph plotted for different load conditions[6]. It has selected one reasonable compression ratio of CI engine (CR-17.5:1) for the single-cylinder, four-stroke direct-injection, compression ignition engine. Variable compression ratio experimental results helped find the three different hybrid nanoparticle combination tests without the EGR test discussed in this research[7][8]. The CI engine's standard compression ratio is selected between 15 and 19:1 and used for diesel engine simulation and experimental research, and a realistic compression ratio is predicted to be 17.5:1. The efficiency and emission characteristics of base fuel (diesel) engines provided valuable Information for reducing the emission parameters with 0 to 15 percent EGR. They selected better combinations among the three combinations of nanoparticles based on the SFC, NOx, In-Cylinder Peak Pressure and ID of single-cylinder CI engines. Experimental results helped pick up the right combination, used the literature results, and focused on comparing them with different loads. The Brake thermal efficiency (BTE) of small single-cylinder CI engines increased with the impact of nano-additives on the diesel fuel engine and increased nano-additives concentration. An experimental study carried out predicted the current research objectives, met all comparisons and obtained results from the investigations[9][10]. Previous authors have found that, suggested that nanofluid additives are promising alternatives, improve the BTE of diesel engine, and enhance performance. Experiments conducted and obtained engine test results with modified diesel at various dosing levels of nanoparticles (25-100 ppm), showing performance and emission characteristics of Cobalt Oxide (C) + Cerium Oxide (B)[11][12].

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)

Vol 4, Issue 6, June 2018

II. IGNITION DELAY OF COBALT OXIDE (C) + CERIUM OXIDE (B) COMBINATIONS AND COMPARISON WITH RESPECT COMPRESSION RATIO

Experimental and Diesel RK simulation helps find the ignition delay, suitable CR, and EGR to compare various load conditions. Experimental and simulation methodology aids to predict suitable parameters based on the simulation results and presented in this section. The following parameters, BTE and BSFC, predicted form the experiments and simulation results. The following parameters, ignition delay (ID), suitable injection timing, compression ratio, EGR, and many injector holes, are highly influenced to control the emissions[13]. To compare different load conditions, experimental and diesel, RK simulation helps find the ignition delay, adequate CR and EGR. Experimental and simulation methodology helps to predict acceptable parameters and discusses in this section. The experiments and simulation outcomes are focused on the following parameters, BTE and BSFC predicted, the following parameters, ignition delay (ID), appropriate injection timing, compression ratio, EGR and number of injector holes highly influenced to control the emissions[14].

The combinations of cobalt oxide (C) + cerium oxide (B) nano-combinations, SFC, NOx, in-cylinder peak pressure, and single- (Base fuel D100) simulation results concerning CR, EGR and injection timing. Cylinder CI engine ID with different proportions and The ignition delay time for the compression ignition engine fueled alternatively with pure diesel and nanoparticles has been experimentally and numerically investigated. The engine was run under full load conditions at a constant speed, 1500 rpm at maximum brake torque and maximum brake power. Before accepting a particular ignition delay assessment technique, various criteria suggested as essential for defining the start of combustion have been considered. The associations between these parameters have been studied and concluded with the best method for identifying the start of combustion[15]. The experimental findings were further compared to the ignition delay expected by specific correlations. The results showed that the established ignition delays agree with those of the Arrhenius style expressions for pure diesel fuel, whereas the correlation results for diesel with nanoparticles are substantially different from the experimental results. Its experimental results helped find and parameters and compare the fuel (diesel) engine's performance and emission characteristics.

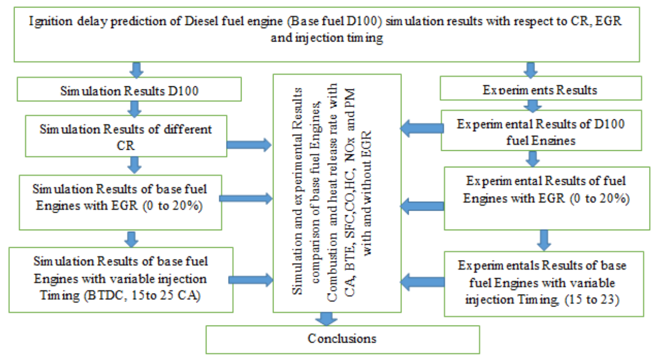

Figure 1 Ignition delay prediction of Diesel fuel

Table 1 NanoParticle Cobinations (Cobalt Oxide (C) + Cerium Oxide (B))

Sl. No	Combinations of Nanoparticles	Mass Fractions (grams)
2	Cobalt Oxide (C) + Cerium Oxide (B)	i) C 1.25 g + B 1.75 g ii) C1.50 g + B 1.50 g iii) C 1.75 g + B 1.25 g

III. ID OF COBALT OXIDE (COB) + CERIUM OXIDE (CEO) COMPARISON WITH VARIOUS COMPRESSION RATIO

Cerium Oxide, a rare earth metal with a dual valance state nature, has exceptional catalytic activity, especially in the nanosized form due to its oxygen buffering power. It also contributes to the combined elimination and degradation of nitrogen dioxide and hydrocarbon pollutants from diesel engines as an additive in diesel fuel.

The current work discusses the impact of nanoparticles of cerium oxide on diesel engine output and pollution. Chemical processes synthesised cerium oxide nanoparticles and characterisation techniques such as TEM, EDS, and XRD. In a two-step process, cerium oxide was blended into diesel using a regular ultrasonic shaker to achieve stable suspension. The effect of nanoparticles on the different physicochemical properties of diesel fuel was also explored through detailed studies using the standard research methods of ASTM. In the diesel engine, load tests conducted to examine the reliability of the engine. Cobalt oxide – The oxygen atoms in cobalt oxide particles can moderate the combustion reactions. The combustion was cleaner when using the cobalt additive, and the emission of CO and UBHC reduced. Several researchers have researched the usage of variable nanoparticles as diesel additives and the effect of such a procedure on the output and contaminants.

This research focused on unique combination methods such as CEO1250COB175, CEO150COB150, and CEO175COB125 combined to find the performance, ignition, and emission characteristics discussed in this

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)

Vol 4, Issue 6, June 2018

section. Figure 2 shows ignition delay with various compression ratios and experimental results of the single-cylinder engine and predicted and compared with different loads. Many technical methods in the literature have been used to describe the start injection and start of combustion. The in-cylinder pressure with CA determined the start of combustion and the rate of combustion curves of heat release rate using a range of measurement methods before accepting a formal assessment. This method was used to calculate the time of the ignition delay. The needle rise, the heat release rate, and the cylinder pressure effects were predicted based on an average of 500 consecutive cycles.
A large number of people was necessary to avoid random fluctuations in measurements. A data-smoothing model was needed to discover the SOC from here Cylinder pressure trace and the heat release curve rate. The ID of different combinations is shown in Figure 2 shows the variation of the ID of CEO1250COB175. Based on these investigations, the ID of CEO1250COB175 is predicted, and it plotted with different compression ratios, as shown in Figure 6.2. Based on this analysis, the conclusion arrives 1) Ignition delay of CEO1250COB175 and all combinations decreased when increased compression ratio from 15 to 18 for all load conditions due to its in-cylinder pressure and temperature. 2) The ID of CEO1250COB175 decreased from 14.64 deg to 10.61 deg, and compared to the diesel fuel test; it helps to conclude that the ID of all load condition decreased when CR increases. 3) The ID of CEO1250COB175 in all load conditions, nearly 1.5 deg decreased compared with diesel fuel engine and compared with low to full load conditions.

