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INVESTIGATION OF ADDITIVE ON WORKING BEHAVIOR OF BIODIESEL OPERATED DIESEL ENGINE

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ABSTRACT :
Nowadays, researchers are view in multidimensional of the consumption of fossil fuels, energy conversion and emission control. Many researches proved that biodiesel is the best alternate sources for conventional diesel fuel. In worldwide biodiesel is extracted from vegetable oil obtained from transesterification process. In the present investigation, the nerium oil methyl ester (NOME) with L-ascorbic acid as additive is used as fuel in order to find out working characteristics of diesel engine. The NOME) proportions with 1% L-ascorbic acid (LA) as additive. The break thermal efficiency (BTE) of B20 with 1% of LA is 3.12% higher than diesel. The brake specific fuel consumption (BSFC) decreased 3.84% by adding of LA additive with B20 blend (B20+LA 1%). The hydrocarbon (HC), carbon monoxide (CO) and oxides of nitrogen (NO_x) are found reduced than that of diesel.
Key Words: Nerium biodiesel, LA,BTE, Emission, diesel engine

INTRODUCTION :

Investigation of alternative energy sources have been continuing widely because of increasing Consumption of fossil fuels, energy conversion and global warming issue as such situation demand for searching alternative fuels for conventional diesel engines. Vegetable oil had a promise as suitable alternative source for conventional diesel engine. Vegetable oils had higher viscosity because it contains triglycerides and fatty acids. The converted free fatty acid and vegetable oil esters through why transesterification process is called as biodiesel. Now a day's biodiesel has used as alternate for diesel because it have more advantage like global warming benefits and mainly it is converted from renewable vegetable source. And another one benefit of biodiesel is operates in diesel engine with little (or) no modification. [1-4]. Extraction of biodiesel is mainly from edible oils like pumpkin, sunflower, castor and some other vegetable oils. Since india is not satisfied in the production of edible oil with compliance of non edible oils that means neem, nerium, rubber and etc., these seed oil esters are used as alternate for pure diesel. The working behaviour of vegetable oil biodiesels such as sunflower oil, castor oil, jatropha biodiesel are studied than diesel. From the investigations sunflower has higher BTE for various load conditions. Among the biodiesel research sunflower oil methyl esters have higher NOx emission. Whereas biodiesels emits lower in pollutants than diesel fuel. It also emits less amount of toxic gases and minimum amount of CO_2 because of addition of methanol. Some researchers found that slight change in the NOx, CO, and HC over pure diesel. Usage of non edible vegetable oil biodiesels showed increases exhaust gas temperature at full load condition [5-15]. The PPDA, LA, AT, 1,4- dioxane, Leaf extract are included to mixed in Annona biodiesel (MEAO), mango seed biodiesel (MEMSO), calophyllum biodiesel, sapota biodiesel (B20) and Annona–Eucalyptus oil blend. The NO_x emission for MEAO + LA200, 4ml of LA+MEMSO, leaf extract with (B20), 0.010% of PPDA+MEAO, MEAO + P200, A20-10 ml of 1,4-dioxane, 1.5% of leaf extract and combination of Annona–Eucalyptus oil to AT A-tocopherol acetate are lowered by 23.38%, 9%, 42.15%, 25.51% and 23% respectively than B20 without additive. Also other pollutants are reduced for all antioxidant additive except leaf extract with (B20) and 4ml of LA+MEMSO as compared with B20. However, the BTE and BSFC are observed with no effect for all antioxidant additives except A20-10ml of 1, 4-dioxane [16-24].

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MATERIALS AND METHODS:

Transesterification

In this transesterification process 2000 ml of nerium oil is kept in the flask. Simultaneously on the other side 20 grms NaOH and calculated amount of methanol is mixed until both are dissolved. Then the dissolved NaOH and methanol is mixed with the nerium oil and it is undergoes to stirring process by using magnetic stirrer. At the time of stirring process it is kept at 60 ºC in the hit plate. This process allowed for upto 2 hours and it took 6 hours to settle down the unwanted glycerin at beaker bottom and the required NOME is floated on the top of the beaker. Then the unwanted methanol is removed by heating the coarse biodiesel for 15-20 minutes at 100°C. This coarse biodiesel have some amount of the impurities which are removed by washing process with 500ml of water. Then the neat solution is called nerium oil methyl ester.

