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PERFORMANCE AND EMISSION CHARECTERESTICS OF DIESEL ENGINE USING NANO AND BIO FUELS

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ABSTRACT

The present work aims to the estimation of diesel engine performance characteristics of emission by using diesel and bio diesel with etanol blends with the addition of cerium oxide nanoparticles. The stability of pure diesel and diesel-biodiesel-ethanol fuel are analysed with addition of cerium oxide nanoparticles. By engine performance tests, it is noted that blends with high speed in ultrasonic bath stabilization increase the stability. The experiments are conducted in single cylinder four stroke diesel engine coupled with an eddy current dynamometer variable compression ratio engine to estimate performance characteristics. The cerium oxide acts as a catalyst and reduces the emissions like Carbon monoxide and NOx. In these experiments using diesel and biodiesel ethanol blend with additive cerium oxide nanoparticle to progress the combustion of the fuel and reduction of the exhaust emissions.

1. INTRODUCTION

The energy import is considered as one of the major issues to economic as well as social developments in world. India is facing a more deficiency in lack of crude oil. In India the resource crude oils is limed the utilization of the crude oil will be more and more. The major uses of the fossil fuels are agriculture, industrial and transportation sector which will effect the environment polluted. An urgent required for find the alternative sources such as the alternative fuels arise and the increase the efficiency also reduced the environmental polluted. Now a day's use the alternative fuels, biodiesel and ethanol are considered as a most desirable fuel and fuel additive have the high oxygen content and renewable in nature. Rao et al. (2009) evaluated the performance and emission of single cylinder four stroke diesel engines with Jatropha bio diesel. The diesel to biodiesel ratio as 75:25 (B25), 50:50 (B50) and 25:75 (B75) are used to analyze and compared with diesel fuel. From the final results, the blend B25 has the performance nearer to diesel fuel. Altinet et al. (2001) conducted experiments in single cylinder direct injection compression ignition engine with the employment of methyl radical esters of vegetable oils (sun flower, Cotton seed, soya, and corn oils) as fuels. The test results shows that the thermal potency of the engine with biodiesel blends similar and fuel consumption is increased compared to diesel at a constant engine speed of 1500 rpm. These investigations reveals that the brake thermal efficiency of biodiesel blend B20 is as regards (nearer) to the diesel fuel and the thermal efficiency of diesel fuel is higher by 12% when compared with neat biodiesel (100%) at full load. The CO emissions are lower for biodiesel and its blends with diesel as compared with diesel whereas NOx emissions are over the diesel. Siva Kumar A et al. (2009) investigated the performance check on a diesel engine with neat diesel fuel and Cotton seed biodiesel mixtures. The engine experimental results showed that exhaust emissions like carbon monoxide (CO), particular matter (PM) and smoke emissions were reduced for all biodiesel mixtures. However, a small increase in Nitrogen oxides (NOx) emission was found for biodiesel mixtures. Sudhakar et al. (2001) has conducted investigations to search out the suitability of Rape seed oil in compression ignition engine. Investigations are conducted with 25%, 50% and 75% of Rape seed oil in an exceedingly mix of Rape seed oil and diesel. From the experimental results it's found that the mix with 25% of Rape seed oil is showing higher performance.

Qiu et al. (2001) conducted the behaviour of the pure diesel and nanodiesel (combination of diesel and nanoparticles) determine that a concentration of nickel nanoparticles between 0.2 and 0.5 give the best anti-wear behaviour and friction reduction. V. Arul Mozhi Selvan et al. (2009) has conducted the performance and emission characteristics of compression ignition engine.

2. MODELLING AND ANALYSIS

Experimental set up

The experimental is conducted to find the phase separation phenomena of the bio-diesel ethanol blends. In this experimental use cerium oxide nanoparticles in diesel ethanol blend and pure diesel has the tendency to set down at the fuel tank. Used in the tests cerium oxide nanoparticle with the size of 32nm and ethanol (99.9%). After series of experiments, it's find that the blends subjected to high speed mixing followed by ultrasonic bath stabilization improves the state of being stable. The separation between ethanol and diesel.