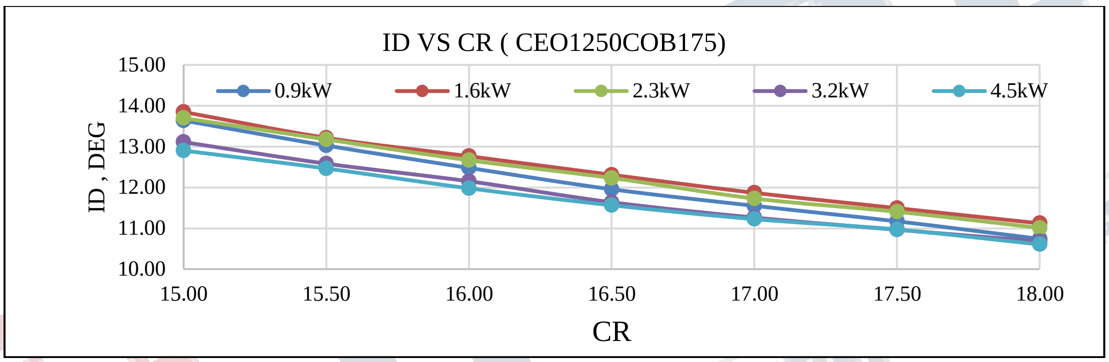

Figure 2 ID comparison of experimental results with CR

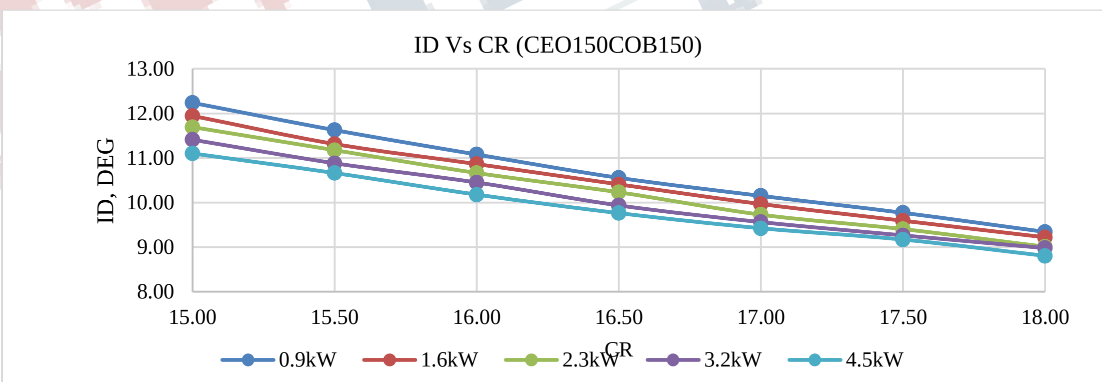

Figure 3 ID of CEO150COB150 comparison with variable CR

Figure 3 shows the decreases in ignition delay with the effect of compression ratio and investigated the combination of CEO150COB150. The ID of all load conditions predicted, and it plotted concerning CR and its variation, as shown in Figure 3. The same trend followed by all combinations, Ignition delay of CEO150COB150 decreased when increased compression ratio for all load conditions. The ID of the CEO150COB150 fuel engine varies from 12.64 deg to 9.22 deg, it reflects the evaporative heat release and diffusion heat release, and it increased from 33.2 j/deg to 80.6j/deg, respectively. Based on this analysis, the following conclusions made. 1) ID decreased when increasing the mass of nanoparticle in the diesel fuel. CE150COB150 test ID slightly lower compared to CE125COB175 experimental test. It is found from the figure 4 the simulation and experiments found the maximum in-cylinder peak pressure, and it increased from 67.45 to 99.6 bar with an increase load from 0.5kW to 4.5kW. Heat release rate with CA plotted shown in the Figure in this section. Evaporative heat release and diffusion heat release are 33.2 j/deg to 86.6j/deg, respectively.

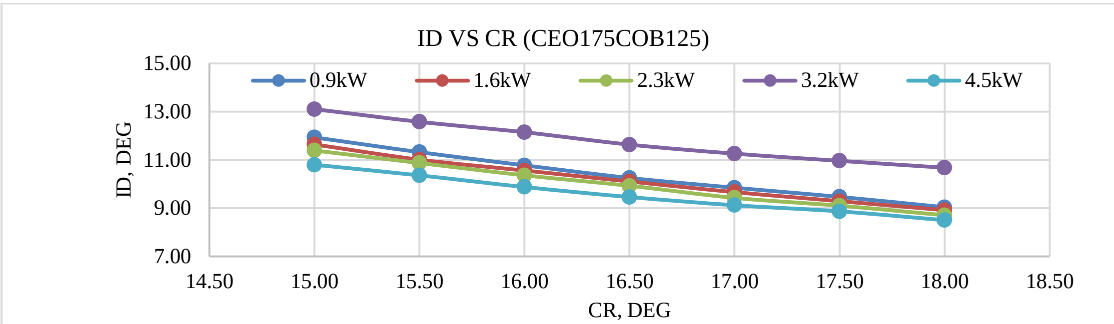

Figure 4 ID of CEO175COB125 comparison with variable CR

Figure 4 shows that the Ignition delay prediction is helped to identify the combustion duration and efficiency. The ID of CEO175COB125 decreases when increasing the compression ratio from 15 to 18:1 and follows the same trend for all load conditions. The ID CEO175COB125 shows that the diesel fuel engine varied from 11.64 deg to 8.2 deg and slightly higher than the CEO175COB125 mode test and indicated that the ID of CEO175COB125 at a rate of 4.5 kW decreased and also followed the same trend at full load condition. Based on the details of the investigations, some conclusion is made. 1) Based on the ID of all nanoparticles combinations and selected suitable compression ratio 17.5: 1, it is used thoroughly to predict the better performance and selected for suitable for all nanoparticle combinations.

IV. RESULTS AND DISCUSSION OF IN-CYLINDER PRESSURE FLOW CHART AND COMPARED WITH CEO1250COB175, CEO150COB150 AND CEO175COB125

Diesel fuel engine (Base fuel D100) simulation and experimental results comparison and compared with CEO1250COB175, CEO150COB150 and CEO175COB125 with EGR

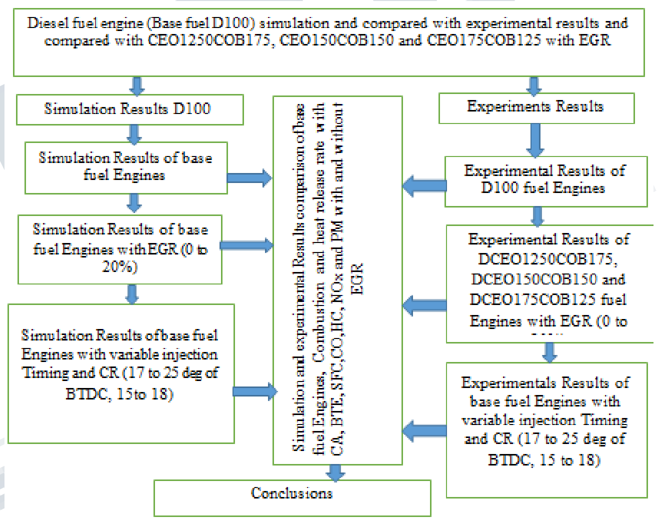

Figure 5 Simulation and experimental Results discussion procedure

4.1 Pressure Vs Crank Angle and Heat Release rate Diagram of CEO1250COB175

The Figure shows that, in the In-Cylinder Pressure Vs CA, CA's heat release rate is shown in Figure 6 and 7. Experimental In-Cylinder Pressure Vs CA helps to find the ignition delay and heat release rate. Variation of in-cylinder pressure with CA of CEO1250COB175 plotted and compared with different load conditions.

