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EFFECTS OF ADDITIVES IN A SINGLE CYLINDER CI ENGINE FUELLED WITH BLENDS OF BIO DIESEL

S. SIVAGANESAN*, A. MAHAVISHNU and M. CHANDRASEKARAN

Department of Mechanical Engineering, School of Engineering, Vels University, CHENNAI (T.N.) INDIA

ABSTRACT

Countries are developing the alternate energy sources for suitable alternate diesel fuels which act as environment friendly. Searching the alternate fuels mainly stands from protecting or reducing the environment and long term usages of conventional Hydrocarbon fuels. Basis of different alternate sources, fuels are find from triglycerides from vegetable oil or fat oil presence a possible alternate as substitute diesel. Alternate energy Triglycerides are having a properties which is near by the diesel fuel properties like high temperature characteristics has concluded to possible ways. Fatty acid methyl ester (FOME) which is clarified from triglycerides using the method tranesterification methanol. Renewability of biodiesel is most advantage and environment friendly by reducing the level of carbon gases at the time of emission to atmosphere and decrease the green house effect.

Key words: Methyl ester neem oil, Transesterification, Al_2O_3 Nano powder.

INTRODUCTION

Alternate renewable source like bio diesel is alternate fuel for diesel which is made from Vegetable or Animal fats. A blend with diethyl ester with bio diesel has most equal characteristics compared to diesel fuels lowest emission in engine. Carbon gases are decreased by using the renewable energy source bio diesel. At the time of manufacturing the biodiesel from vegetable oil has the neutral level of hydrocarbons. During combustion and manufacture carbon dioxide is offset by CO_2 consumed during the growth of the crops. Biodiesel works with current engine technology and environment and helps to our infrastructure. Bio diesel is the clean fuel and does not require any fleets and need not to purchase a special vehicle. Now a days global environment affects from fossil fuels due to population of transports lowest efficient of manufacturing process. To increase the

*Author for correspondence; E-mail: sivaganesanme@gmail.com

efficiency of progress has to use the current reserve oil. Easy way of usage and the runs with all version of diesel engines, no need to modify the applied engine. Green house gases are reduced by biodiesel upto 45% compared to petrol and diesel engines. And also decreases the particulates of hydrocarbons, carbon monoxide and improving the quality of air. Production of biodiesel based on the process of tranesterification, which acts glycerides from pure edible oil by using the catalyst of methanol and alkaline. In this study alternate source of energy is possible by bio diesel and acts friendly to the global environment. Pollution control occurred by this alternate source bio diesel and production of this biodiesel is in ease of access. Performance of bio diesel is comes near by the diesel fuels .Emission of exhaust is arrested by this Bio diesel and helps to save the reserve fuels.

Methodology

Study of Engine performance by using alternate energy source as neem oil methyl ester which blends with Al_2O_3 nano powder. Neem oil is esterified and transesterified for producing methyl ester as bio diesel which characteristics comes nearby diesel. Adding Different quantity of Al_2O_3 nano powder (0.1 mg, 0.2 mg, 0.3 mg and 0.4 mg) experiment done with Kirloskar single cylinder CI engine. Performance characteristics comparison between different proportion of blended bio diesel with Al_2O_3 nano powder and diesel. Testing of single cylinder CI engine performance, emission and smoke are calculated and comparison shows in graphical way.

