Experimental Analysis Of Biodiesel By Using Nano additives On VCR Diesel Engine

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ABSTRACT

An experimental research is performed to determine the performance qualities of a variable compression engine at constant speed using cerium oxide nanoparticles as being fuel-borne additives in diesel–biodiesel blend. In this research, the effects of adding CeO2 nanoparticles to cotton seed oil-diesel blended (B20) fuel on compression-ignition engine had been experimentally investigated. The B20 with, 50, and 100ppm dosage of CeO2 nanoparticles were examined at various engine loads and constant engine speed. The fuel blends were labelled as B20, B20+50ppm and B20+100ppm. Moreover, even without the any engine alterations, the performance properties of those fuel blend samples were investigated through the experimentally measured standards like viscosity, density, cloudpoint, calorific value and pour point while the engine performance has also been examined through the factors like EGT, BSFC, and BTE. The experimental outcomes show that the use of biodiesel blend along with CeO2 Nano particles in diesel fuelled engine has revealed good improvement in performance.

Keyword: - *CeO2 in cotton seed oil biodiesel, B20+50ppmCeo2, performance of VCR Diesel engine.*

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1 INTRODUCTION

Fast depletion of non-renewable fuels has recommended research and development on substitute renewable fuels. In this situation, vegetable oils are observed to be a possible energy resource which can replace fossil fuels. The oil have been gathering popularity as a substitute fuel for the diesel fuelled engines since its characteristics are nearly the same as those of diesel fuel. Biodiesel is the crucial renewable alternative to diesel fuel in diesel engine uses. Many analysis works has been practiced to analyse the efficiency as well as engine emissions of unmodified diesel fuelled engines, operated with biodiesels produced from eatable vegetable oils as well as non- eatable vegetable oils correspondingly. At this regards biodiesel is non-risky, eco-friendly and biodegradable for environment compared to diesel fuel. Alternate fuel for compression ignition engine is made from agricultural feed stocks as well as pure vegetable oil, such biodiesel are being used as a substitute of standard diesel fuel. For that reason, the feed stocks of those renewable sources such as agricultural wastes, edible and also non-edible organic oils are viewed as the possible fuel for complete substitution of diesel fuel in CI engines.

1.1 Objectives

- To increase performance of engine using biodiesel with Ceo2 nanopartical
- To decrease ignition delay and accelerate the ignition.
- To increase the brake thermal efficiency.

2 MATERIALS AND METHOD

2.1 Biodiesel Production

Fig2.1 Biodiesel

There are three basic methods for producing biodiesel from oils and fats:

- Oil trans esterification catalysed by a base.
- Oil trans esterification catalysed by an acid.
- The oil is converted into fatty acids, which are then converted into biodiesel.

2.2 Blend Preparation

The blend of bio diesel and pure diesel is prepared by mixing accurate quantity of methanol taken in a pipette and pouring in a beaker containing adequate quantity of pure diesel. Here “B” stands for blend and the number written along with it denotes the percentage by volume of bio-diesel present in the mixture.

In present world blends up to a percentage of 20 to100 are prepared and tested in various conditions. A blend with 5% by volume methanol and 95% by volume pure diesel is denoted as “B5”. Similarly B20+50ppm and B20+100ppm contain 20% and100% by volume cotton seed oil mixed with 80% and 100% pure diesel with 50ppm and 100ppm respectively.

Fig 2.2 Biodiesel Blends

2.3 Magnetic Stirrer

- A magnetic stirrer is a device widely used in laboratories and consists of a rotating magnet or a stationary electromagnet that creates a rotating magnetic field. This device is used to make a stir bar, immerse in a liquid, quickly spin, or stirring or mixing a solution
- Turn on the magnetic stirrer by flipping the power switch on (–), then rotating the left knob in a clockwise direction. 3. The farther you rotate the knob, the faster it will spin to stir your solution. You can control the stirring speed between about 120 and 1400 rpm