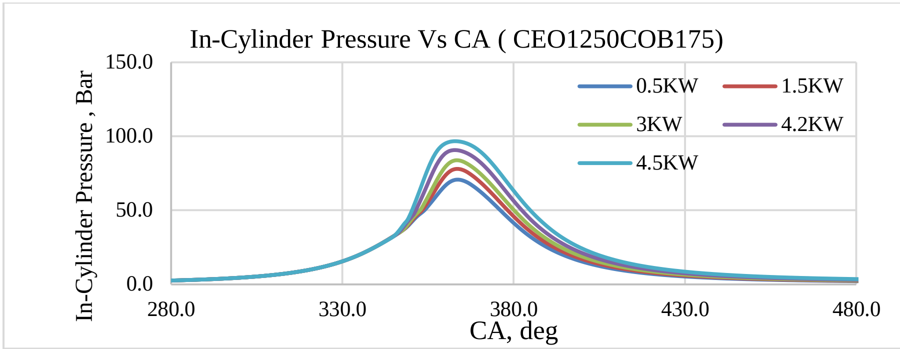

Figure 6 In-Cylinder Pressure with CA Comparison

Figure 6 shows the Peak Pressure variation, and it varies from 69.2 to 95.5 bar when the load increase from 0.5kW to 4.2kW. Peak pressure is attained ATDC 7deg, it is better Information about the graph and supported to improve the BTE. CEO175COB125 pressure Vs CA better compared to the other two combinations. Peak Pressure of all combinations is similar trends because of constant speed and load comparison. In-Cylinder pressure is clear evidence of in-cylinder combustion of nanoparticle supported to increase the combustion efficiency and decrease the emissions.

Experimental results analysis focused on finding the performance and emission parameters of CEO1250COB175 combination and compared with test base fuel (D100) experimental test. Cycle Fuel Mass (CFM) g/cycle of D100 is predicted by using TFC, and it varies from 0.0111g/cycle to 0.0289 g/cycle and used to simulation, and it varies from 0.5 to 4.99 kW. Variation of in-cylinder pressure with CA of CEO1250COB175 plotted and compared with different load conditions shown in figure 6.7. Experimental and simulation results of the base engine are well agreements in all load conditions and its peak p

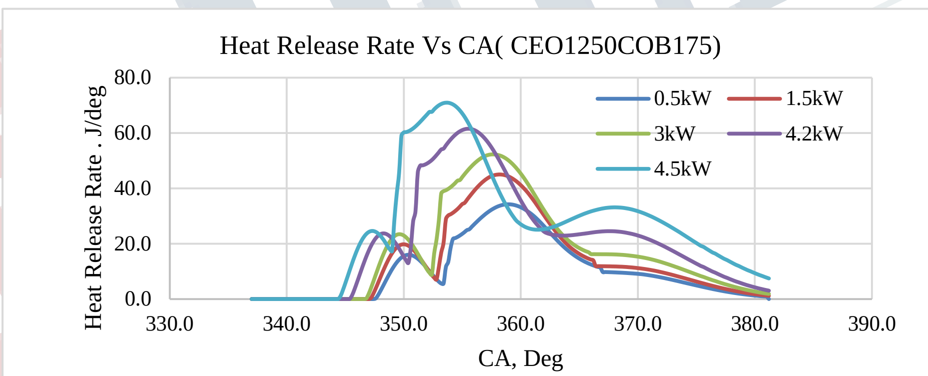

Figure 7 Heat Release Rate with CA Comparison

Figure 7 shows that the variation of in-cylinder pressure with CA of CEO1250COB175 plotted and compared with different load conditions. The maximum in-cylinder peak pressure is found in Figure 6, and it increased from 67.45 to 99.6 bar with an increase load from 0.5kW to 4.5kW. In-cylinder pressure data were used to find the indicated mean adequate pressure, indicated power, heat release rate with CA and ignition delay. Heat release rate with CA is plotted, shown in Figure 7. Evaporative heat release and diffusion heat release are 31.2 j/deg to 79.6j/deg., respectively.

4.2 Pressure Vs Crank Angle and Heat Release rate Diagram of CEO150COB150

Variation of in-cylinder pressure with CA of CEO150COB150 plotted and compared with different load conditions. This in-cylinder pressure versus CA diagram is used to find each load's Pmax values and compared with different load.

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)

Vol 4, Issue 6, June 2018

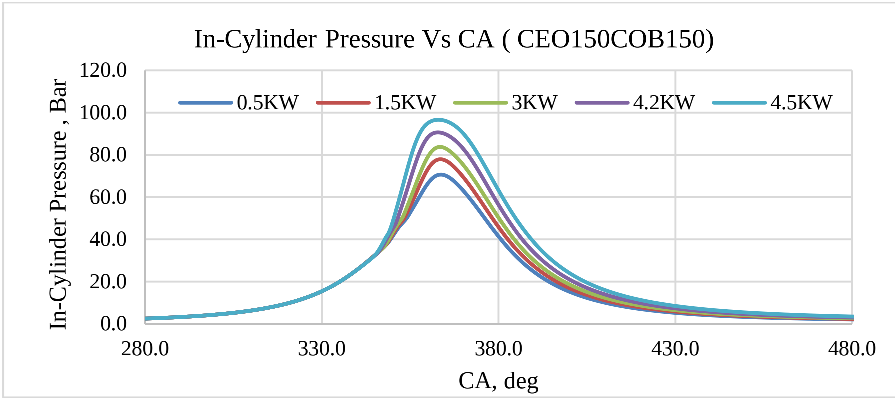

Figure 8 In-Cylinder Pressure with CA Comparison

Figure 8 shows that the variation of In-cylinder pressure with CA gives valuable Information about the combustion viz, such as combustion, in-cylinder peak pressure, and combustion duration. The maximum in-cylinder peak pressure is found in Figure 6.8; it increased from 67.45 to 99.6 bar with an increase load from 0.5kW to 4.5kW.

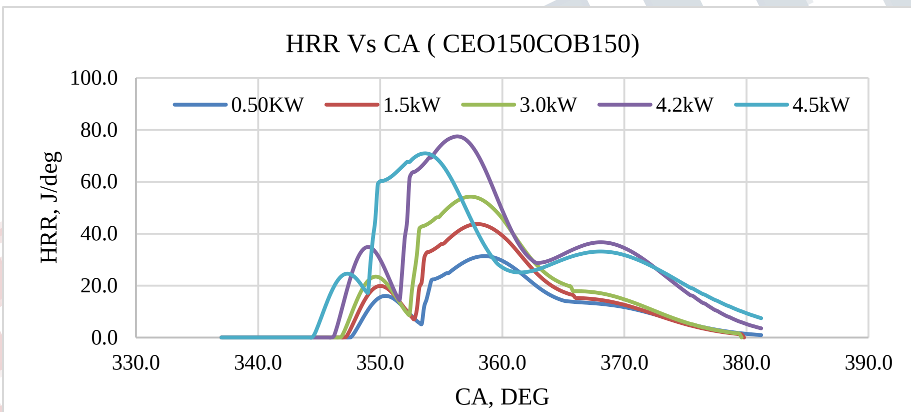

Figure 9 Heat Release Rate with CA Comparison

Figure 9 shows the heat release rate with CA prediction is highly influenced, and study about the combustion, and it heats release. In-cylinder pressure data were used to find the indicated mean adequate pressure, indicated power, heat release rate with CA and ignition delay. Heat release rate with CA is plotted, shown in Figure 9. Evaporative heat release and diffusion heat release are 31.2 j/deg to 79.6j/deg., respectively and it useful prediction of controlling the NOx emission and PM emissions. This study highly supported to predict of the performance of the combustion and heat release rate for a different combination of nanoparticles.

