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Effects on Diesel Engine Characteristics and Emission of Nanofluids Blends with Diesel

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Abstract : In current research moreover studied the performance and emission characteristics of different fuels in VCR engines. In this paper observed the performance and emission characteristics of nano fuel as additives with diesel in a different composition. In a future conducting experiment to evaluate the effect of cerium and magnesium oxide level 1% of diesel. The experiments to be perform in 4 stroke water cooled diesel engine at constant 1650 RPM, over different load condition. The properties such a viscosity, flash point and calorific value were determined as per standards. The experiment was conducted using diesel and nanoparticles blends with different ratios.
Keywords : Diesel engine, CeO_2 and MgO nanoparticles, ultrasonicator.

Introduction

The compression ignition engines are broadly used due to its dependable operation and economy. As the petroleum reserves are depleting at a quicker price due to the boom of populace and the subsequent source utilization, and pressing need for search for a renewable alternative gasoline arise. Also the risk of world warming and the stringent authorities' law made the engine producers and the customers to comply with the emission norms to keep the environment from pollution. Among the many choice fuels, ethanol, electric, solar energy and biodiesel (vegetable methyl esters) are considering as a most desirable source extender and fuel additive due to its excessive oxygen content and renewable in nature. Nano particles such as cerium oxide (CeO_2) and zinc oxide (ZnO) nanoparticles have been they utilized in many fields. CeO_2 and MgO nanoparticle have been used in diesel engine to reduce Ignition delay, Specific fuel consumption, exhaust emission smoke and brake thermal efficiency also increase.

Literature Study

Abbas Alli Taghipoor Bafghi et al., [1], in this study the main objectiveEffects of CeO_2nanoparticle addition in standard diesel and diesel-biodiesel blends on the performance characteristics of a Compression ignition engine. According to use cerium oxide and diesel-biodiesel blends. As results, the B5D95-25 fuelcompound has increased torque, while its SFC increase is about 1.4% compared to pure diesel fuel. In higher percent of biodiesel and nanoparticles, the B20D80-5 fuel compound is a suitable compound due to having low fuel consumption and SFC and relatively good power and torque.

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Abdel Razek S M et al., [2], Effect of aluminum oxide nano-particle in jatropha biodiesel on performance, emissions and combustion characteristics of DI diesel engine. 20% jatropha biodiesel and 80% diesel fuel with AL_2O_3 nanoparticle size of 20, 30 and 40 ppm blend in biodiesel. Alumina nanoparticles are 40 ppm compared to B20 fuel is an increase of 12% in the brake thermal efficiency, atthe levelof 40 ppm Al_2O_3 nanoparticles blends, the smoke will be reduced by 20% , unburned hydrocarbon level10% and carbon monoxide by 29% compared to B20 at full load operating conditions.

Ali M.A. Attia et al., [3], in this study the main objective is to operate diesel engines using jojoba oil shows a promising alternative fuel for conventional diesel fuel. In this work, a Al_2O_3 nano-particles are added to a mixture of jojoba methyl ester and conventional diesel fuel with different doses levels from 10 to 50 mg/l. The received mixture is homogenized with an ultrasonicator machineblender. This fuel combination overall BSFC is reduced by 6%, engine thermal efficiency is increased 7%, and engine emissions have been reduced (NOx about 70%, CO about 75 %, smoke opacity about 5%, and UHC about 55 %) compared with the corresponding values obtained when only a blended fuel of 20% biodiesel is used.

Annepu Shobha Rani et al., [4], Experimental investigation on the performance and emission characteristics of the di-diesel engine using diesel- ethanol blends and aluminum oxide nanoparticles. In this experiment, ethanol is an alternative fuel with diesel as different proportions like 15%, 25%, and 35%, respectively and aluminum oxide 50ppm nano additives are added to each blend. Normal butanol (5%) was added to the diesel-ethanol blends, with and without the use of nano-additives. N-butanol is used to prevent the phase separation between diesel and ethanol. The brake thermal efficiency of the engine was increased in diesel-ethanol blends with nano-additives, compared to neat diesel and other blends. Specific fuel consumption is a little increase with and without the additive of nanoparticles of diesel-ethanol blends.