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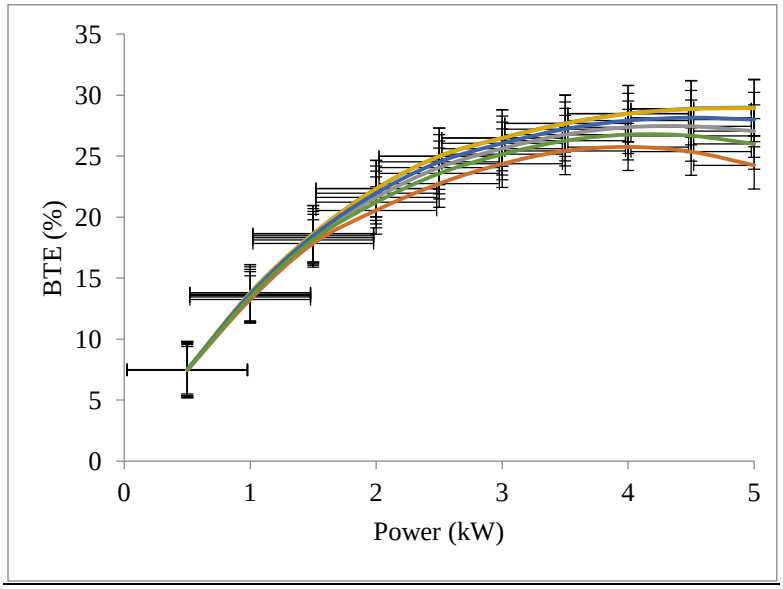
Figure-1: Experimental set up

The biodiesel is produced using the transesterification process. all the blends fluids for phase separtion is taken for half an hour and markiness procedure is used to assess the state of being stable of the resulting suspension. The experimental procedure and experimental facility is descused by Mozhi Selvan et al., (Arul Mozhi Selvan, 2009; Arul Mozhi Selvan, 2008). The engine load connected to the dynamometer. The fuel flow is measured aburette with two infra red optical sensor, air flow rate is measured to air flow sensor. The inlet and exhaust gas temperature is measured by K type thermocouples sensor the gas analyzer is used to measured the exhaust gas constituents such as Nox, CO, HC and the smoke meter is used for measure the smoke. Steady state condition recorded for all result conditions.

3. RESULTS AND DISCUSSION

Brake Thermal Efficiency

The Fig.2. shows the variation of brake thermal efficiency with power. The pure diesel has higher BTE compared to other fuel blends. Due to lower calorific values of diesel ethanol blends BTE decreases. The addition of cerium oxide improves the BTE of diesel ethanol blends. The highest BTE is observed as 25.90%in pure diesel where it is 23.04% for the D70+C10E20 blendat power 2 kW.



Carbon Monoxide Emission

The Figure.3. Shows the variation of carbon monoxide emission with power. The CO emission is reducing use of the blend fuels compared to the pure diesel fuel. The presence of oxygen molecules in the castor oil decreases the CO emissions. The higher carbon monoxide is observed as 0.28% in pure diesel where it is 0.20% for the D70+C10E20 blender under the same power 2kW. The use of blended fuels carbon monoxide is low compared to the pure diesel.