4.3.3 Pressure Vs Crank Angle and Heat Release rate Diagram of CEO175COB125

Variation of in-cylinder pressure with CA of CEO175COB125 plotted and compared with different load conditions. This in-cylinder pressure versus CA diagram is used to find the P_{max} values of each load and compared with different load

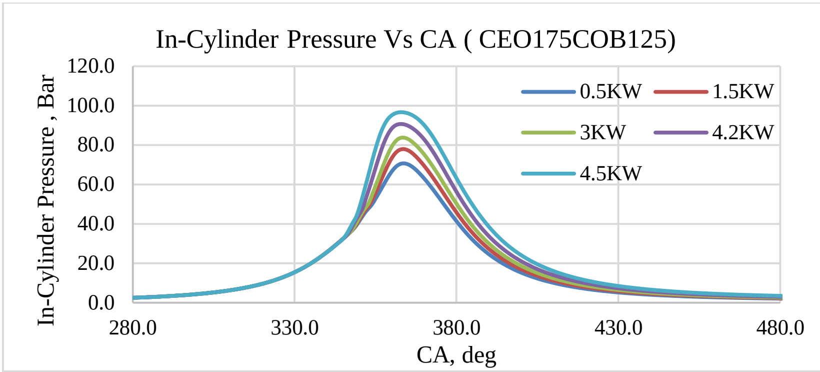

Figure 10 In-Cylinder Pressure with CA Comparison

Figure 10 shows that the variation and importance of In-cylinder pressure variation with CA give valuable Information about the combustion viz, such as combustion, in-cylinder peak pressure, and combustion duration. The maximum in-cylinder peak pressure is found in Figure 10; it increased from 67.45 to 99.6 bar with an increase load from 0.5kW to 4.5kW.

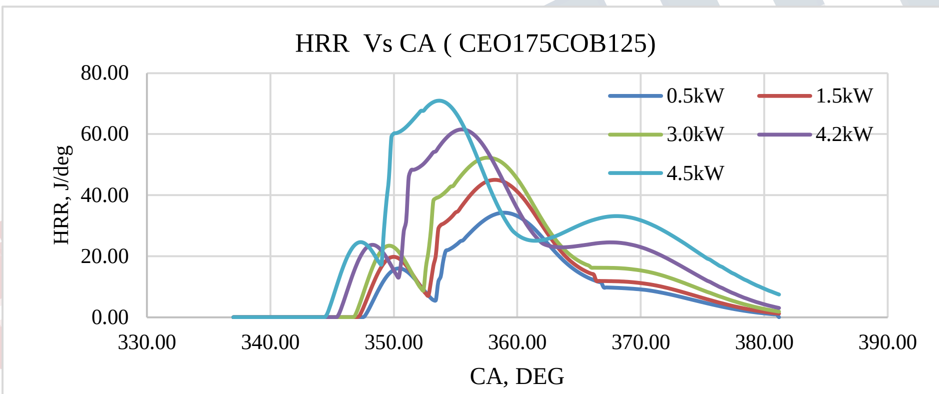

Figure 11 Heat Release Rate with CA Comparison

Figure 11 shows the heat release rate with CA and used to find the rate of In-cylinder pressure, and this data was used to find the indicated mean effective pressure, indicated power, heat release rate with CA and ignition delay period. Heat release rate with CA is plotted, shown in Figure 11. Evaporative heat release and diffusion heat release are 32.2 j/deg to 78.6j/deg, respectively. Heat release rate prediction is supported to identify the combustion difference and rate of heat release. It is helped to predict the improved efficiency of the combustion of nanoparticles.

V. COMPARISON OF PEAK PRESSURE VARIATION OF DIFFERENT COMPRESSION RATIO

To find each load's Pmax values, in-cylinder pressure versus CA diagram is used and contrasted with different loads. In-cylinder pressure variation provides useful Information about combustion, such as combustion, peak pressure in-cylinder, and combustion duration. The diagram is also used to describe the beginning of injection (SOI), the beginning of each load's combustion (SOC). The maximum in-cylinder peak pressure is shown in Figure 6.2, with a rise in load from 0.5kW to 4.5kW from 67.45 to 99.6 bar. The IMEP indicated power, heat release rate with CA and ignition delay time found using in-cylinder pressure data. The CA heat release rate is plotted in Figure 6.3. 31.2 j/deg to 79.6j/deg are evaporative heat release and diffusion heat release.

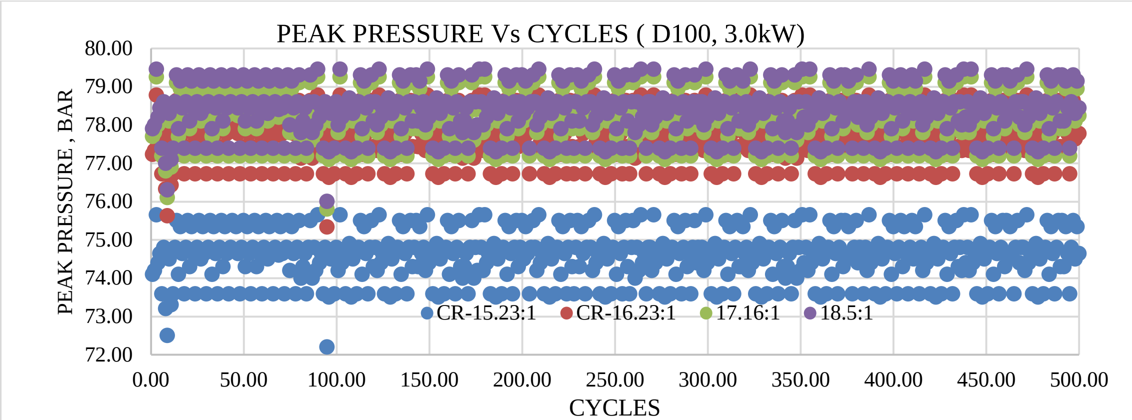

Figure 12 Comparison of Peak Pressure of D100, and Variation for Different Compression Ratio

Figure 12 shows the peak pressure variation with 500 cycles. This in-cylinder pressure versus CA diagram is used to find the D100 mode test's Pmax values for each load conditions and compared. In-cylinder pressure variation with CA gives valuable Information about the combustion stabilisation and constant power output. Such as start of combustion, in-cylinder peak pressure and duration of combustion are better evidence of combustion. The maximum in-cylinder peak pressure predicted from Figure 12; increased from 67.45 to 99.6 bar with an increased load from 3.0 kW. Figure 11 shows the heat release rate with CA and used to find the rate of In-cylinder pressure, and this data was used to find the indicated mean adequate pressure, indicated power, heat release rate with CA and ignition delay period. Heat release rate with CA is plotted, shown in Figure 11. Evaporative heat release and diffusion heat release are 32.2 j/deg to 78.6j/deg, respectively. Heat release rate prediction is supported to identify the combustion difference and rate of heat release. It is helped to predict the improved efficiency of combustion of nanoparticles