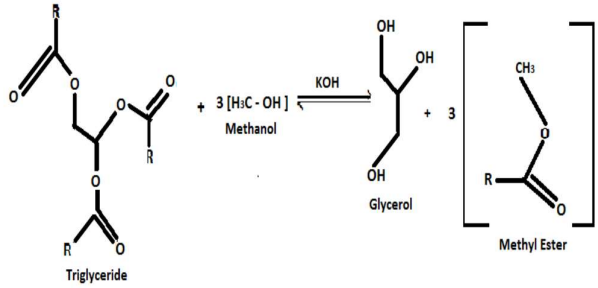

Fig. 1. Transesterification

Properties of Nerium biodiesel compared with diesel

The property of nerium biodiesel is shown in Table 1.

Table 1. Properties of Nerium Biodiesel

Properties	Units	Diesel	Nerium oil methyl ester(NOME)
Calorific value	MJ/kg	43.2	42.19
Kinematic viscosity 40℃	cst	3.1	3.7
Density	Kg/mm^3	830	850
Flash point	℃	65	70
Fire point	℃	69	83
Cetane number		45	55

Experimental Setup

A constant speed single cylinder diesel engine is connected with eddy current dynamometer which is used to find out the working behaviors. The schematic diagram of the engine is shown in Fig.2.

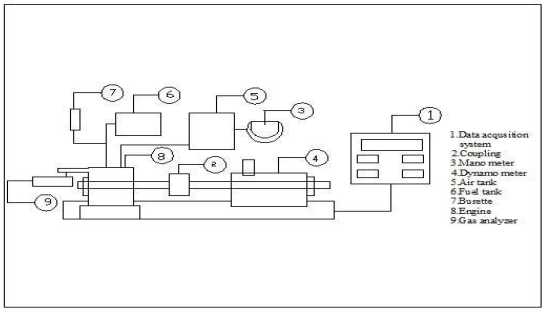

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Fig. 2. Experimental set up

Engine Specification:

The Table 2 shows the specification of diesel engine.

Table 2. Specification of diesel engine

Manufacturer	Kirloskar oil engines limited
Type of Engine	Vertical, 4-Stroke Single cylinder
Model	SV1
Rated Output	5.2 kW
Speed	1500 rpm
Compression Ratio	17.5:1
Bore and stroke	87.5 x 110 (mm)

Experiment procedure :

The manual diesel engine was started by using mechanical lever and allowed to run 15-20 mins to attain the steady state condition with constant speed of 1500 rpm. Then various performance, combustion and emission values were noted for different load conditions. The five gas analyzer measures CO, HC, NO_x and particulate matters. Smoke capacity of engine is measured by smoke meter. Three sets of readings were taken during each load condition for standardizing the value.

RESULTS AND DISCUSSION :

BTE:

