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Performance And Emission Analysis Test On DI- Diesel Engine Fueled With Biodiesel And Barium Oxide Nanoparticles Blended

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Abstract: *This project aims at a comparative study on performance, emission and combustion of Barium Oxide nanoparticles when blended with Biodiesel in single cylinder, direct injection water cooled direct compression ignition Engine. Because of modernizations and increase in number of automobiles worldwide, the consumption of diesel has massively increased. As petroleum is non-renewable major source of energy and its reserves are scare now a days, there is a need for research in finding alternative fuels for automobiles. And also Bio diesels are renewable, nontoxic and eco-friendly fuels that can play an important role in automobile industries. And This paper deals with the transesterification of custard apple seed oil by means of methanol in presence potassium hydroxide catalyst at less than 65°C. The viscosity of biodiesel produced from custard apple seed oil is nearer to that of the commercially available diesel. The custard apple seed oil is characterized by GC (Gas chromatography) analysis and the important properties of biodiesel such as density, flash point,cloud point,carbon residue are found out and compared with that of ASTM – biodiesel standards and commercially available diesel. The study encourages the production of biodiesel from Custard apple seed (Annonasquasoma) oil and value additionof custard apple fruit. By increasing performance of engine , control the emissions and also to surplus the soot formation.*

Keywords*: Biodiesel , Custard apple seed (Annonasquasoma) oil, Bariumoxide Nanoparticles ,Potassium hydroxide catalyst, transesterification.*

I. INTRODUCTION

Energy consumption is constantly increasing all over the in spite of the rationalisation measures that have been undertaken. Liquid fossil fuels are the man and most frequently used for mobile machinery . considering the fact that the entire devolpment of mobile machinery is based on the use of liquid fossil fuel . It is difficult to expect a shift from this trend to a mass devolpment and use of new engine constructions that would be suitable for some other type of fuel.

The studies have been on discovering the fuel that would be adaptable to the existing engine constrictions and that would meet the criteria regarding renewability,ecology and reliability of use. Fulfillment of the mentioned criteria is the basic for a sucessfull fossilfuel replacement by some other types of fuel. During last decade of biodiesel has become the most common renewable liquid fuel due to its possibility to meet set requirements of the previously mentioned criteria. Many researchers have produced the biodiesel from nonedible oil, Which include Jatropha (jatropha curas) oil, Karanga or Honge (pongamia pinnata/glabra) seed oil, polanga (Calophyllum Inophyllum), tobacco (Nicotianatabacum) seed oil.

In the production process of biodiesel, the effects of process parameters such as alcohol to oil molar ration, catalyst concentration, reaction time, and reaction temperature have been studied and optimised. The fuel properties of produced biodiesel have been investigated and compared with the standard specifications for assessing their feasibility to substitute the petroleum fuels. However there are many other non edible oil for which process parameters are not being optimised. One among them is sugar apple (Annona aquasoma) seed oil.

Biodiesel obtained for the organic waste, the spent seeds of Custard apple. This source can be a very good utility product as there is no special investment required and additionally it can be a source of waste clearance.

Figure1: custard apple(Annonasquamosa) fruits and seeds.

Custard apple seed with a bionomial name annonasquasoma with other name sugar apple, the most widely grown species of annona and a native of tropical Americans and West indies. This is native from countries Asia, Burmese, Philippines.

The fruit is round to conical, (5-10 cm) 2.0.3.9 inch in diameter and N(6-10cm) 2.4.3.9 inch long, and weighting 100-240g (3.5-8.5), with a thick rind composed of knobby segments. The colour is typically pale - green to blue - green, with a deep pink blush in certain varieties, and typically has a bloom. It is unique among annona fruits in being segmented tend to separate . When ripe, exposing the interior.

The flesh is fragrant and sweet, creamy white to light yellow, resembles and testes like custard. It is soft, slightly grainy, ad slippery. The hard shiny seeds may number 20-40 or more fruit and have brown to black coat. In India mostly grow in rural areas of Andhra, Karnataka, Maharashtra and other countries. The custard apple as belong to the family Annonanceae is commonly found in deciduous forests, also cultivated throughout India and other tropical countries.

The emphasis of present work is to produce biodiesel from Annonasquasoma seed oil by transesterification process using methanol and sodium hydroxide catalyst. Then the further to take performance and emission analysis test on single cylinder DI- diesel engine by increasing the performance of engine and control the emissions.

II. MATERIALS AND METHODS

2.1 Oil Extraction.

The seeds were collected from the different households as one as discards the seeds after consuming the fruit. The collected seeds were dried and crushed in a expeller. For complete extraction of oil the seeds were passed four times through the expeller. The neat oil is allowed to settle for 48 hours and after that oil is stored in an airtight container to avoid oxidation.