Amit et al., [5], in this study the main objective is to evaluate the impact on the performance of direct compression ignition engine by adding cobalt oxide and Fe_2O_3 nanoparticle in jatropha biodiesel. An Experimental analysis was carried to study the performance characteristics of four stroke, single cylinder, and water-cooled direct injection diesel engine. Cobalt and iron oxide nanoparticle was added with jatropha biodiesel in the mixed proportion of 10, 20, 30,40,50,60 parts per million. The range of nanoparticle size was 30-70 nanometer. The engine was loaded with different brake power with each blend of diesel jatropha biodiesel- fuel additive. The notable improvement in brake thermal efficiency, brake specific fuel consumption, and exhaust gas temperature is observed.

Arul Mozhi Selvan.V et al., [6], in this study the main objective is to analysis the effects of cerium oxide nanoparticle addition in diesel and diesel-biodiesel-ethanol blends on the diesel. Performance and emission characteristics of a ci engine according to using cerium oxide nanoparticleethanol (99.9% purity) and the nanoparticles size of 32nm. As results, carbon monoxide emission decreases with the use of cerium oxide nanoparticles in diesel-biodiesel-ethanol blends and neat diesel. The addition of CeO_2 decreases the HC emission when comparing with neat diesel and diesel-biodiesel-ethanol blends.The brake thermal efficiency of a neat diesel is higher than diesel-biodiesel-ethanol blends for different loads and a slightly improvement is observed with the addition of cerium oxide with diesel ethanol blends.

Arun A et al., [7], Effect of nano-fluid addition emission reduction in biodiesel. Using Al_2O_3) as nano additive in jatropha biodiesel blended with various proportions of nano-additives 25ppm, and 50ppm respectively. The BSF was increased in B50-Al2O3(50ppm). The CO emission decreases by adding of B50-Al2O3(50ppm). The HC emission level was decreased at B50-Al_2O_3 (50ppm). The NOx emission is lower for the diesel than the addition of B50-Al_2O_3 (50ppm). By the addition of Al_2O_3 slightly increased compared with diesel.

Balaji G et al., [8], Effect of carbonnanotube as an additive with biodiesel on the performance and emission characteristics of a diesel engine. The CNT nano additive is mixed in various proportions (100 to 300 ppm) with the methyl ester of neem oil. The BSF increases by 4.17% and NO emissions reduce by 7.25%for MENO+CNT200 combinationcompared to diesel. The NO, HC, CO and emissions were reduced by addingnano additive to the neat biodiesel. The engine performance like brake thermal efficiency increases and brake specific fuel consumption decreases by adding nano additive.

Deepak K.T et al., [9], Experimental investigationonthe effect of inclusion of nanoparticles on diesel fuel properties.In this research the effect of Nano additives such as CeO_2 and TiO_2, Composite of CeO_2, TiO_2 and Cobalt-doped on diesel fuel properties are investigated. Nanoparticles of size range 10-20 nanometers are used to prepare the Nano fuel with diesel as the base fuel. By the little changing the fuel properties we can improve the combustion and emission reduces. The value of viscosity is much less than that of pure TiO_2 Nano fuel compare to other composites.

Deepali Meshram et al., [10], Experimental analysis on the performance of diesel engine using a mixture of diesel and bio-diesel as blending fuel with cerium oxide nanoparticle additive.cerium oxide nanoparticles size of< 50 nm was mixed into the ultrasonicatormixture and adding diesel and bio-diesel at the ratio of 0.25g/l and 0.5g/l for the new formulation of fuels. By using 0.25 g/l n-CeO_2 with diesel improvement on Brake power and 25gm/lit n-CeO_2 and diesel and 80%diesel, 20% biodiesel and .5gm/lit n- a cerium oxide improvement on Brake thermal efficiency are observed.

Dinesh kumar E et al., [11], Combustion and performance of bio-diesel blend with cerium oxide nano additive on a diesel engine. B40 (40% Jatropha oil biodiesel and 60% diesel fuel by volume)B20 blend with 100mg (cerium-oxide) additive per liter of B40 fuel from various test fuels. The performance of the engine with fuel additives shows good result both mechanical and indicated thermal efficiency shows great improvement as compared to diesel. Indicated thermal efficiency at load 50% and 75% show improvement of 2.00% and 7.27% and mechanical efficiency improvement were 6.66% and 3.07% at 50% and 75% load.