Neem oil methyl ester

Neem oil is selected for producing bio-diesel. It goes under the process of Esterification and transesterification process. The procedure is to modify the composite of oil like extraction of solvent to remove the blends of components. Yield of neem oil can be occurred from seeds of neem kemel widely varies from 25% to 45%. Neem seeds are converted into oil by the method of pressing of seeds through cold pressing or incorporating temperature controls. In most of factories by using hexane extracts the neem oil remains from seed cake. Result of extracted solvent oil has the less quality compared to the oil produced by cold pressing process and also applied in soap manufacturing. The neem oil content with azadirachin has a range from 300 ppm to 2500 ppm depends upon the raw material (neem seeds) quality and extraction which is used for producing neem oil and also byproducts like glycerine, alcohol and amount of water. These byproducts are must be removed by the process of dependent. The required alcohol mixed to create the following equivalents like triglyceride and several part of alcohol for the completion of reaction. In nature glycerine has the higher density compared to bio diesel and this variations are exploited to differ the glycerine byproduct. By the process of distillation methanol has been separated and then reused and it has been out as a waste. Other byproduct soap is converted into acids. Triglyceride which is reacting with alcohol like ethanol (2) results of ethyl ester of fatty acids (3) and glycerol. Fats and oil of animal and vegetables are made of triglycerides as well as esters consist of three fatty acids with tetrihydric alcohol. Process of tranesterification depronote the alcohol as a stronger base of nucleophile. The ethanol and methanol are used for this process. Inputs are only the triglyceride and alcohol. At the time of esterification process alcohol reacted by the triglyceride presence of catalyst Process, the alcohol is deprotonated with a base to make it a stronger nucleophile. Commonly ethanol or methanol is used. As can be seen, the reaction has no other inputs than the triglyceride and the alcohol. During the esterification process, the triglyceride is reacted with alcohol in the presence of a catalyst, usually strong alkali (NaOH, KOH, or Alkoxides).

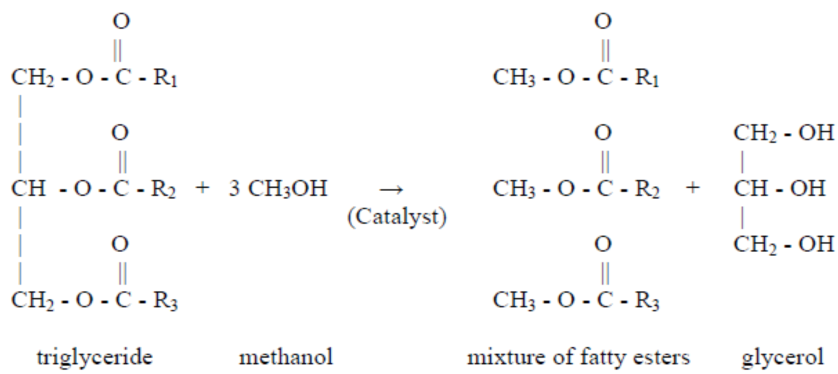

Fig. 1: Transesterification chemical reaction

The reaction with alcohol and fatty acids are creates mono alkyl ester and crude form of glycerol. The reversible reaction between bio-lipid and alcohol. Excess alcohol should be added to run the solvents to protect the conversion complete. Characteristics of neem oil, NOME and diesel comparison shown in below.

Table 1: Comparison of fuel parameters

Fuel parameter	Diesel	Neem oil	Nome
Viscosity @ 40c in cst	5	57.4	6.42
Cetane number	50	38	46
Calorific value in kcals/kg	10270	8403	8556
Specific Gravity @15°C/15°C	840	919	870
Flash point in ^{0}C	56	201	180

Alumina nano powder

Protecting by bold oxide shell with the help of melt dispersion mechanism, fast heatening process of alumina nano powder occurred. This mechanism acts on Al core generates a much internal compressive pressure (single to multi GPa). Shell spallation leads by tensile hoop stress in the alumina.

