EFFECTS OF NANOPARTICLES ADDITIVES ON PERFORMANCE AND EMISSIONS CHARACTERISTICS OF A DI DIESEL ENGINE FUELLED WITH BIODIESEL

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Abstract: The current work carried to guarantee the likelihood of utilizing Chicken fat oil biodiesel acquired from waste of poultry businesses as an elective fuel for diesel in a CI engine. The investigational work completed in a CI engine utilizing Chicken fat oil B20 biodiesel blend and blended Zinc oxide nanoparticles to biodiesel as an added substance. The performance and emission qualities of B20 biodiesel blend and Zinc oxide included B20 biodiesel researched by contrasting them and diesel. Computerized 4-stroke, single cylinder, naturally aspirated, direct injection diesel engine utilized for the experimentation work. The investigational test results covers that the performance attributes enhanced with B20 biodiesel blend with nanoparticles. Extensive decreases in CO, UBHC observed and the decreases in NOX emission are accomplished while utilizing B20 biodiesel blends with Zinc oxide nanoparticles, B20 biodiesel blend compared with the diesel.

Keywords: Chicken Fat Methyl Ester, Zinc oxide, Performance, Combustion, Emission.

I. INTRODUCTION

In recent years, the petroleum price is increasing rapidly; therefore, the researchers are seeking alternative fuel sources. Biodiesel has much concentration in the previous decade because of its capacity to supplant petroleum derivatives, especially, the natural issues worried about the fumes gas emanation through the utilization of petroleum derivatives additionally empower the use of biodiesel, which has ended up being eco-accommodating significantly more than non-renewable energy sources. Biodiesel is a fuel included mono alkyl esters of long chain unsaturated fats got from vegetable oils or creature fats, assigned B100 and meeting the necessities of ASTM D 6751. Biodiesel made by trans-esterification process. This procedure changes over vegetable oil and creature fat into esterified oil, it is utilized as diesel fuel or blended with general diesel fuel.

Biodiesel is produced according to the sources in which it is classified into two categories: edible and inedible oil, such as Karanja, jatropha, waste plastic oil, used cooking oil, rubber oil, etc. (1). Improve engine performance and emissions by changing the fuel. Sadhik Basha [5] The search for biodiesel and biodiesel emulsions the primary supply is set up from a vegetable oil and exposed to blending with any added substances, for example, CNT (carbon nanotubes) and DEE (diethyl ether) to improve the properties of diesel and Engine. Debabrata Barik and R. Vijayaraghavan [6]. The chicken fat methyl ester (CFME) was produced from chicken fat used in meat processing industries. The results showed that the replacement of diesel was feasible with CFME. DCFME30 achieved excellent results in terms of performance and emissions compared to other blends. The process of evaluate engine performance Prabu and Anand [7] used alumina oxide and cerium oxide nanoparticles in the Jatropha biodiesel blend to, combustion and emission characteristics of a diesel engine. They found NO reduction, smoke opacity, unburned hydrocarbons and CO emissions. Bashaetal. [8] Studied aluminum oxide (Al2O3) nanoparticles and water emulsion fuel in diesel. The results indicated that Al2O3 nanoparticles can increases the combustion of the emulsion fuel and reduce the emission of exhaust gases. M. Kirubakaran, V. Arul Mozhi Selvan [10] This paper discusses the importance of animal fats for energy generation, in particular from residual chicken fat, the benefits of using chicken fats for biodiesel production, different forms of oil extraction from chicken fat and different biodiesel production techniques. The study reveals that biodiesel produced from residual chicken fat would be an adequate substitute for edible vegetable oils due to the low cost, ease of availability and properties of the methyl ester of chicken fat within the limits of ASTM biodiesel standards D 6751. Furthermore, research work must be carried out to improve the cycles of re-use of the catalyst, the purity of biodiesel and the profitability of the biodiesel production process in the future

This examination will concentrate on zinc oxide nanoparticles, zinc oxide nanoparticles have been blended with a methyl ester of chicken fat at 40 ppm, 80 ppm and 120-ppm fixation. The impacts of including nanoparticles the combustion characteristics, performance parameters and exhaust emissions have been deliberately examined with a speed of 1500 rpm.