Fangsuwannarak k et al., [12], Improvements of palm biodiesel properties by using a nano-TiO_2 additive, exhaust emission, and engine performance. TiO_2palm oil ratios of 2%, 10%, 20%, 30%, 40%, 50% and hundred percent in the relaxation of normal diesel are denoted as B2, B10, B20, B30, B40, B50, and B100, respectively. The maximum reduction of the viscosity was once in the modified fuel with the addition of 0.1% dosing level as in contrast with standard POB fuels without the additive. B20-1%, B10-0.1% fuel samples provided. The adding of 0.1% TiO2 fuel level inimproved the engine performances.

Ganesan. S et al., [13], Influence of MgO on performance and emissions of di engine using blends of castor oil. Usage of Diesel, castor oil and MgO nanoparticles for a compression ignition engine and study the emission characteristics of this fuel at different mixing ratios and analyze the different levels of residue particles. Comparison of emission characteristics of pure diesel with that of sample one (80% diesel + 20% Castor oil + 50ppm Magnesium Oxide) at 200bar gives the lower value of NOx, Unburnt hydrocarbon than pure diesel.

Ganesan.S et al., [14], Learn about the essential objective is emission characteristics of biofuel in constant speed diesel engine under various injection pressure. Sample 1- 75% diesel + 25% Castor oil + 45ppm magnesium oxide nanoparticle (200 bar). Sample 2- 85% diesel + 25% castor oil + 45ppm magnesium oxide nanoparticle (220 bar) .sample 3- 85% diesel + 25% castor oil + 45ppm magnesium oxide nanoparticle (240 bar). As results blends have a decrease value of CO, hydrocarbon at 240 bar then 200 and 220 bars. This is due to better combustion of biofuel inside the cylinder than diesel. The no emission is lower (162 ppm) at 240 bar with 75% load compared to other pressures.

Ghafoori M et al., [15], Effect of nanoparticles on the performance and emission of a diesel engine using a biodiesel-diesel blend. Multi-Wall Carbon Nano Tubes (MWCNT) with the dosing levels from 2.5 to 30 ppm with the waste vegetable oil (WVO) methyl esters. The WVO methyl ester was blended with diesel fuel in the percentage of 80% of diesel and 20% biodiesel by volume (B20). Engine test results showed that maximum power was 63 kW at 900 rpm for D80B20 (80 %vol. diesel+20%vol. biodiesel) blended fuel that contains 30 ppm CNT. The results show that engine's power with D80B20 that contains 30 ppm nanoparticles compared to diesel fuel increases by about 17 percent. Maximum torque was 350 Nm for D80B20 blended fuel that contains 30 ppm carbon nanotubes. The results show that engine's torque with D80B20 that contains 30 ppm nano-particles compared to diesel fuel increases by about 18 percent.

Gnanasikamani Balaji et al., [16], Influence of alumina oxide nanoparticles on the performance and emissions in a methyl ester of neem oil-fuelled direct injection diesel engine. The Al_2O_3 nanoparticles are mixed in various proportions (100 to 300 ppm) with the methyl ester of neem oil. The brake thermal efficiency acceleratedby 4.23% and NO emissions. And decreased by mean of7.81% for MENO+ALN200 combo compared to neat biodiesel. The NO, HC, CO, and smoke emissions decreased by addingnano additive to the neat biodiesel.

Jayanthi.P et al., [17], in this study the main objective is to analyze the effects of nanoparticles additives on performance and emissions characteristics of a diesel engine fuelled with biodiesel.According to copper oxide nanoparticles 50ppm, 100ppm and 150ppm.In the biodiesel with the mixing of ultrasonicator set at a frequency of 20 kHz for 30 minutes. As outcomebrake thermal efficiency for B20+80ppm increased via3 to 4% when compared with biodiesel without nanoparticle additive. The CO emission decreased by using B20+80ppm has observed when compared with standard diesel. The carbon monoxideemissions decreased by way of 25% when in compared with net diesel. The hydrocarbon emissions are obtained minimum for B20+80ppm when compared with diesel and other biodiesel nano-fuel additives.

Madhan N Raj et al., [18], in this study the main objective is to Investigation on aluminum oxide nanoparticles blended diesel fuel combustion, performance and emission characteristics of a diesel engine. For the blending of aluminum oxide nanoparticles in diesel, take a sample of diesel say 1litre and then 0.025g of aluminum oxide in the nanoparticles form is introduced to make the dosing stage of 25ppm. The dosing level of 25ppm is 0.025g/l, respectively. As results, specific fuel consumption is higher for standarddiesel fuel and it has decreased with the addition of AONP.A small enhancement is observed with the addition of AONP with diesel fuel. With the use of AONP in diesel fuel the CO emissions decreases at higher level load conditions. The addition of AONP decreases the HC emissions when comparing with neat diesel. The NOx emission was found to be drastically increased with the addition of AONP with diesel fuel.