2.2 Transesterification Reaction.

The tranesterification reaction was carried out in a laboratory scale batch reactor equipped with thermometer and condenser the heating and stirring were done with a hot plate magnetic stirrer system. In each set of experiments 50g of oil was heated to the predefined set .

Temperature and after attainment of predefined temperature the mixture of catalyst and methanol was transferred to reactor and all predefined sets as transesterification reaction conditions were measured from this point for each set of experiment. Stoichometrically 3:1molar ratio of alcohol to oil is needed for completion of transesterification reaction, but many researchers reported that biodiesel yield is maximum with excess molar ratio of alcohol to oil.

Hence in the present investigation, in each set of experiment,6:1 molar ratio of alcohol to oil and constant stirrer speed were maintained. After the completion of predefined set of transesterification reaction conditions the reaction mixture was transferred into a separating funnel left for 60 minutes to separate into biodiesel and glycerol.

Table 1: Properties of Biodiesel

SI.NO	PROPERTIES	EXPERIMENTAL VALUES		
		BIO DIESEL (Custard apple seed)	**BIO DIESEL Standard value (ASTM)**	**Commercially available diesel**
1	Kinematics viscosity (centistokes)	5.71	1.9-6.0	1.3-4.1
2	Density (Kg/m³)	865	870-900	845-920
3	Flash point (°C)	150	130	54
4	Calorific value(KJ/Kg.k)	37510	37000-42500	43500

The lower layer of glycerol was removed and the upper layer of crude biodiesel is washed several times with hot water at 50°C to remove the impurities.

III. EXPERIMENTAL SETUP AND TEST PROCEDURE

The experimental study was carried out to investigate the performance and emission characteristics of a compression iginition engine with custard apple methyl ester and relating it with that of diesel. The diesel engine was primarily started with diesel and then with the produced test fuels. Speed of the engine was maintain constant speed at 1500 rpm under varying load conditions .

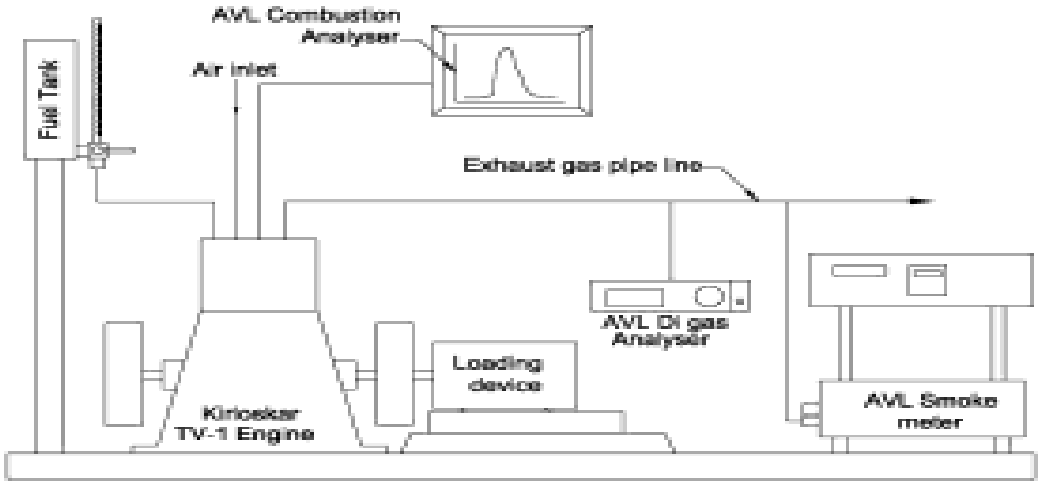

Figure 2: Experimental setup

Table2: Engine specification

Make	Kirloskar – TV1
Power and speed	3.5 kw and 1500rpm
Type of engine	Single cylinder, DI and 4 stroke
Compression ratio	16:5:1
Bore and stroke	80mm and 110mm
Method of loading	Eddy current dynamometer
Method of starting	Manual cranking
Method of cooling	Water
Type of ignition	Compression ignition
Nozzle opening pressure	210 bar
Injection timing	23º before TDC

Speed of the engine was maintain constant speed at 1500 rpm under varying load conditions to measure the performance parameters such as brake thermal efficiency, brakepower(BP), brake specific fuel consumption (BSFC) and exhaust gas temperature and also to measure the emission parameters like carbonmonoxide(CO), unburned hydrocarbon(HC) and nitrogen oxide(NO) emissions for both diesel and the prepared test fuels with the help of AVLDIGas 444analyzer.