Nomenclature

CFME	Chicken Fat Methyl Ester
B100	Biodisel 100%
D	diesel
ZnO	Zinc oxide
BP	Brake Power
BTDC	Before Top Dead Center
BTE	Brake Thermal Efficiency
HRR	Heat Release Rate
B20	20% biodiesel + 80% Diesel
CO	Carbon monoxide
EGT	Exhaust Gas Temperature
UBHC	Unburnt Hydrocarbon
NOx	Oxides of Nitrogen
ppm	Parts per million
LPH	Liters per hour
B20CFME	20% Chicken fat methyl ester + 80 % Diesel
B20CFMEZNO	20% Chicken fat methyl ester + 80 % Diesel+ Zinc oxide

II. MATERIALS AND METHODS

2.1 Biodiesel Production Procedures

The biodiesel fuel prepare from transesterification of chicken waste fat oil. The chicken waste collected was cleaned by washing it in water and it is heated up to 120^0C to lose all its moisture content and was strained which in turn filtered it. After filtration process, purified chicken oil was obtained. The nanoparticles are weighted 40ppm of mass fraction and added to biodiesel blends by using ultrasonicator set to dissolve the nanoparticles completely into the fuel (B20CFME ZnO 40ppm). The same principal is applied for 80ppm and 120ppm to prepare ZnO and biodiesel blends (B20CFME ZnO 80ppm, B20CFME ZnO 120 ppm). The properties of the fuels are appeared Table 1.

Table 1. Properties of fuels used for Testing

PROPERTIES	UNITS	DIESEL	B20CFME	B20CFME ZnO 40	B20CFME ZnO 80	B20CFME ZnO 120
Density	kg/m^3	850	835	840	845	850
Kinematic Viscosity	at 40 °C, cst	2.0	2.52	3.219	3.41	3.92
Calorific Value	kJ/kg	43900	42437	42697	42663	43000
Fire Point	°C	49	49	67	65	58
Flash Point	°C	56	68	71	69	62
Cetane Index	-	51	54	57	56	55

2.2 Experimental Setup and method

The specification of engine as shown in Table.2.

Table 2. Specification of test engine

Parameters	Specifications
Engine	Four Stroke Single Cylinder
Make	Kirloskar
Number of cylinder	One
Speed	1500 rev/min
Bore	85 mm
Stroke length	110 mm
Compression ratio	17.5:1
Starting	Cranking
Working length	Four Stroke
Method of cooling	Water cooled
Method of ignition	Compression ignition
Dynamometer	Eddy current

2.3 Engine Test Procedure

The experiments were conducted using pure diesel as a reference fuel (indicated as B0), biodiesel 20% + diesel 80% (B20CFME), biodiesel 20% + zinc oxide at 40 ppm (indicated as B20 CFME ZnO 40), 20% of biodiesel + 80 PPM of zinc oxide (indicated as B20 CFME ZnO 80) and 20% of biodiesel + 120PPM of zinc oxide (indicated as B20 CFME ZnO 120) at different loads from 0% to 100% in the steps of 25%.

2.4 Experimental setup

The engine configuration includes a constant speed engine of one cylinder, 4 stroke and 1500 rpm associated with the eddy current dynamometer. The rotameters are housed with cooling water and the estimation of the water flow of the calorimeter as shown in Fig. 1. The examinations were performed at a steady speed of 1500 rpm and Engine consists of an air box, air pressure gauge transmitters, fuel estimation unit and estimates of fuel flow, process marker and piezoelectric control unit. The rotameters are arranged to estimate the flow of cooling water and the calorimeter. Before using the engine with another fuel, it was allowed to continue running for the time necessary to devour the remaining fuel from the previous test. Engine braking power (BP), brake thermal efficiency (BTE), specific brake consumption (BSFC), heat recovery speed (HRR), maximum pressure (PC), monoxide of carbon (CO) Emissions of unburned hydrocarbons (UBHC) and nitrogen oxides (NOX) have been calculated for biodiesel in different mixtures