Manibharathi.V et al., [19], Experimental Investigation of CI Engine Performance by Nano Additive in Biofuel. The Nano additive rhodium oxides were added to Pongamia oil to diesel. The addition of Nano additives in diesel it reduces NOx emission up to 37% when compared with net diesel. It also reduces the unburnt hydrocarbon up to 45%. Nanoparticles reduce the energy consumption and improve the thermal efficiency.

Mu-Jung Kao et al., [20], aqueous aluminum nanofuel combustion in diesel fuel. Aluminum nanoparticles are about 40–60 nm and they are included with thin layers of pure aluminum oxide due to the high oxidation. The aluminum nanopowder additive mixed in diesel fuel causes a clear smoke reduction and for engine speeds less than 1800 rpm/min the NOx concentration has also a decreasing tendency.

Nandha Kumar V et al., [21], Influence of Al_2O_3 nanoparticles blended with waste cooking Oil in the performance, exhaust emission and Combustion Characteristics on a DI Diesel Engine. Characteristics using aluminum oxide (Al_2O_3) as nano additive in WCO blended with various proportions of nano-additives 25ppm, 50ppm, and 75ppm respectively. The brake thermal efficiency was increased in B20 Al_2O_3 75ppm at all loads than neat diesel. The CO emission decreases by addition ofB20 Al_2O_3 75ppm.The HC emission level was decreased at B20 Al_2O_3 75ppm

Nishant Mohan et al., [22], in this study the main objective performance study of a diesel engine using nano fuel. According to use aluminum in base diesel was made using ultrasonicator for 15 minutes, and the addition of the surfactant. The composition of the fuel was nanoparticles 0.5 wt. %, surfactant (0.1 wt. %) and rest diesel. As results, peak cylinder pressure decreased at full load conditions and was registered as 55 and 62 for nano fuel and diesel respectively. Engine performance parameter study revealed a noticeable reduction of 7% in specific fuel consumption with nano fuel in comparison to diesel for generating equivalent brake power.

Nithin Samuel et al., [23], in this study the main objective is to performance and emission characteristics of a CI engine with cerium oxide nanoparticles as an additive to diesel. According to use for mixing diesel fuel with cerium oxide nanoparticles is an ultra-sonic shaker. As results fuel consumption is decreased by 0.5 kg/wk.hr for diesel mixed with cerium oxide at 30 ppm. Mechanical efficiency of the engine is enhanced by 20% while using fuel added with 30 ppm cerium oxide. However thermal efficiencies are higher for neat diesel than the fuel mixed with the nanoparticle.

Pallavi George et al., [24], Experimental investigation on single cylinder diesel engine fuelled with soya bean biodiesel blends with nano-additives. Soya Bean Methyl Ester (SBME) and Nanoparticles (Al_2O_3)blend with the mass fraction of 50 ppm and 100 ppm by means of an ultrasonicator,which was set at frequency 40 kHz. Brake thermal efficiency increases with increasing load for biodiesel, biodiesel and it's blended with Nanoparticles (AL_2O_3) at 25% of load blend, B20 gives higher brake thermal efficiency and the value is 20.4%.Volumetric efficiency is more for all bends at all loads compare to that of Diesel fuel. Among all blends, B20 gives the highest value of volumetric efficiency at all load.

Prabakaran V et al., [25], Comparison of Performance, Combustion and Emission Parameter for Copper Oxide additivesBlended with Vegetable oil Biodiesel in an IC Engine.Copper oxide (CuO) nano additives

25ppm, 50ppm and 75ppm respectively. The brake thermal efficiency was increased in B20CuO75ppm at all loads than neat diesel. The specific fuel consumption is higher for the B20CuO75ppm than neat diesel at the entire load compared with the different dosing level of blends.

Prabhu L et al., [26], in this study the main objective is to the investigation on performance and emission analysis of titanium oxide nanoparticle as an additive for bio-diesel blends. In this research work, titanium oxide and methyl ester are taken. A 50ml of TiCl4 was gradually added to the 200 ml in the cool bath. The brake thermal efficiency was improved by 1.32% for B20 with 250ppm added with nanoparticle compared to 500ppm with 20%diesel-biodiesel blends and without nanoparticle addition with B20 blend at full load. As results carbon monoxide and hydrocarbon emissions decreased with the addition of nanoparticles in diesel-biodiesel. The CO and HC emissions are decreased by 20% and 17.5% respectively for 250 ppm added with B20 as additives at full load compared to 500ppm with 20% diesel-biodiesel blends and without nanoparticle addition with B20 blend at full load.