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IV. RESULTS AND DISCUSSION

4.1 performance characteristics

4.1.1 specific fuel consumption

Figure 3. shows the variation of specific fuel consumption with brake power. Biodiesel is blended with different proportions B5, B10, B15, B20, B30. The specific fuel consumption decreases with an increase on engine load
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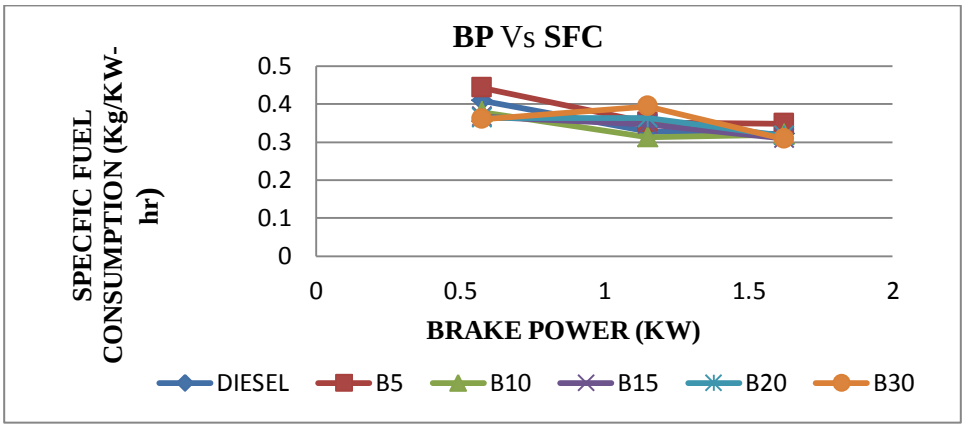

Figure 3 show the variation of BP vs SFC

4.1.2 Brake thermal efficiency

Figure 4. Show the variation of brake thermal efficiency with brake power. Brake thermal efficiency is increase with an increase the engine load.

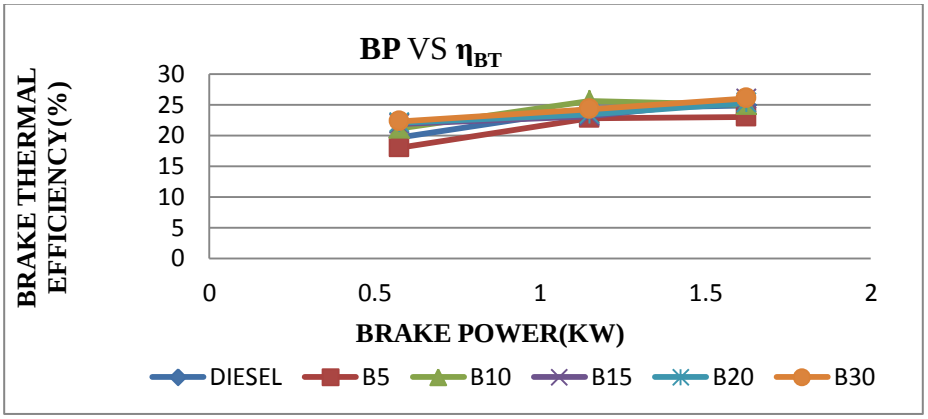

Figure 4 show the variation of BP vs η_{BT}

4.2 Emission characteristics

4.2.1 Carbon monoxide (CO)

Show figure 5 .The Emisssions of carbon monoxide (CO) and Brake power of an engine found that they decrease with increasing the carbon monoxide emission with various BP point.

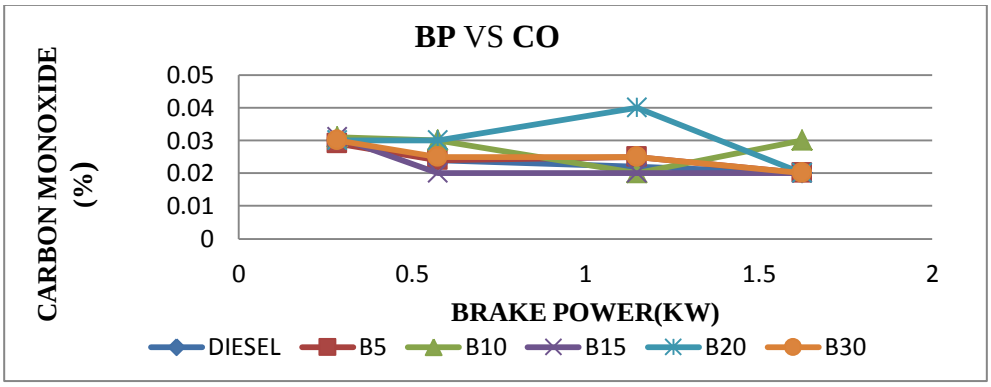

Figure 5 show the variation of BP vs CO

4.2.2 Hydrocarbon (HC)

Show figure 6. The Emisssions of Hydrocarbon (HC) and Brake power of an engine found that they decrease with increasing the carbon monoxide emission with various BP point.