Fig 2.3 Magnetic stirrer

3 FUEL PROPERTY

The test fuel standards are kinematic viscosity, density, flash point, lower heating value and calorific value for Diesel , B20 and its blends B20+50ppm, B20+100ppm are described in Table 1. The benefits of increasing flash point in biodiesel consist of greater safety, which makes it easier to transport when compared to diesel fuel; less fire risk, more safer to storage as well as limited chances of uncontrolled explosion. This will lead to enhanced operation heat, greater losses, higher pressures and temperatures and also decreased overall cycle efficiency. However, rise in density of biodiesel in a fuel sample decreases its calorific. It causes greater fuel consumption

Properties Comparison Table

Properties	Diesel	Biodiesel	B20	B20+50ppm	B20+100ppm
Kinematic Viscosity (mm^2/s)	3.111	4.312	3.534	4.6449	4.6894
Flash Point (oC)	63.928	129.625	90.45	167	168
Lower Heating Value (kJ/kg)	43482.4	39057.7	41185.27	45483	45519
Cetane Number	48.4	56	52.33	50.5	51
Density (kg/m^3)	833.75	874.25	838	835.7	835.9

Table 1

4 EXPERIMENTALSETUP PROCEDURES

The investigation is carried out on four-stroke, single cylinder, water-cooled direct injection diesel engine. The rated power of the engine is 5.4 kW with the constant speed of 1500 rpm. The graphical view of the experimental setup is dis-played in Fig.. The engine standards are displayed in Table 3.The engine operates at its rated speed for load testing. The diesel fuel engine is worked at a standard input of 200.

- Adjust the flow of water for cooling the engine.
- The engine was started by the starter motor. The speed was adjusted exactly to 1500 rpm through throttle or accelerator wire attached to a screw.
- Load was varied from 0 kg to 10 kg and engine speed was kept constant about 1500 rpm.
- At each load engine speed, time for 10 cc fuel consumption and temperature of exhaust gases was measured. Take all the reading by increasing load by turning the wheel fitted on the side of the frame.

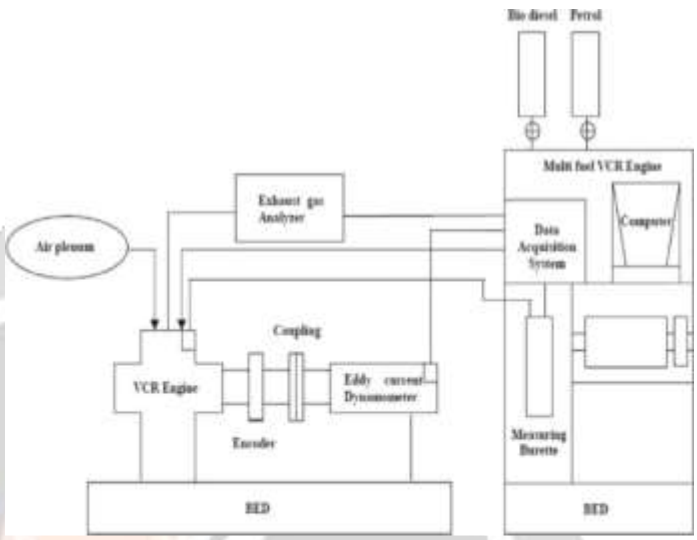


Fig. 4.1*VCR Diesel engine*　　fig.*4.2 SCEMATIC DIAGRAM OF VCR TEST ENGINE SETUP*

6 Result Table

	Torque (Nm)	**BP (KW)**	**FP (KW)**	**IP (KW)**	**BMEP (bar)**	**IMEP (bar)**	**BTHE (%)**	**ITHE (%)**	**Mech. Efficiency(%)**
B20CR16+ 50	0.51	0.08	2.09	2.17	0.10	2.66	2.15	59.09	3.64
B20CR17+50	0.42	0.06	2.3	2.5	0.08	3.00	1.79	66.76	2.7
B20CR18+50	0.34	0.05	2.68	2.74	0.06	3.35	1.43	74.44	1.93
B20CR16+100	0.50	0.01	3.03	3.11	0.13	3.85	2.11	84.65	2.49
B20CR17+100	0.44	0.03	3.29	3.36	0.08	4.12	1.85	91.5	2.06
B20CR18+100	0.38	0.06	3.56	3.62	0.07	4.40	1.60	98.35	1.63
B100CR16	0.46	0.07	2.35	2.42	0.09	2.90	1.49	49.46	3.01