Ramarao K et al., [27], the experimental investigation on performance and emission characteristics of a single cylinder diesel engine using nano-additives in diesel and biodiesel. By using by using different blends of cottonseed oil methyl esters, for which Cerium Oxide Nano additives of size 30-50 nm is added in different proportions with neat diesel. The BTE of the engine increases with increasing load for diesel and biodiesel and its blends with the addition of Nano additive (Cerium Oxide). The EGT of the engine decreases with increasing load for diesel and biodiesel and its blends with the addition of Nano additive Cerium Oxide. The NO_X emissions from cottonseed oil and their different blend accept B20 + 0.04 and B20 + 0.08 gm. with the addition of Nano additive decrease as compared to diesel fuel.

Ramesh Babu. K et al., [28], Theoretical and experimental validation of performance and emission characteristics of nano additive blended diesel engine. The nanoparticles of alumina are mixed with the diesel fuel in the mass fractions of 25 ppm to 75 ppm systematically. The thermal efficiency of a modified diesel is higher than pure diesel at all the loads. The NO_X emission is lower for diesel- alumina blends than neat diesel. The smoke opacity decreases with the diesel - alumina blends. The addition of aluminum oxide (alumina) nanoparticles in neat diesel proportionately.

Rao S.Ch. et al., [29], in this study the main objective is to analyze the performance analysis of diesel engine fuelled with diesel along with nano-additives. According to the nano-particle 40ppm and dispersed in the diesel with the added of ultrasonicator set at a frequency of 20 kHz for 15-30 minutes. As results ZnO and CeO2 based metallic additives reduced the flash and fire point depending on the rate of the additives. The smoke was found lesser when using the 40ppm cerium oxide nanoparticles compared to the neat diesel and othernano-additives.

Rolvin DeSilva et al., [30], in this study the main Objective is to analyze the effect of titanium dioxide and calcium carbonate Nano additives on the performance and emission characteristics of C.I. Engine. According to 100ppm of nanoparticles are dispersed in the fuel sample to form a Nano fuel and the base fuel used is a B20 blend of methyl ester. Results are 2.05% increase in brake thermal efficiency and 5.7% decrease.The unburnt hydrocarbons and smoke are found to be low in case of fuel with TiO_2. NOx emissions are slightly higher at difficult loads when TiO_2 nanoparticles are used. Hence titanium dioxide nanoparticles with a concentration of 100ppm in the B20 sample shows better performance and emission characteristics.

Santhanamuthu M et al., [31], Evaluation of CI engine performance fuelled by Diesel-Polanga oil blends doped with iron oxide nanoparticles. Iron oxide nanoparticles were added in three different concentrations viz., 100, 200 and 300 ppm levels in all the three polanga oil – diesel fuel blends to study their effects on engine performance. Performance and emission parameters were equal to that of neat diesel above 20% polanga oil content in diesel with iron oxide nanoparticles at different load conditions.

Shanmugaraja M et al., [32], Experimental investigation of bio-diesel production using Pongamia oil and process parameter optimization using the Taguchi technique.Experimental investigation of bio-diesel production using Pongamia oil and process parameter optimization using Taguchi technique. BN20 fuel blend in diesel. The engine performance with biodiesel is similar to that of diesel, while emission is less in case of biodiesel.

Shelet D.D et al., [33], Emission characteristics of a diesel engine using palm biodiesel with copper oxide nanomaterial as an additive. The experimentation was carried out on a 4 stroke, single cylinder diesel engine with Diesel and various combinations of 20%, 40%, 60%, 80% and 100% Palm oil biodiesel with copper oxide as an additive. From the experimental outcome CO by 31%, HC by 10% and NOx by 35%. The blend B20 Palm biodiesel with Copper Oxide as additives gives less emission as compared to petroleum diesel.

Soukht Saraee H et al., [34], 2015 Reduction of emissions and fuel consumption in a compression ignition engine using nanoparticles. Silver powder 30–50 nm, mixture of the diesel,10, 20, 30,40ppm nanoparticle was blend with diesel fuel prepared. Adding silver nanoparticles to the diesel fuel will improve the fuel consumption and the range of emitted pollution.