Table 2: Property of Al_2O_3 nano

Thermal	Unit of measure	SI/Metric
Thermal conductivity	W/m°K	35
Coefficient of thermal expansion	10^{-6}/°C	8.4
Specific heat	J/Kg.°K	880
Maximum temperature	°C	1750
Electrical	**Unit of measure**	**SI/Metric**
Dielectric strength	ac-kv/mm	16.9
Dielectric constant	@1 MHz	9.8
Dissipation factor	@1 KHz	0.0002
Loss tangent	@1 KHz	-
Volume resistivity	Ohm.cm	$>10^{14}$
Mechanical	**Unit of measure**	**SI/Metric**
Purity	%	99.90%
Average particle size	nm	18
Morphology	-	Sphere
Density	gm/cc	3.89
Color	-	White
Elastic modulus	Gpa	375
Bulk modulus	Gpa	228
Shear modulus	Gpa	152
Poisson’s ratio	-	0.22
Compressive strength	Mpa	2600
Hardness	Kg/mm^2	1440
Fracture toughness	Mpa.m$^{1/2}$	4

Deagglomaration equipment nome + AL_2O_3 nano

The conversation and deagglomeration of solids to liquid. This process is most important applications of devices which runs by the ultrasonic. The individual and separate particles are held by the different forces of nature liquid surface tension and Van Der Waals forces. The higher viscosity of fluids made by this effect. The forces of attraction should be overcome in deagglomerate and blend the particles in liquid media.

EXPERIMENTAL

In this study we chosen the kirloskar engine which is single cylinder, direct injection and computerized engine due to it has the character to stand in high pressure encountered and applied in agriculture and factorial fields. So this type of engine chosen in this study and engine specification is given in Table 3.

Fig. 2: Blends of neem oil methyl ester with Al_2O_3 nano

Table 3: Engine specification

No of cylinders	1
No of strokes	4
Rated power	5.2 KW@1500 rpm
Compression ratio	17.51
Stroke length	0.11 m
Orifice diameter	0.02 m
Cylinder diameter	0.0875 m
Dynamometer arm length	0.195 m

The layout of experimental, which is used to study the performance of engine is shown in below.

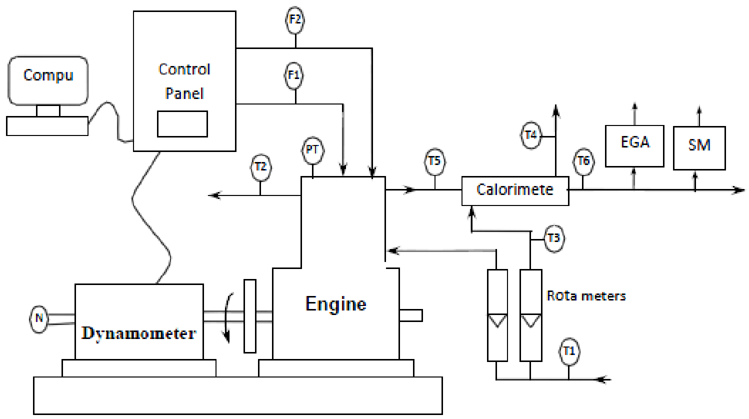

Fig. 3: Experimental setup

The exhausts from the engine emitted gases are defined by five gas analyzer model of 5G-10 planet equipment. Necessity of charging is must to the analyzer for continuous experiment testing. The connector of harness one is connected to analyzer and the other one is connected the engine where the exhaust emission. In Fig. 3 shows the analyzer placement after the engine exhaust. The principle non dispersive infrared absorption as light absorption in the region of infrared is used for measurements. The light source produced the broadband infrared radiations across a gas filled chamber such as CO_2 or methane. These gas attracts the radiations of known wavelength and which is measure the exhaust gas concentrations. 0.2, 1, 2, 3, 4 and 5.2 kw loads are applied and pressure of injection 210 bar rated speed of 5.2 kw temperature of exit coolant is 65^0C. The esterified neem oil blends with different quantity of Al_2O_3 nano powder like 0.1 g, 0.2 g, 0.3 g and 0.4 g. These blends are used in this experiment. The blends with vegetable oil and diesel heated externally stated temperature earlier to injection into the cylinder taken for testing. Before taking the readings have to warm up and stabilize the engine. Observations are recorded thrice repeated to find a actual value. The various factors like brake mean effective pressure, brake thermal efficiency, brake power, efficiency of mechanical and volumetric, specific fuel consumption, exhaust temperature peak pressure and composition of exhaust gases were calculated. The maximum applied load calculated. The level of fuel checked periodically and to check the fuel valves were opened. The cooling water supply was opened since it is a water cooled engine. The decompression lever is kept in the open position. The engine is started in no load condition. The engine is allowed to run for 3 minutes before it attains steady condition. The time taken for 10 cc of fuel consumed by the engine at each load was noted

RESULTS AND DISCUSSION

Specific fuel consumption are decreased in all range of additives mixture shown in Fig. 1 Decreased level is high. There is no significant variation in BSFC with the addition of additive mixtures.