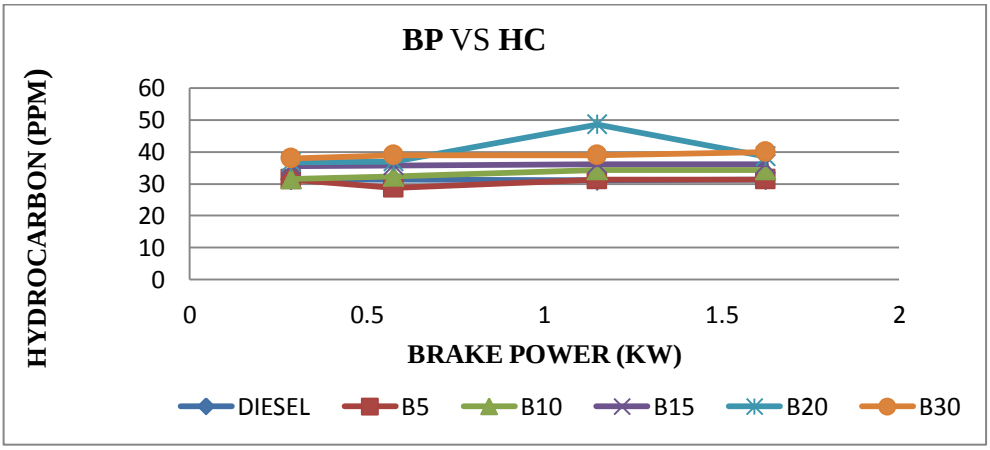

Figure 6. Show the variation of BP vs HC

4.2.3 Carbon dioxide ($CO_{2)}$

showFigure 7 The Emission of CO_2 and Brake power of an engine found that they decrease with increasing the carbon dioxide emission (CO_2) with various brake power points.

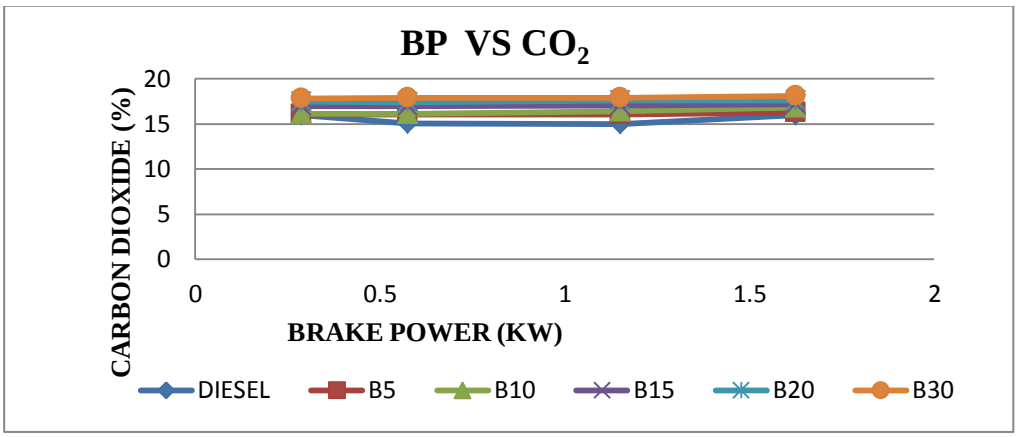

Figure 7 . Show the variation of BP vs CO_2

V. CONCLUSION

The performance and emission characteristics on single cylinder DI- diesel engine fuelled with custard apple seed (annonasquasoma) biodiesel is blended with barium oxide nanoparticle. The biodiesel is blended with different ratio B5, B10. B15, B20, B30 is compared to diesel. Performance and emission parameters like Brake thermal efficiency, specific fuel consumption, mechanical efficiency, CO, HC, CO_2, O_2 emissions are measured, compared and analysed. Based on the experimental result, the following conclusions are obtained.

The performance and emission test of all parameters are decrease with increasing at various brake power points.

- The specific consumption of biodiesel (0.3 kg/ kwhr) is maximum decrease at 1.62 kw BP point.
- The brake thermal efficiency of biodiesel (27%) is maximum increase at 1.62 kw brake power point.
- The carbon dioxide (CO_2) emission of biodiesel (16.75%) is maximum decrease at 1.62 kw BP point.
- The hydrocarbon(HC) emission of biodiesel is maxium decrease (31.28 Ppm) at 1.62 kw BP point.
- The carbon monoxide (CO)emission of biodiesel (0.02%) is maximum decrease at 1.62 kw brake power point.

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