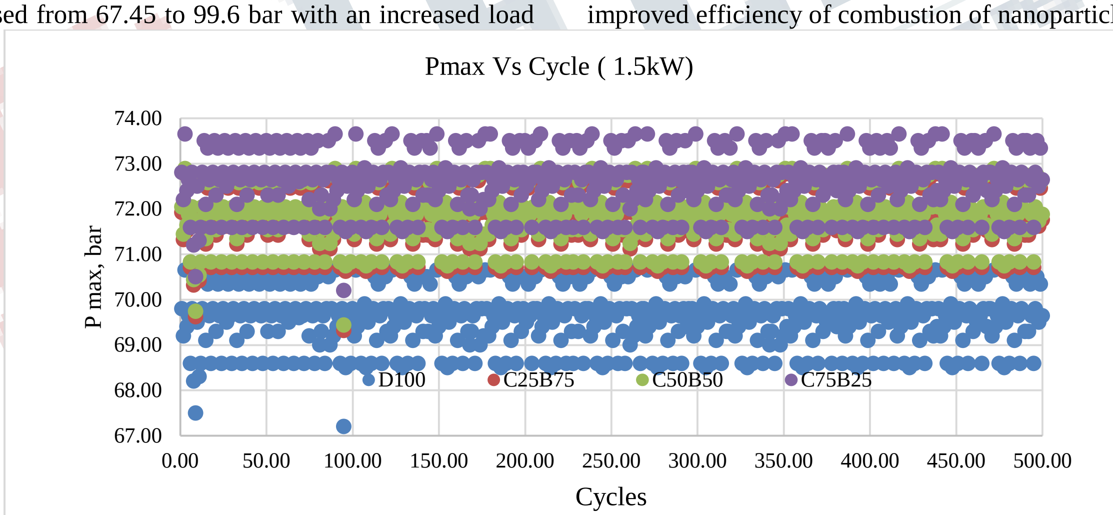

Figure 14 Comparison of Peak Pressure for Different Compression Ratio

The maximum in-cylinder peak pressure is found in Figure 14; it increased from 67.45 to 99.6 bar. In-cylinder peak pressure data was used to find the standard deviation and covariance of peak pressure, which helped to conclude the combustion characteristics and constant power output. Heat release rate with CA is plotted concerning CA. Evaporative heat release and diffusion heat release vary from 31.2 j/deg to 79.6j/deg, respectively. This indicates better evidence for the constant heat release rate. Figure 11 shows the heat release rate with CA and used to find the rate of In-cylinder pressure, and this data was used to find the indicated mean effective pressure, indicated power, heat release rate with CA and ignition delay period. Heat release rate with CA is plotted, shown in Figure 11. Evaporative heat release and diffusion heat release are 32.2 j/deg to 78.6j/deg, respectively. Heat release rate prediction is supported to identify the combustion difference and rate of heat release.

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 4, Issue 6, June 2018

It is helped to predict the improved efficiency of combustion of nanoparticles

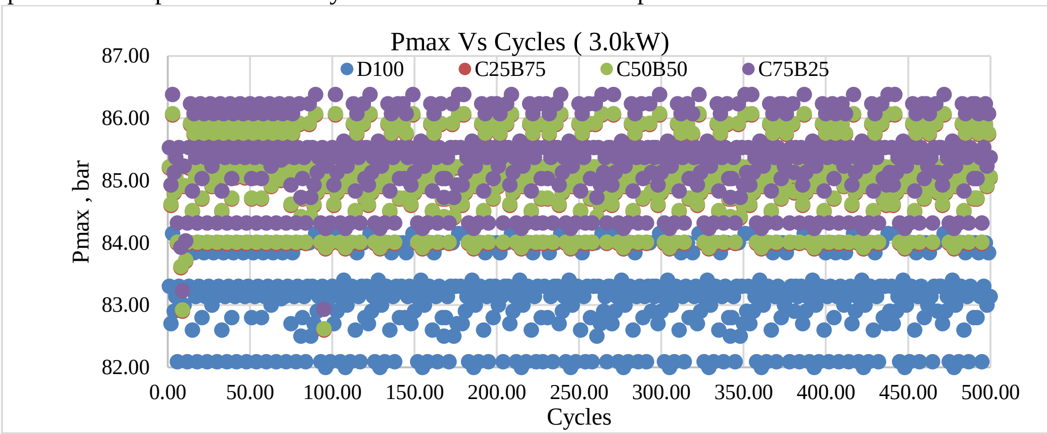

Figure 15 Comparison of Peak Pressure for Different Compression Ratio

The maximum in-cylinder peak pressure is found in Figure 15; it increased from 67.45 to 99.6 bar. In-cylinder peak pressure data were used to find the standard deviation and covariance of peak pressure, and it helped to conclude the combustion characteristics and constant power output. Heat release rate with CA is plotted concerning CA. Evaporative heat release and diffusion heat release vary from 31.2 j/deg to 79.6j/deg, respectively. This indicates better evidence for the constant heat release rate.

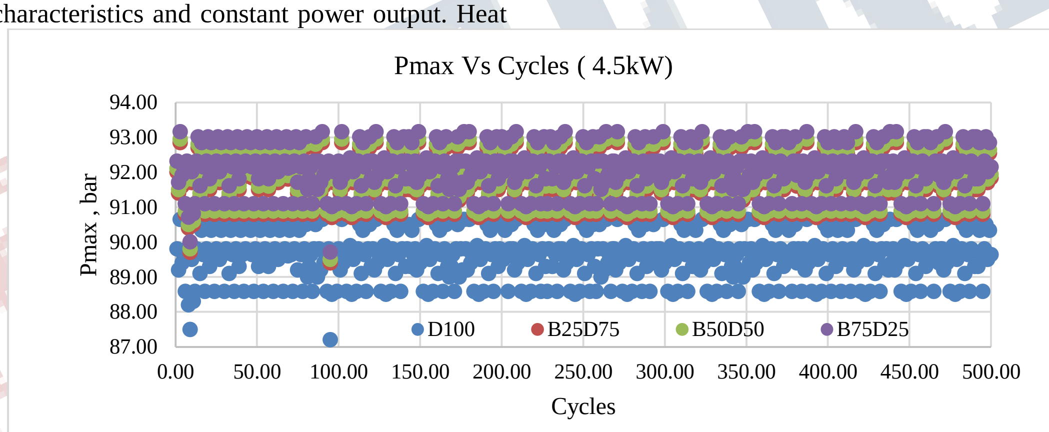

Figure 16 Comparison of Peak Pressure for Different Compression Ratio

In-cylinder pressure data were used to find the indicated mean effective pressure, indicated power, heat release rate with CA and ignition delay. The heat release rate with CA is plotted, as shown in the Figure. Evaporative heat release and diffusion heat release are 31.2 j/deg to 79.6j/deg. respectively

VI. PERFORMANCE AND EMISSION PARAMETERS COMPARISON OF CEO1250COB175, CEO150COB150 AND CEO175COB125 WITH EGR

Performance parameters, namely BTE and BSFC and CO, UHC, NOx and PM emission characteristics, compared with various BP. BSFC is a measure of an engine's fuel efficiency that burns fuel and generates rotational power output. The value of the BSFC shows how effectively the engine converts the supplied fuel into useful work. Calorific value (CV) is one of the critical parameters used to assess diesel features on BSFC. The higher the CV value, the lower the BSFC since a decrease in the calorific value of fuel contributes to an increase in fuel consumption to achieve the corresponding power output. Performance and emission characteristic of base diesel fuel engine, D100, CEO1250COB175, CEO150COB150 and CEO175COB125 help find the experimental engine's variation of performance and emission characteristics. Performance tests were carried out on the D100-base fuel engine, CEO1250COB175, CEO150COB150 and CEO175COB125 with a suitable compression ratio of 17.5:1 with 0% EGR and 15%EGR modes used to the benchmark of the other four combinations

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)

Vol 4, Issue 6, June 2018

of test fuels. BTE and ITE compared with BP shown in the Figure.