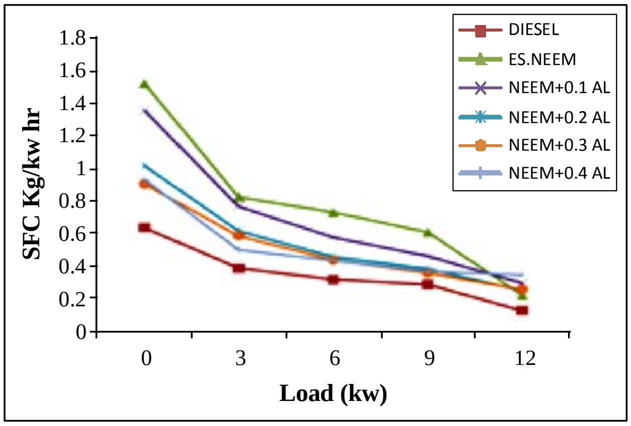

Fig. 1: Variations of SFC on load

The low range of Brake thermal efficiency in MENO at all range of loads. Fig. 2 shows Break thermal efficiency slightly increases with the addition of additive mixtures.

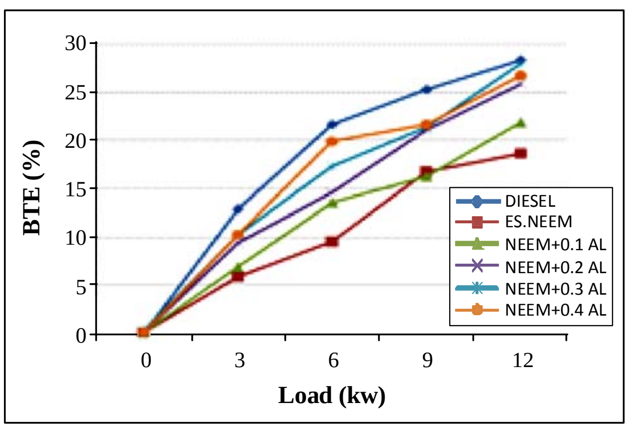

Fig. 2: Variations of BTE on Load

Increase of engine load increase the emission of NO_x. NO_x decreases at the time of adding additives compare with the pure diesel. In order to increase the additives upto 0.2 g decreases the NO_x emission. This addition of Al_2O_3 mixture decrease the NO_x emission by

27%. Fig. 3 shows the different range of emission combination of NO_x with Brake power of engine. At the large adding of additives 0.4 g reduces the NO_x by 22.37% compared to diesel at the time of full load condition.

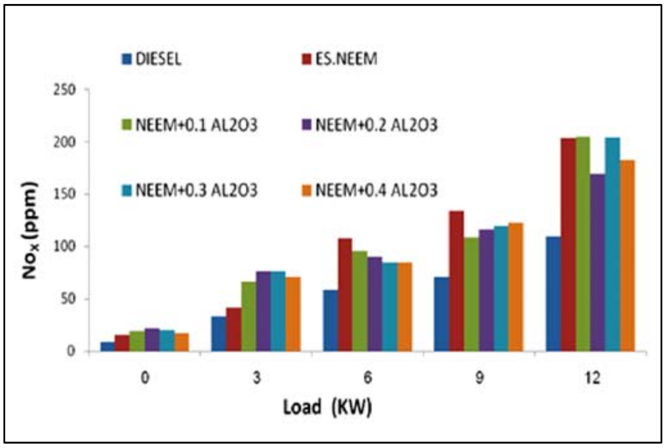

Fig. 3: Variation of No_x on Load

Fig. 4 shows the decreasing of hydrocarbons by increasing of additives by 0.2 g. In order 0.2 g reduces the HC upto 22%. Performance increased compare than diesel.