Figure 1. Diagram of the engine setup

III. RESULTS AND DISCUSSION

3.1 Performance Analysis

3.1.1 Brake Thermal Efficiency

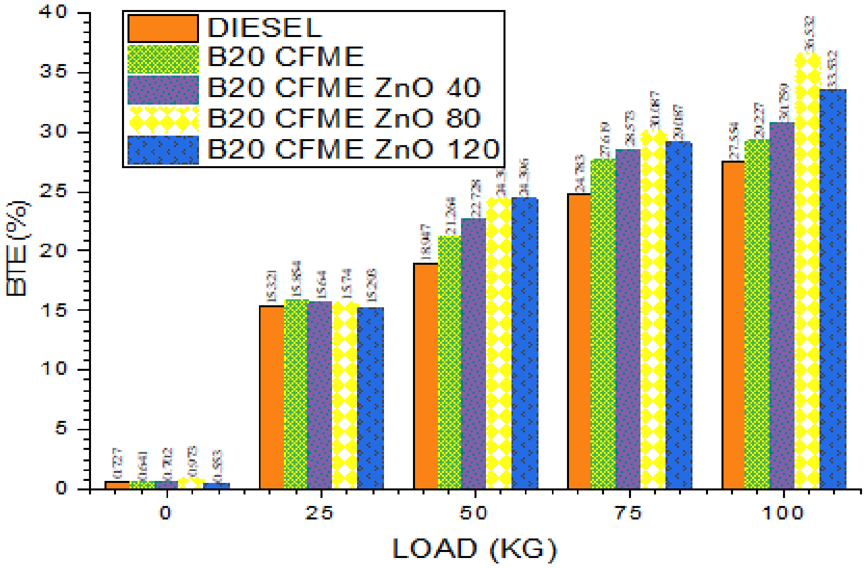

Figure.2 Variation of BTE with Load

Figure 2 shows that Compare to other mixtures The thermal efficiency of the mixture of 20% biodiesel + 80 ppm of zinc oxide (indicated as B20 CFME ZnO80) is better. we can notice that the reduction in viscosity leads to better atomization, fuel vaporization and combustion. This could also be due to better use of thermal energy. As the combustion of biodiesel in the mixture was faster, the thermal efficiency was improved. The B20CFME ZnO80 biodiesel efficiency at full load is 36%.Compare to other mixtures

3.1.2 Specific fuel consumption

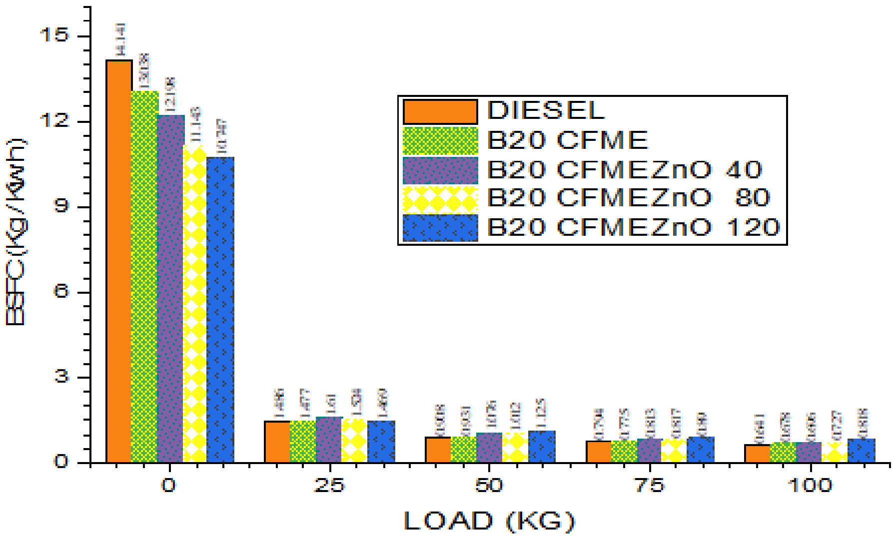

Figure.3 Variation of BSFC with Load

The figure 3 shows BSFC versus engine load for different blends.in this figure it is clear that BSFC decreases with increasing load because of lower calorific values and also the more oxygen content present in ZnO because of this enhancement in combustion. At full load the maximum BSFC is observed for diesel (0.818Kg/kW-hr) and minimum for B20CFMEZnO100 (0.641Kg/kW-hr).