Like most fossil fuels, carbon and hydrogen make up the source of diesel fuel. Complete combustion of diesel fuel will only contain CO2 and H2O in engine combustion chambers for the ideal thermodynamic equilibrium (Prasad and Bella 2010). However, air-fuel ratio, ignition timing, combustion chamber turbulence, combustion shape, air-fuel concentration, combustion temperature, etc.), and many harmful products are produced during combustion. CO, HC, NOx, and PM are the most critical harmful materials.

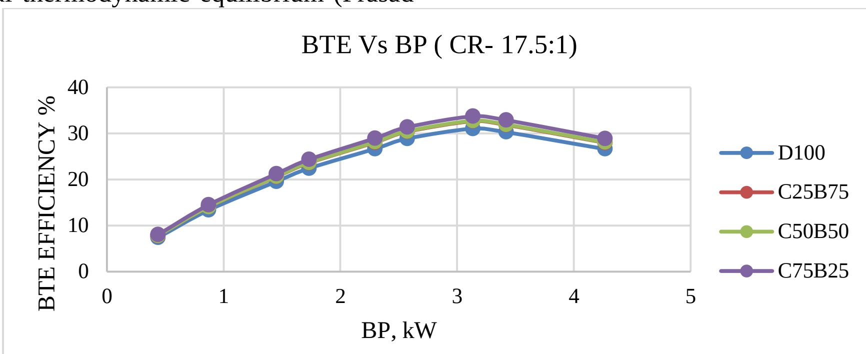

Figure 16 BTE comparison with BP

It can be seen in figure 16; the BTE of D100 increased from 7.99% to 31.12% when the load increased from 0.5 to 4.27 kW. The CEO175COB125 BTE increased from 8.10% to 33.1% when the load increased from 0.5 to 4.27 kW. The CEO1250COB175 BTE rose from 8.01 percent to 32.6 percent, significantly lower than the other two combinations. As the load increased from 0.5 to 4.27 kW and slightly higher than the CEO1250COB175 mode, the BTE of CEO150COB150 increased from 8.11 percent to 33.28 percent and slightly lower CEO175COB125 mode testing. Based on the CEO175COB125 mode experiments, better performance compared to the other two combinations is indicated.

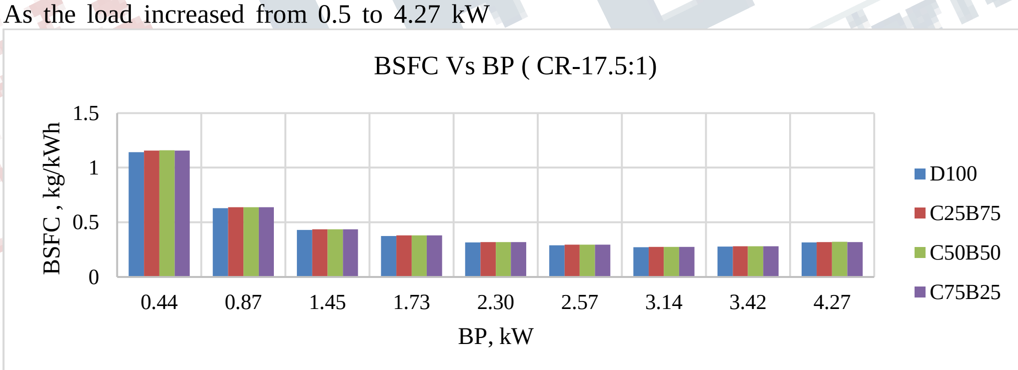

Figure 17 BSFC comparison with BP

Figure 17 shows that BSFC variations concerning BP for the test of engines D100, CEO1250COB175, CEO150COB150 and CEO175COB125 are shown in the Figure. When compared to maximum load, CO of CEO1250COB175 reduced by 21.2 per cent. CEO150COB150 test mode BSFC decreased from 22.3 per cent to 23.3 per cent compared to 5.12 BMEP, BSFC of CEO1250COB175 tests revealed that compared to BP, BSFC decreased 25.9 per cent. It is found that form the test mode of graph CEO175COB125 is lower than all other combinations due to better combustion than the other two modes. Carbon monoxide comes from incomplete combustion, where the whole phase of oxidation does not occur. This concentration is primarily dependent on the mixture of air/fuel and is highest where the excess air factor (λ) defined as a rich mixture is less than 1.0. It can be caused when starting and immediate acceleration of the engine where the rich mixtures are required. Due to air deficiency and reactant concentration, all the carbon can not convert to CO2 in the rich mixtures, and CO concentration can be formed. Even though CO is formed in rich mixtures during activity, a small CO is also emitted due to chemical kinetic effects under lean conditions.

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)

Vol 4, Issue 6, June 2018

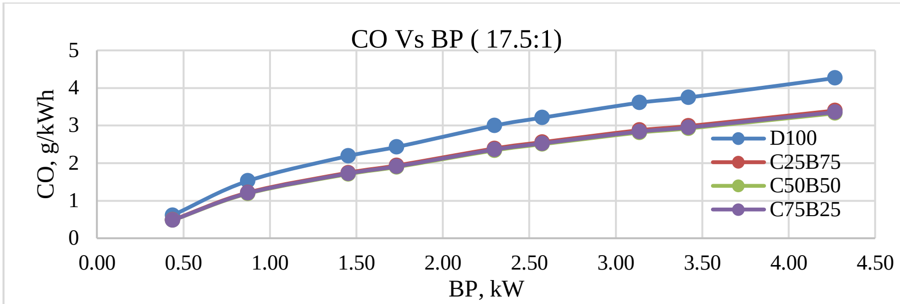

Figure 18 CO comparison with BP

Figure 18 shows that CO emission variations concerning BP for the test of engines D100, CEO1250COB175, CEO150COB150 and CEO175COB125 are shown in the Figure. When compared to maximum load, CO of CEO1250COB175 reduced by 21.2 per cent. CEO150COB150 test mode CO emissions decreased from 22.3 per cent to 23.3 per cent compared to 5.12 BMEP, CO emissions from CEO1250COB175 tests revealed that compared to 5.12 BMEP, CO emissions decreased 25.9 per cent. It is found that form the test mode of graph CEO175COB125 is lower than all other combinations due to better combustion than the other two modes.