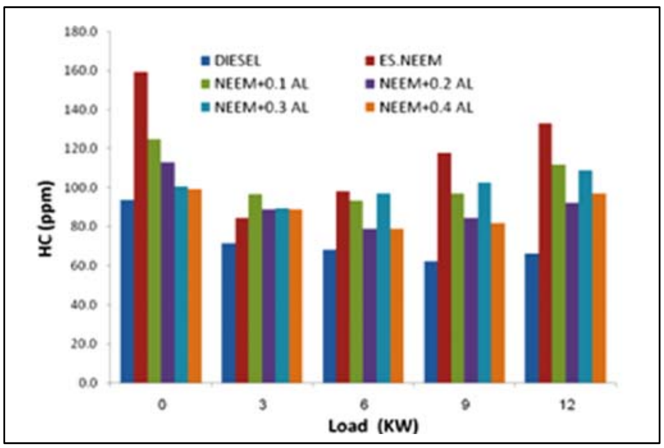

Fig. 4: Variation of HC on load

All neem-mixture with additive slightly decrease the CO_2 compared to pure biodiesel. There is no significant variation in carbon dioxide emissions with the addition of additive mixtures at maximum load. Fig. 5 shows the variation of carbon dioxide emission with brake power.

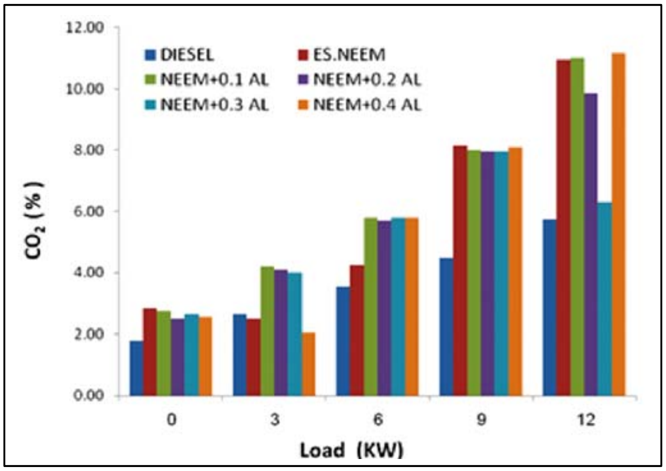

Fig. 5: Variation of CO_2 on Load

Gradual increasing of engine load CO emission decreases. There is no significant variation in CO emissions with the addition of additive mixtures after Al_2O_3. Incomplete combustion fuel air ratio creates CO emissions. Fig. 6 shows the variation of carbon monoxide with BP. Mixture of Al_2O_3 decreases the CO emission by 29.41% at maximum load condition.

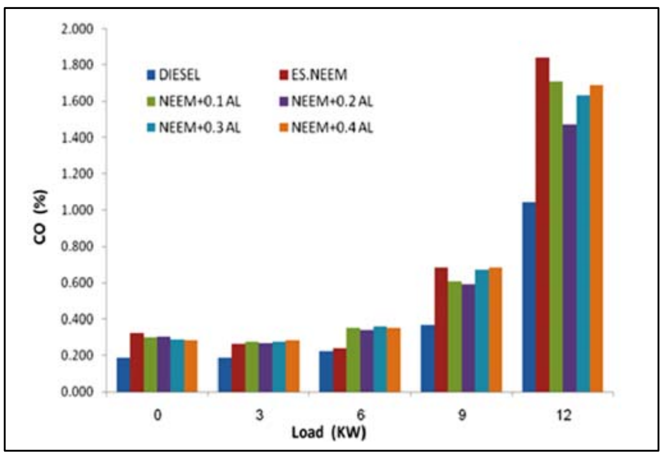

Fig. 6: Variation of CO on load

All neem-mixture with additive slightly decrease the oxygen compared to pure biodiesel. There is no significant variation in Oxygen emissions with the addition of additive mixtures at maximum load conditions. Addition of additive decreases O_2 emission compared to pure biodiesel fuel shown in Fig. 7.