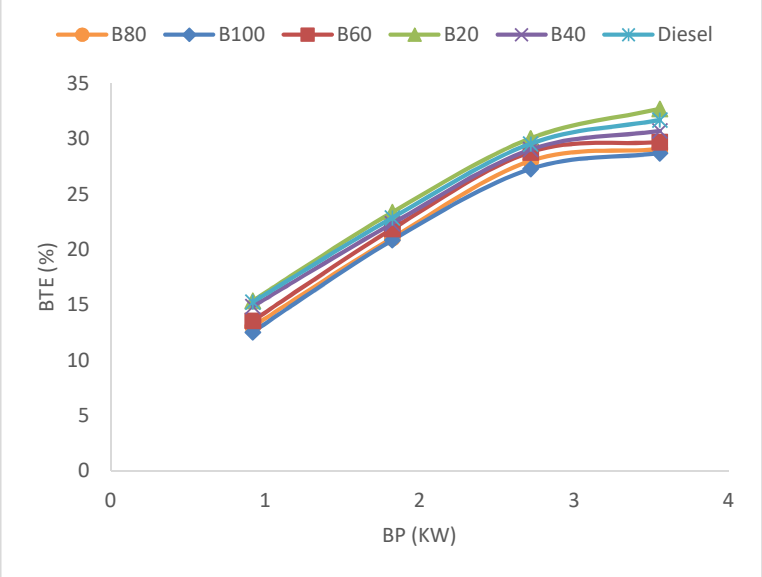

Fig.3. BTE Vs BP

Fig 3 shows the deviation between BP and BTE for different proportions of NOME with LA. It shows that diesel inferred higher BTE. The NOME have lower heating value, high viscosity and low volatility than diesel. The Adding of 1% L-ascorbic acid as an additive, improve the oxidation stability of nerium oil biodiesel and also biodiesel 1% (NOME) having excess oxygen content, When this leads to complete combustion of B20+LA 1% blend have increase in BTE by 3.12% than diesel.

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BSFC

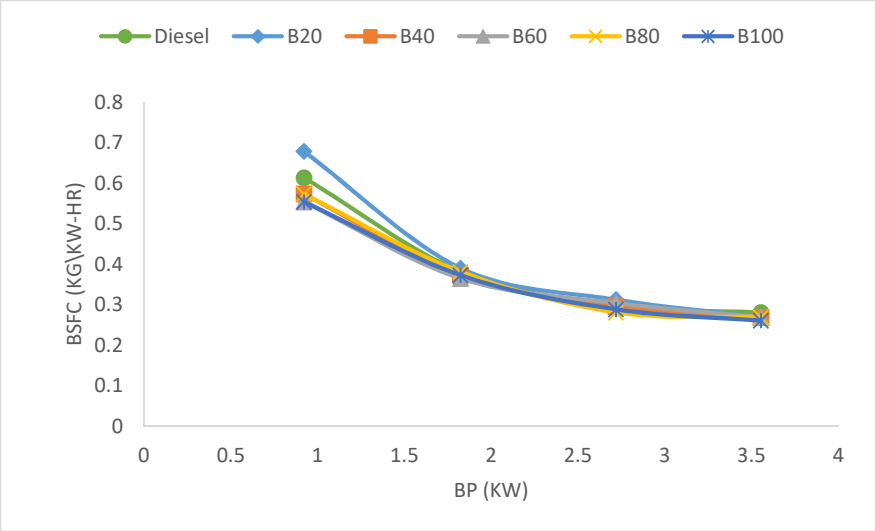

Fig. 4 BSFC Vs BP

Fig 4 shows the deviation between BP and BSFC for different proportions of NOME with LA. The BSFC for NOME proportions were higher because of lower heating value. Further it is also seen by the Fig. 4. At full load condition BSFC decreased 3.84% by adding of LA additive with B20 blend (B20+LA 1%). This is owing to proper and more complete combustion which results from anti oxidant addition.