Hydrocarbon emissions are composed of unburned fuels because of low combustion temperature, which occurs near the cylinder wall zone. At this point, the air-fuel mixture temperature significantly less compares to the centre of the cylinder temperature. UBHC consist of thousands of species, such as alkanes, alkenes, and aromatics. They are usually stated in terms of equivalent CH_4 content. Performance parameters of base engines were plotted concerning BMEP, with and without EGR mode of operation

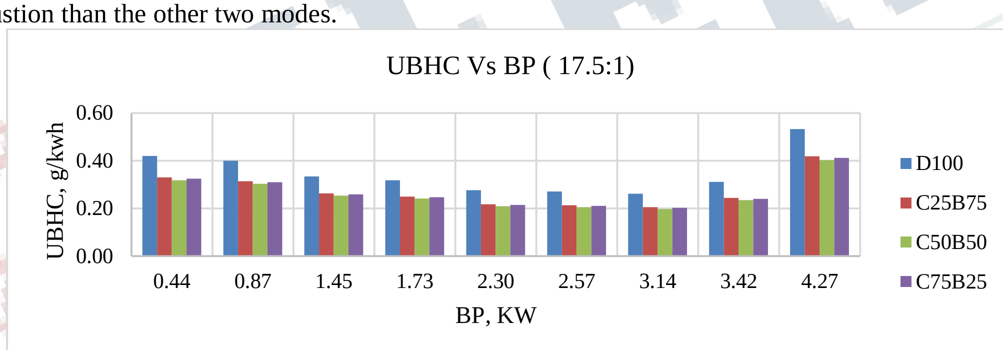

Figure 19 UBHC comparison with BP

Figure 19 shows UBHC emissions variations concerning BP for BASE FUEL, CEO1250COB175, CEO150COB150 and CEO175COB125 engines. UBHC emissions of CEO1250COB175 are decreased from 9% to 12% when the load increased from o to 100% load. UBHC emissions of CEO150COB150 is decreased from 8 to 12.2% when the load increased from o to 100% load; UBHC emissions of CEO1250COB175 experiments showed that it decreased from 9.2% to 12.3 % when the load increased from o to 100% load.

IFERP
connecting engineers... developing research

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)

Vol 4, Issue 6, June 2018

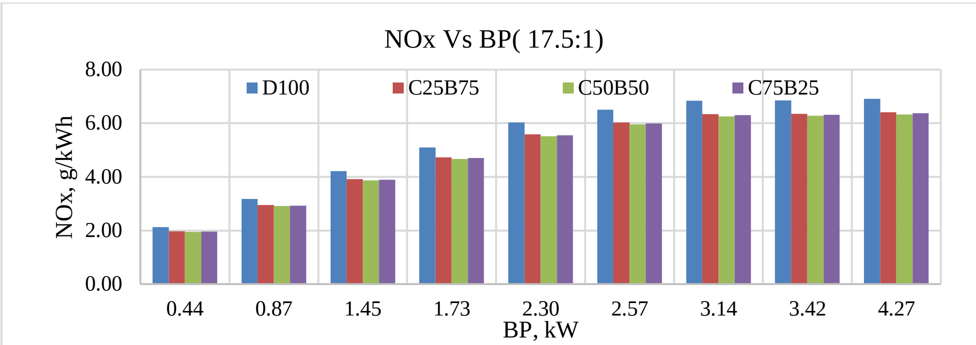

Figure 20 NOx comparison with BP

Figure 20 shows the variations of NOx emission for BP for BASE FUEL, CEO1250COB175, CEO150COB150 and CEO175COB125 engines. NOx emissions of CEO1250COB175 are decreased from 9% to 12% when the load increased from o to 100% load. NOx emissions of CE150COB150 are decreased from 8 to 12.2% when the load increased from o to 100% load, NOx emissions of CEO1250COB175 experiments showed that it decreased from 9.2% to 12.3 % when the load increased from o to 100% load.

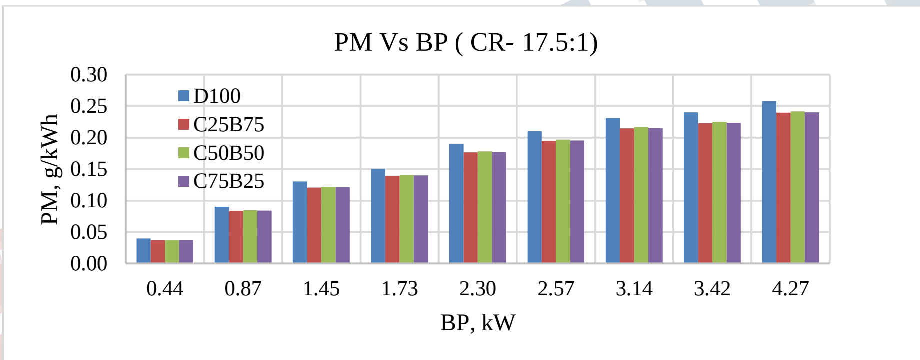

Figure 21 PM comparison with BP

Figure 21 shows that the PM emission variation for BP for the engines BASE FUEL, CEO1250COB175, CEO150COB150 and CEO175COB125 seen in Figure 21. Based on the study, the conclusion of the experimental findings obtained is: 1) CEO1250COB175's PM falls from 12% to 16% when the load rises from o to 100%. 2) As the load rose from o to 100 percent load, PM emissions of CEO150COB150 decreased from 18 to 18.6 percent. 3) CEO175COB125 experiments' PM emissions found that when the load rose from o to 100% load, it decreased from 18.2 percent to 19.3 percent. It suggested that with the aid of nanoparticles in the fuel, the combustion temperature controlled. Is oxygen increases PM emissions, but nanoparticles are present in the mixture of air-fuel, it supports the increase of combustion efficiency due to the combination of nanoparticles.

VII. CONCLUSION

In-Cylinder Pressure Vs, CA of CEO1250COB175, increased when compared to a diesel fuel engine, and it increases from 2. To 3.2%. Pmax in increased when compression ratio increase from 15 to 17.56:1 at all load conditions, is reflected in all combinations test. Heat Release rate Vs CA of CEO1250COB175 increased when compared to diesel fuel engine, and it increases from 2. To 3.4%. BTE of CEO1250COB175 increased when compared to a diesel fuel engine, and it increases from 2. To 3.1%. BSFC of CEO1250COB175 decreased from 1.8 percent to 1.5 percent. UBHC of CEO1250COB175 test shows it reduced by nearly 20.2 per cent compared to diesel fuel test. CO of CEO1250COB175 test shows CO emissions reduced by 20.1 per cent at 100% load than diesel fuel engine. PM of CEO1250COB175 test 14 to 15% decreased when compared to diesel fuel engine,

CEO150COB150

In-Cylinder Pressure Vs, CA of CEO150COB150, increased when compared to a diesel fuel engine, and it increases from 2. To 3.6%. Heat Release rate Vs CA of

CEO150COB150increased compared to diesel fuel engine, and it increases from 2. To .31%. BTE of CEO150COB150 increased when compared to a diesel fuel engine, and it increases from 2. To 3.5%. BSFC of CEO150COB150 experiments showed it decreased from 1.51 percent to 2.1 percent when the load increased from o to 100 percent. UBHC of CEO150COB150 test mode decreased from 22.3 percent to 23.3 percent compared to base fuel engine. CO of CEO150COB150 test mode decreasing from 22.3 percent to 23.3 percent compared to Diesel fuel mode at BMEP of 5.12. The NOx of CEO150COB150 is decreased from 8 to 12.2% when the load increased from o to 100%. PM emissions of CEO150COB150 are decreased from 18 to 19.2% when the load increased from o to 100% load

CEO175COB125

In-Cylinder Pressure Vs, CA of CEO175COB125, increased when compared to a diesel fuel engine, and it increases from 2. To 3.1%. Peak Pressure variations of CEO175COB125 decreased when increasing the concentration of nanoparticles. It is better evidence to improve combustion efficiency and engine stability at different load conditions. The Peak Pressure of CEO175COB125 slightly higher and stability compared to the other two test fuel combinations. Heat Release rate Vs CA of CEO175COB125 increased compared to diesel fuel engine, and it increases from 2. To 3.5%. BTE of CEO175COB125 increased when compared to a diesel fuel engine, and it increases from 2. To 3.4%. BSFC of CEO175COB125 test showed that BSFC decreased due to increased combustion efficiency. BSFC of D100 test decreased from 1.14 kg/kWh to 0.27 kg/kWh and increased marginally to 0.3161 kg/kWh when the load increased from 3.3 to 4.5kW. The CEO175COB125 mode BSFC decreased to 0.264 kg/kWh from 1.115 kg/kWh and marginally increased to 0.308 kg/kWh under maximum load conditions. BSFC of CEO175COB125 test decreased by 2.232% compared to the D100 test. BSFC of CEO175COB125 test showed that 2.33% decreased compared to D100 at 3.14 kW load and lower compared to two other combinations UBHC of CEO175COB125 tests shows, it decreased from 22% revealed that when compared to BMEP.