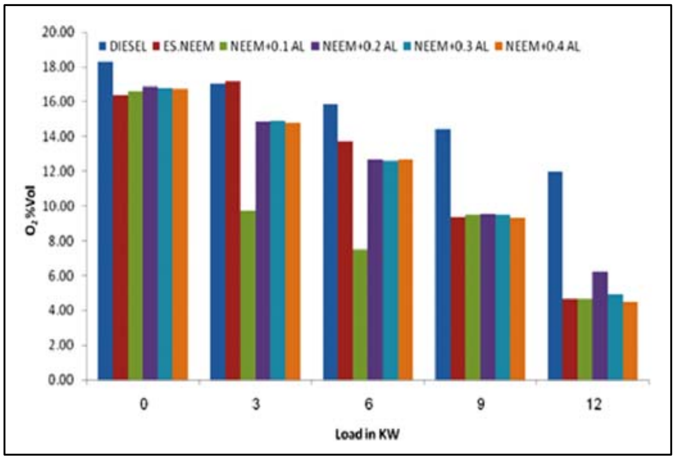

Fig. 7: Variation of O_2 on load

HSU Value increase means high intensity of optical beams passes over smoke filter paper (i.e) Smoke filter paper has more smoke density on it Above Fig 8 shows the Neem + 0.4 g of Al_2O_3 influence more Smoke density on filter paper (i.e) High combustion takes place while adding more Al_2O_3. Addition of additives decreases the smoke at all load conditions.

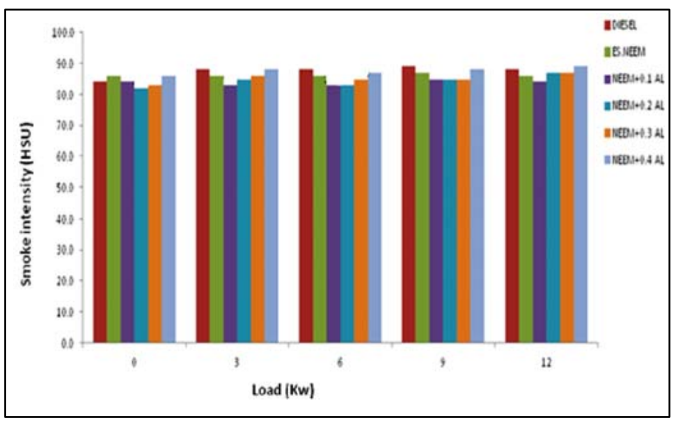

Fig. 8: Variation of smoke intensity on load

CONCLUSION

Analysis and comparison of engine performance and emission characteristics by pure diesel and Bio diesel mixture of Al_2O_3 nano. As per the experimental output conclusions are drawn as graphical representation as follows For MENO 100mg Al_2O_3

mixture, NO_x emissions reduce by 26% compared to pure biodiesel at maximum load range. For MENO 50 mg mixture, HC emissions reduce by 27% compared to pure biodiesel at maximum load range. For MENO 50 mg mixture, CO emissions reduce by 32% compared to pure biodiesel at maximum load range. For MENO 50mg mixture, Smoke Intensity reduces by 9.59% compared to pure biodiesel at maximum load range. There is no significant variation in CO_2 emissions, BTE and BSFC. Based on this study of experiments Bio diesel produced from neem oil mix with nano particles Al_2O_3 reduce the emission level of NO_x, HC, CO and the intensity of smoke.

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