Sungyong Park et al., [35], Emission characteristics of exhaust gases and nanoparticles from a diesel engine with biodiesel-diesel blended fuel (BD20). Nanoparticle size distribution of the CRDI diesel engine equipped with WCC consuming diesel fuel and 20% biodiesel-diesel blended fuel (BD20) produced from soybeans, respectively. The averages of CO, THC and smoke emissions in all modes of the ECE R49 cycle were reduced by about 19.6, 35, and 20 %, respectively, when going from D100 to BD20, but the NO_X emission of BD20 increased by 3.7%. The conversion efficiencies of THC and CO in WCC under D100 and BD20 were about 50% and 80% in the ECE R49 cycle, respectively.

Suresh Y et al., [36], in this study the main objective is to study performance test of CI engine are conducted for different curcas nut bio-diesel blends with the nanoparticle. Curcas nut seed is chosen for biodiesel production and Cobalt oxide nanoparticle experiment is conducted for B10, B20 and B30 with 75mg Cobalt oxide nanoparticles. The engine experimental results of Curcas nut bio-diesel blend with nanoparticle showed that efficiency including thermal efficiency is 2% increased, and mechanical efficiency was reduced by 2% for biodiesel blend with the nanoparticle. However, a slight increase in specific fuel consumption was experienced for biodiesel mixture with the nanoparticle. The cobalt oxide nanoparticle acts as an oxidizing catalyst and also provides oxygen for complete combustion of the blends.

Srinidhi C et al., [37], A Diesel Engine Performance Investigation Fuelled with Nickel Oxide Nano Fuel-methyl Ester. 20ppm and 40ppm of Nickel Oxide Nanoparticles (NiO) were mixed with Palm oil methyl ester-diesel blend, B10, forming B10 containing 20ppm of NiO particles and B10 containing 40ppm of NiO particles. The brake thermal efficiency was seen highest for B20 with NiO 40ppm dosing level. Specific fuel consumption was lowest for B20 blend of Diesel-palm oil methyl ester and a NiO nanoparticle dosing level of 40ppm. The usage of nanoparticle produced an average reduction of brake specific fuel consumption of 5.6% with respect to their base blends.

Vishwajit A. Bhagwat et al., [38], Graphene nanoparticle - biodiesel blended diesel Engine. Honge Oil Methyl Ester [HOME] and graphene nanoparticles were blended with the biodiesel fuel in the mass fractions of 25ppm and 50ppm with the aid of a mechanical homogenizer and an ultrasonicator. HOME results in poor performance in terms of reduced brake thermal efficiency. However, HOME performance was improved by adding nanoparticles. The brake thermal efficiency of HOME50graphene nanoparticles blended fuel was higher compared to that of HOME25graphene blends due to higher dosing level graphene nanoparticles to biodiesel. HOME results in poor performance in terms of increased Smoke opacity hydrocarbon emissions. This emission is drastically reduced with HOME50GRAPHENE nanoparticles blended fuel compared to that of HOME25GRAPHENE blend due to the increased dose level of nanoparticles to the biodiesel.

From this literature reviews

The properties of cerium oxide and oxide are concluded below points:

Cerium oxide

1. CeO_2 based metallic additives reduced the flash and fire point depending on the rate of the additives.
2. Mechanical efficiency of the engine is enhanced by 20% while using fuel added with 30 ppm cerium oxide.
3. CeO_2+B5D95-25 compound has the highest amount of power and torque increase.
4. Cerium oxide nanoparticle with the size of 32nm use is carbon monoxide emission decreases.

Magnesium oxide

1. The NO emission is lower using magnesium oxide 162 ppm. The smoke decreases with the fuel blends with an oxygenated additive at 240 bar.

Conclusion

From the literature reviews, nanofuel shows the positive result on the diesel engine. As results, 19% increase in engine performance compared to diesel fuel. Nano fuel as exiting the gases CO, HC, NO and unburned hydrocarbon gives lower value compared to diesel. There will be maximum research done in CU, TiO_2, SiO_2, CuO, Fe_2O_3, ZnO, Co_2O_3, CeO_2, Al_2O_3 and MgO nanoparticles. In this present work as using magnesium oxide and cerium oxide in the blend ratios 200, 400,600,800ppm with diesel in CI engine.

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