UBHC of CEO175COB125 is lower than all other combinations due to better combustion than the other two modes. CO of CEO175COB125 decreased from 25.3 percent compared to the base engine, based on these investigations.CO of CEO175COB125 is lower compared to all other combinations due to better combustion.

NOx CEO175COB125 experiments showed that it decreased from 9.2% to 12.3 % when the load increased from o to 100%. PM emissions of CEO175COB125 experiments showed that it decreased from 18.2% to 21.3 % when the load increased from o to 100%. Based on the detailed investigation, In-Cylinder pressure, heat release rate concerning CA, and ignition delay of D100, CEO1250COB175, CEO150COB150 and CEO175COB125, and comparing its performance and emission characteristics various loads and discussed in this chapter. Chapter 7 addresses the experimental results, comparison with various load conditions with three different nanoparticle combinations

Nomenclature

U_p	-	Average Piston Speed
BDC	-	Bottom Dead Center
BMEP	-	Brake Mean Effective Pressure
BP	-	Brake Power
BSFC	-	Brake Specific Fuel Consumption
BTE	-	Brake Thermal Efficiency
CO_2	-	Carbon Dioxide
CO	-	Carbon Monoxide
CN	-	Cetane Number
CR	-	Compression Ratio
CFR	-	Cooperative Fuel Research
CA	-	Crank Angle
CFM	-	Cycle Fuel Mass
DI	-	Direct Injection
EGR	-	Exhaust Gas Recirculation
FP	-	Friction Power
GHG	-	Green House Gas
HSU	-	Hartridge Smoke Unit
HC	-	Hydro Carbon
IMEP	-	Indicated Mean Effective Power
IP	-	Indicated Power
ITE	-	Indicated Thermal Efficiency
IDI	-	Indirect Injection
ICE	-	Internal Combustion Engine
ISO	-	International Standard Organisation
MTBE	-	Methyl Tetra Butyl Ether
NWR	-	Near Wall Flow
NOx	-	Nitrous Oxide
NDIR	-	Non-Dispersive Infrared Analyser
PM	-	Particulate Matter
PEG	-	Poly Ethylene Glycol
SFC	-	Specific Fuel Consumption
SOC	-	Start of Combustion
SOI	-	Start of Injection
SR	-	Swirl Ratio
U_t	-	Swirl Tangential Speed
TDC	-	Top Dead Center
TFC	-	Total Fuel Consumption

UHC	-	Unburned Hydro Carbon
VCR	-	Variable Compression Ratio

Acknowledgement

I give my very hearty thanks to my supervisor **A.S. Krishnan**, **Dr G Sureshkannan**, associate professor, **Dr K Marimuthu**, head of mechanical engineering department, **Dr V Selladurai, principal**, Coimbatore Institute of Technology, Coimbatore, for all encouragement during this research.

REFERENCES

[1] J. Sadhik Basha, R.B.Anand, The Influence of nano additives blended biodiesel fuels on a diesel engine's working characteristics, Journal of Brazilian Society of Mechanical Science and Engineering 35(2013) 257-264.

[2] Yanan Gan, Yi Syuen Lim, Li Qiao, Combustion of nanofluid fuels with boron and iron particles at dilute and dense concentrations, The Journal of the Combustion and Flame 159 (2012) 1732–1740.

[3] Yanan Gan, Li Qiao, Combustion characteristics of fuel droplets with the addition of nano and micron-sized aluminium particles, The Journal of the Combustion and Flame (2011) 354–368.

[4] Tyagi H, Patrick EP, Ravi P, Robert P, Taewoo L, Jose RP, Paul A (2008) Increased hot plate ignition probability for nanoparticle ladendiesel fuel, NanoLetters 8:1410–1416.

[5] A. Prabu, R.B. Anand, Emission control strategy by adding alumina and cerium oxide nanoparticle in Biodiesel, Journal of the Energy Institute, Volume 89, Issue 3, August 2012, Pages 366-372.

[6] Mu-Jung Kao, Cheng-Ching Ting, Bai-Fu Lin, Tsing-Tshih Tsung, Aqueous Aluminum nanofluid combustion in Diesel fuel, Journal of Testing and Evaluation, Volume 36, No.2.

[7] V. Arul Mozhi Selvan, R. B. Anand and M. Udayakumar, EFFECTS OF Cerium Oxide Nanoparticle Addition In Diesel And Diesel-Biodiesel-Ethanol Blends On The Performance And Emission Characteristics Of A Ci Engine, ARPN Journal of Engineering and Applied Sciences, Vol. 4, No. 7, September 2009.

[8] Janet M. Dowding, Talib Dosani, Amit Kumar, Sudipta Seal, William T. Self, Cerium oxide nanoparticles scavenge nitric oxide radical (_NO), Chem. Commun., 2012, 48, 4896–4898

[9] Yuesong Shen, Shemin Zhu, Tai Qiu, Shubao Shen, A novel catalyst of CeO2/Al2O3 for selective catalytic reduction of NO by NH3, Catalysis Communications 11 (2009) 20–23

[10] X. Shi, Y. Yu, H. He, S. Shuai, J. Wang, R. Li, Emission characteristics using methyl soyate–ethanol–diesel fuel blends on a diesel engine, Fuel 84 (2005) 1543–1549

[11] V. Sajith, C. B. Sobhan, and G. P. Peterson, Experimental Investigations on the Effects of Cerium Oxide Nanoparticle Fuel Additives on Biodiesel, Advances in Mechanical Engineering Volume 2010, Article ID 581407.

[12] A. Prabu, Nanoparticles as an additive in biodiesel on a DI diesel engine's working characteristics, Ain Shams Engineering Journal 9 (2011) 2343–2349.

[13] H. Soukht Saraee, S. Jafarmadar, H. Taghavifar, S. J. Ashrafi, Reduction of emissions and fuel consumption in a compression ignition engine using nanoparticles, International Journal of Environmental Science and Technology (2013) 12:2245–2252

[14] Rajneesh Kumar and Anoop Kumar Dixit, Combustion and Emission Characteristics of Variable Compression Ignition Engine Fueled with Jatropha curcas Ethyl Ester Blend at Different Compression Ratio, Journal of Renewable Energy Volume 2014, Article ID 872923.

[15] Irfan Javed, Seung Wook Baek, Khalid Waheed, Evaporation characteristics of heptane droplets with aluminium nanoparticles' addition at elevated temperatures, Combustion and Flame 160 (2013) 170–183.