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3.2 Emission Analysis

3.2.1 HC emissions

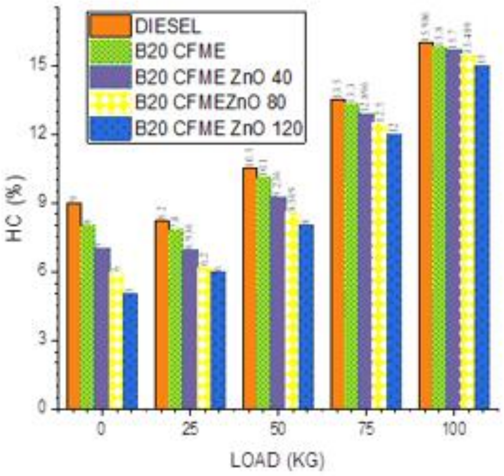

Figure.4 Variation of HC with Load

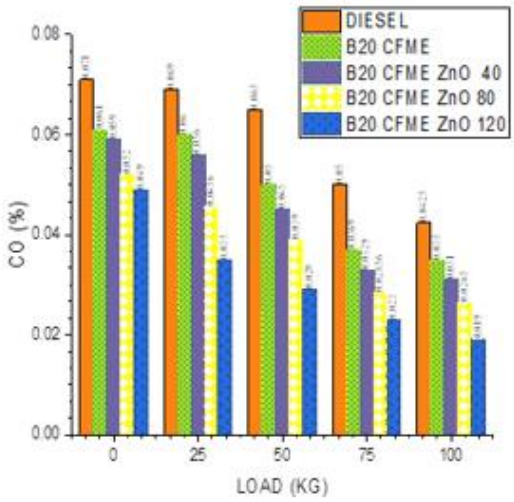

Figure.5 Variation of CO with Load

The UBHC of biodiesel reduces because of biodiesel itself contains oxygen it leads to complete combustion of fuel. In the graph we recognize that as the load increases the B20CFME Zno gives low UBHC than the diesel. This indicate B20CFME ZnO gives complete combustion.

3.3.2 CO emissions

Figure.5 it shows that increase in load and decrease CO emission level. In graph, it clearly shows all fuel blends have less CO emission as Compared to diesel. The CO emission level decreases because of oxygen present in biodiesel leads complete combustion and reduce the CO emission and non-particles acts as a additives and reduce the emission.

3.3.3 Oxides of Nitrogen

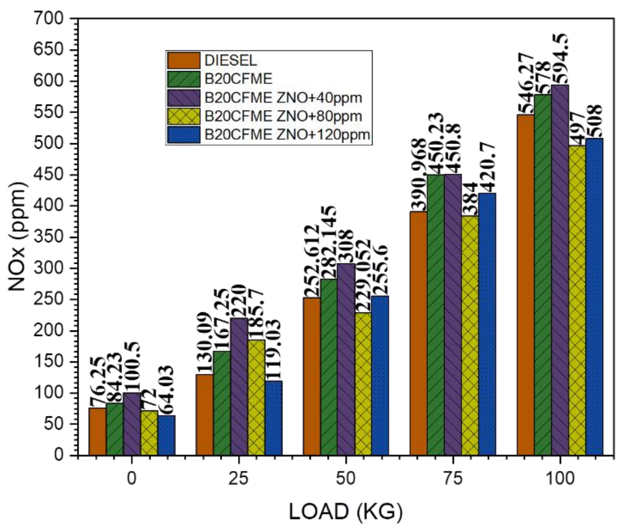

Figure 6Variation of NOx with load

The load increases NOx level also increases figure 6 it is notice that the B20 with 80-ppm ZnO blend gives lower NOx emission then the tested fuel. The 10 to 80ppm NOx level decreases because of enhancement in combustion chracteristics,at the higher loads the NOx levels are high with the addition of ZnO nanoparticle.

IV. CONCLUSION

In this work, experimental analysis is carried. Nanoparticles used were Znic Oxide Nano particles with different concentration is (40ppm, 80pmm, 120ppm) were used for experimental analysis. The following conclusions are drawn

- The brake thermal efficiency of the 20% biodiesel + 80ppmZinc oxide (denoted as B20 CFME ZnO80) blend was better than that of other blends.
- The biodiesel and its blends the BFSC is low because of the low calorific value as compare to diesel
- The HC, CO emission are less in B20 CFMEZNO blend compare to tested blends

Thus Nano particles Biodiesel blend are found to be more efficient as compare to pure diesel

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