4.3 EGT

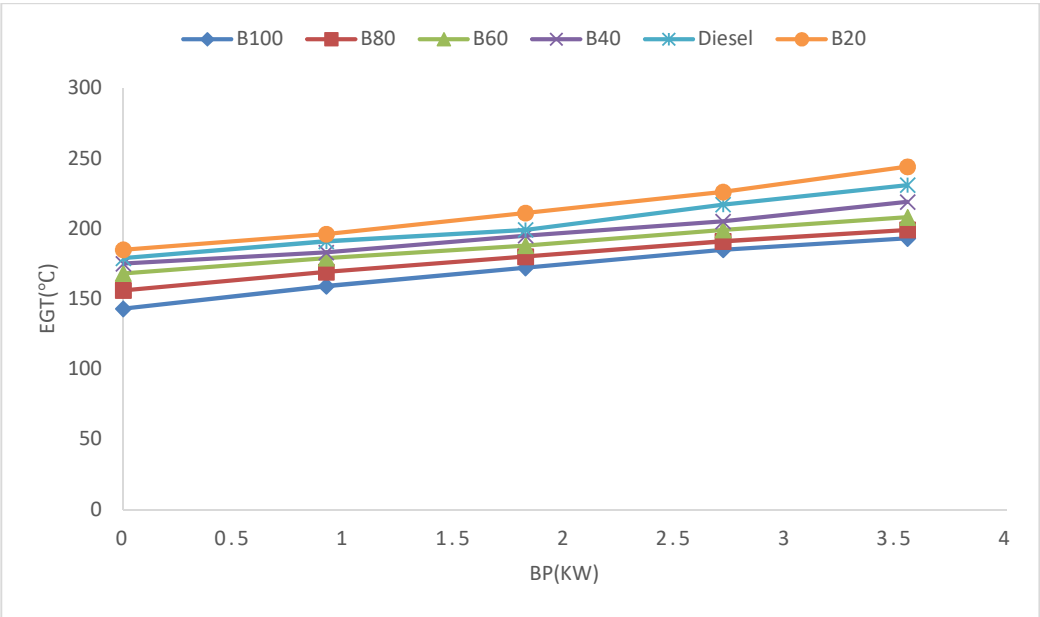

Fig. 5. EGT Vs BP

Fig 5 shows the deviation between BP and EGT for different proportions of NOME with LA. The increase of EGT is observed for neurim oil esters proportions and adding of LA additive. At full load condition B20 (B20+LA 1%) blend produces highest EGT at full load condition over all other

blends. This is due to increase in temperature of combustion which enhances complete combustion than that of other proportions.

HC

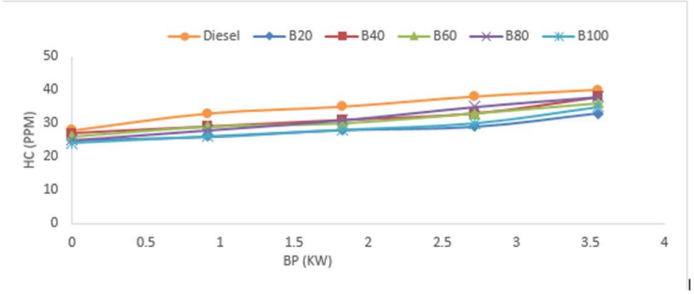

Fig. 6. HC Vs BP

The Fig 6 shows the deviation between BP and HC for different proportions of NOME with LA. From the results the neurim oil methyl esters contains higher O_2 because of this the HC emission is reduced by complete combustion and also LA antioxidant additive is a reducing agent and reduce functional groups available in the NOME with 1% of L-Ascorbic acid. The B20 blend of nerium oil methyl ester has 17.5% lesser HC emission at full load condition.

CO

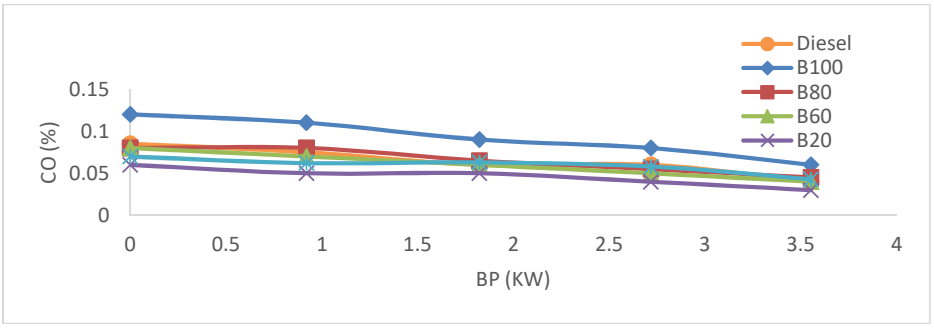

Fig. 7. BP Vs CO

Fig 7 shows the deviation between BP and CO for different proportions of NOME with LA. The combustion values are increased and reducing the carbon monoxide due to available of O_2 in the NOME. The B20 blend of nerium oil methyl ester has 25% lesser CO emission. The adding of LA at 1%, shows the decrease of CO Emission. This is due to OH radicals available in the NOME with NA.