B100CR17	0.33	0.05	2.43	2.48	0.06	3.04	1.11	59.48	2.09
B100CR18	0.20	0.03	2.52	2.55	0.04	3.19	0.82	69.50	1.18

Table 2

7 RESULTS & DISCUSSION

7.1 Performance Characteristics

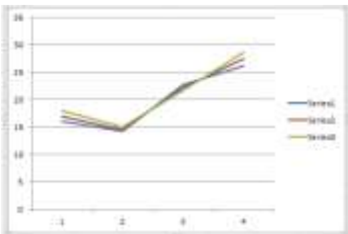
The brake specific fuel consumption (BSFC) of blends B20, D80B20CeO250 and D80B20CeO2100 at varying brake mean effective pressure (BMEP) were shown. It was observed that the BSFC value of D80B20CeO250 and D80B20CeO2100 blends less than that of blend B20, because of improved atomization and better mixing process at higher injection pressure. The BSFC values for D80B20CeO250 and D80B20CeO2100 blends decrease with increase in the dosing level of CeO2 nanoparticle. Based on the results, it is concluded that the decrease in BSFC can be due to the positive effects of nanoparticles on physical properties of fuel and also reduction of the ignition delay time

7.2Brake Specific fuel Consumption

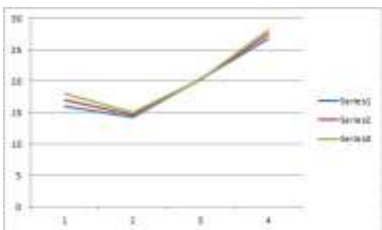
The change of BSFC at different load for various test fuels is dis-played For all of the cases, the BSFC was reduced with improving the load. Especially, the BSFC of the CeO2 nanoparticles added fuel blends was lowered in comparison to the B20. It is because of the less calorific value of the B20 fuel. The CeO2 nanoparticles additive impacted the improved atomization as well as improved combustion and so the fuel consumption had been decreased while improving the power. The BSFC reduces with Improving the dosage level of CeO2 nanoparticles in the fuel blend.

7.3 Brake thermal efficiency:

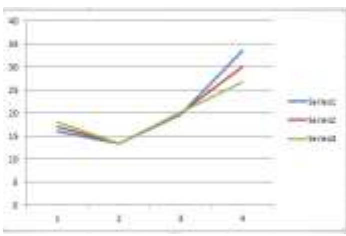
Fig illustrates the change of brake thermal efficiency with load for all the test fuels. It can be found that CeO2 added fuel blends shows enhanced brake thermal efficiency more than B20test fuel. So the B20 produces lass BTE when compared with other fuel blends. The increase in brake thermal efficiency for the nanoparticles added test fuels is because of the better combustion



B20+50ppm



B20+100ppm



B100

8 CONCLUSION

An experimental analysis of CeO2 nanoparticle additives combustion in diesel fuelled engine had been performed at a different dosage of nanoparticle. The ASTM specification tests for the fuel quality measurements had been stated in this report for biodiesel customized by adding CeO2 nanoparticles. The fuel description data proved some similarities as well as differences when considering B20 and also B20 with nano additives. The CeO2 Nano additive fuel blends indicate slight improving in calorific value as well as kinematic viscosity when compared to B20. The lowering in BSFC may be due to the good impact of nanoparticles on physical characteristics of fuel as well as decrease in the ignition delay time. It brings about maximizing in BTE. It can be viewed that the maximum BTE and EGT was found by using Nanoparticle added biodiesel blends. And also that fuel blends produces less BSFC when compared to standard diesel.

- The addition of nanoparticles in biodiesel decreases the ignition delay and accelerates earlier initiation of combustion which results in the lower heat release rate and cylinder pressure at the full load condition.

- Significant improvement in brake thermal efficiency is observed for nanoparticles dispersed test fuels compared to those of B100. At the maximum of 12% improvement in BTE is observed for B20CR+50 test fuels, followed by 9% improvement in BTE for B20 CR +100 test fuel, compared with B100.

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