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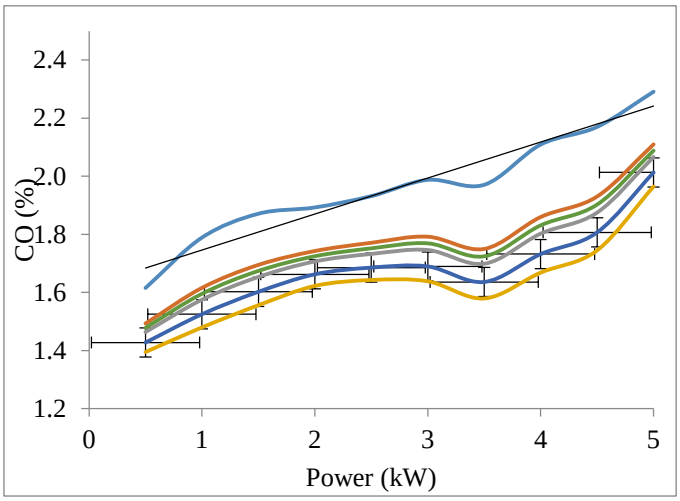
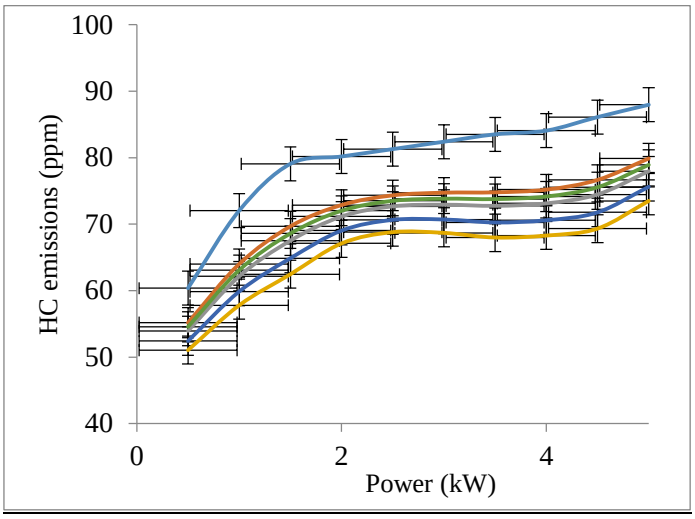


Hydrocarbon emission

The Figure 4 shows the variation of hydrocarbon emission with power. The emissions are decreases with the addition of cerium oxide compared to the pure diesel and diesel-biodiesel ethanol blends. Presence of oxygen molecules leads to the complete combustion. The HC emission of pure diesel is 205.21ppm at maximum power. The hydrocarbon emission of D70+C10E20 blende fuel is 198.8 ppm at the power of 2kW.

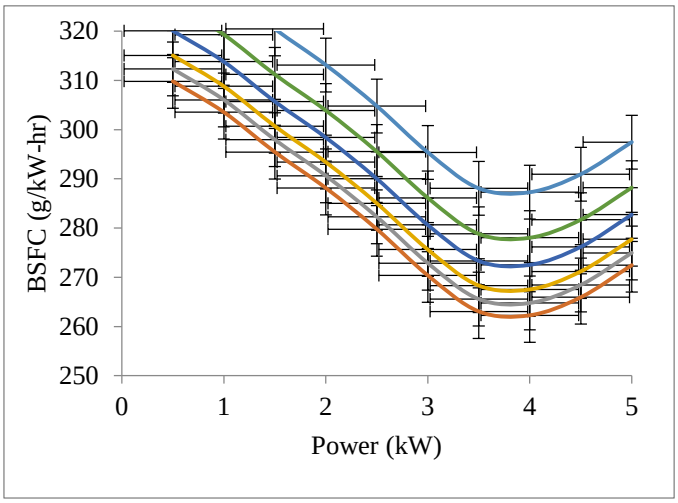


Nitrogen oxide emission

The Figure 5 shows the variation of NO_x emission with power. The NO_x emission of all blended fuels is higher compared to pure diesel fuel. The The NO_x emission mainly depends upon in-cylinder temperature. Due to presence of oxygen molecules causes complete combustion. So, the temperature of the process increases. The effect of enhances combustion fuel causes to produce higher exhaust gas temperature and therefore increase in NO_x emission. The presence of oxygen molecule in biodiesel is also one of the reason to increase the NO_x emission.

Brake specific Fuel Consumption

The Figure 6 shows the variation of brake specific fuel consumption with power. The specific fuel consumption is low for the all blends than pure diesel at the all power. This is due to the higher calorific value of the pure diesel than the diesel ethanol blend. The higher specific fuel consumption is observed as 0.37712 kg/kW-hr for the pure diesel whereas it is 0.35182 kg/kW-hr for the D+CERIA 25 blend at the of 2 kW. This phenomenon is due to the observed of cerium oxide addition is promotes combustion.



4. CONCLUSION

- The specific fuel consumption is lower for the diesel than the diesel-biodiesel-ethanol blends at all the powers.
- The brake thermal efficiency of the diesel biodiesel ethanol blends is low than pure diesel at the all powers and a low improvement is observed with the mixing of cerium oxide with diesel ethanol blends.

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