4.6. NO_x

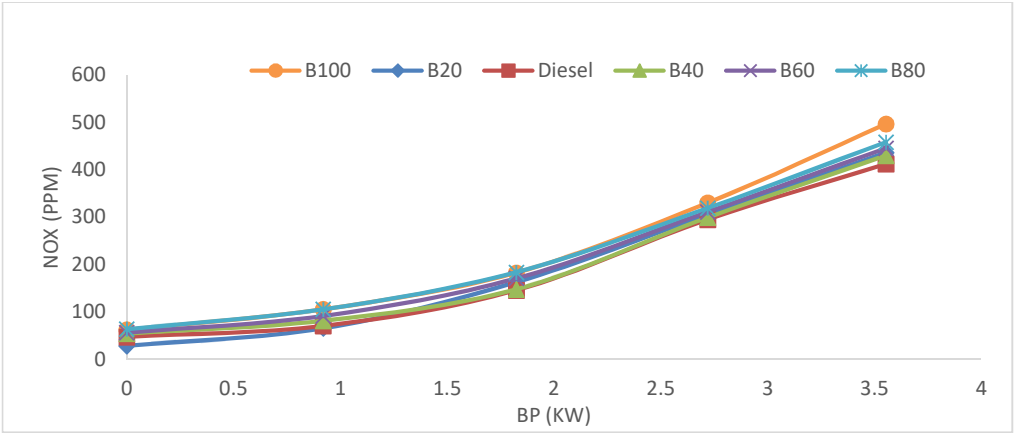

Fig. 8. BP Vs NO_x

Fig 8 shows the deviation between BP and NO_x for different proportions of NOME with LA. The NO_x for NOME is slightly high because of higher CN, O_2 and combustion temperature. It is also higher for NOME and its proportions. Further, The NO_x has been reducing by inclusion of LA shows reduction of formation of free radicals by antioxidants.

4.7. Smoke

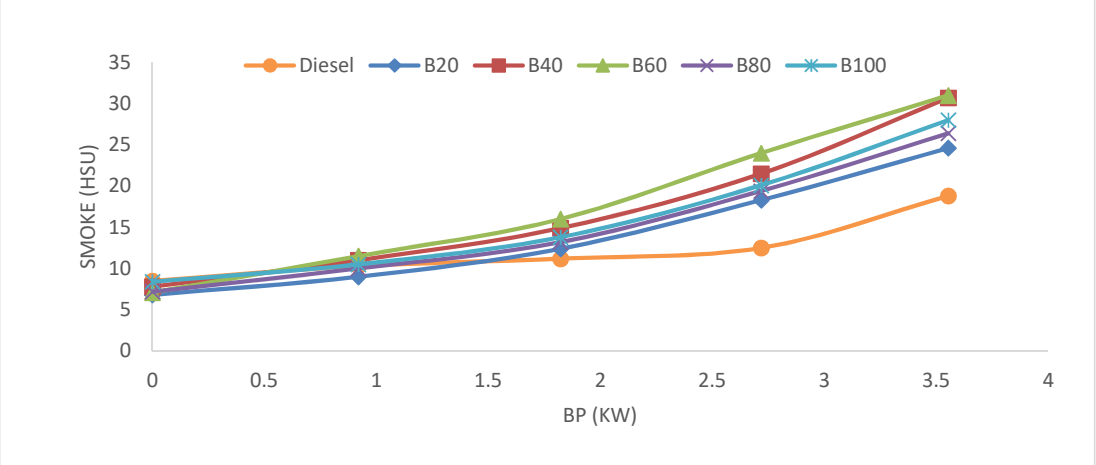

Fig. 9 BP Vs Smoke

Fig 9 shows the deviation between BP and smoke for different proportions of NOME with LA. The NOME with LA shows higher smoke than diesel. This is due to incomplete combustion by NOME has higher combustion temperature.

CONCLUSION :

The B20 of NOME with LA shows the increase of BTE by 3.12% higher and lowered by BSFC of 3.84% lower than diesel. Nerium bio diesel show better performance with 20% blend with 80% conventional fuel. The results show that 17.25% and 25% lower, HC and NO_x than diesel at maximum load. Smoke is slightly higher than diesel. The B20 of NOME can be substitute mineral diesel without affecting engine performance.

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