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ANALYSIS ON PERFORMANCE CHARACTERISTICS AND EMISSIONS OF DIESEL ENGINE USING DIFFERENT BLENDS OF CALOPHYLLUM INOPHYLLUM, COTTON SEED OIL, KARANJA.

Omprakash S Baradol
Department of Mechanical Engineering, HSBPVT's COE, Kashti,

Vijaya kumar N J
Department of Mechanical Engineering,
HKBK College of Engineering, Nagawara, Bengaluru

Kishan Kumar K R
Department of Mechanical Engineering,
HKBK College of Engineering, Nagawara, Bengaluru

Gururprasad
Department of Mechanical Engineering,
Mangaluru Marine College, Mangaluru

ABSTRACT
Ecological concernment and energy extremity of the planet has led to the quest of feasible alternatives to the non-renewable fuel source, FAME (Fatty Acid Methyl Ester) is biodegradable, ecological, alternative, and safe, environmental friendly which has a high flash point and is also termed as Bio-Diesel. In upcoming years, in most of the regions of the world production and application of biodiesel has extrinsic fame. It is usually produced by the method trans-esterification.
In this experiment, biodiesel from Calophyllum Inophyllum oil, Karanja Oil Methyl Ester and Cottonseed Oil has been produced using the trans-esterification process. Engine trail have been executed in water cooled, 4- stroke diesel engine. Investigational analysis has been conducted to study the performance and emission on different biodiesel blends of Cottonseed Oil, Karanja Oil Methyl Ester and Calophyllum Inophyllum oil for unequal injection pressures. From the evaluation of obtained results, it can be deduced that the engine operation process is considerably become better with noteworthy subdual in emissions of the CO and HC.

KEYWORDS: Bio fuel, Calophyllum Inophyllum, Cotton Seed Oil, Karanja

INTRODUCTION
The demand for energy utilization in automobiles and agricultural segment in India has been expanding along with the economic advancement. India was facing difficulties in regard to the fuel necessity for increased transportation pressure and was importing of about 70 % of its petroleum demand. Domestic consumption of mineral diesel in India accounted for approximately 16% of the total imports valued about INR 3.4lakh crores in 2012-13[1]. This indicates the economic stress on the country due to diesel consumption. Since pricing of petroleum products like Diesel, Domestic LPG and kerosene continues to be regulated and subsidized. The subsidy / under recovery on diesel alone accounted for 57.78% of the under recoveries (173,523 crores) during the span of two years.

WHY BIO-FUEL

Alternative fuels, which guarantee sustainable advancement with security of supply and lesser ecological implications, are needed. For transport part confronts extra difficulties sufficient energy density and lower pollutant emission potential because their exhaust items are transmitted straightforwardly into the ambient air, which influences human wellbeing. Appropriately arranged execution of major project for advancement of bio diesel in India, there is a possible into following favourable circumstances.

- Biodiesel shows perfect diesel characteristics, with none or minor hardware modifications within the engine it shows a probability of it being utilized as substitute.
- Utilization of biodiesel is useful in decreasing the greenhouse gas emissions.
- Biodiesel may be manufactured from regional available feedstock resources. Thus advancement of biodiesel industry would fortify local industrialization.
- Blending it with diesel, it is able adjust for the fall of lubricity in low sulphur content diesel on the grounds that substance is being diminished in diesel fuels, to make them perfect with EURO-IV or higher measures.

METHODOLOGY

Biodiesel which might be delivered from consumable and non- consumable oils derived from vegetables, reused vegetable oils and creature fat [2]. This bio degradable substances can be converted through trans esterification by changing over tri-glycerides into unsaturated fats alkyl-esters is one such alternative fuel, which can be utilized as a fractional substitute of fossil based diesel. Trans esterification is a reaction, where tri-glycerides exhibit with in the raw material vegetable oils with essential alcohols in presence existence of a catalyst, which delivers essential glycerol and esters.

COTTONSEED OIL METHYL ESTER PRODUCTION

The trans esterification procedure of cottonseed oil was performed utilizing 5 g potassium hydroxide as catalyst and 200 ml methyl liquor for each 1L [3]. To begin with, the cottonseed oil was heated to around 700C in a reactor then; the catalyst was blended with methyl alcohol to disintegrate and added to the heated cottonseed oil in the reactor. After the blend was blended for 1 hour at an altered temperature of around 700C, it was exchanged to other container and the partition of the glycerol layer was allowed. Once the glycerol layer was settled down, the methyl ester layer framed at the upper piece of the compartment was exchanged to another vessel. After that, a washing procedure was completed to evacuate some unreacted rest of methanol and catalyst utilizing refined water and blown air. At that point, a distillation procedure at around 1100 C was employed for evacuating water contained in the esterified cottonseed oil. At last, the created cottonseed oil methyl ester was left to cool down [4].

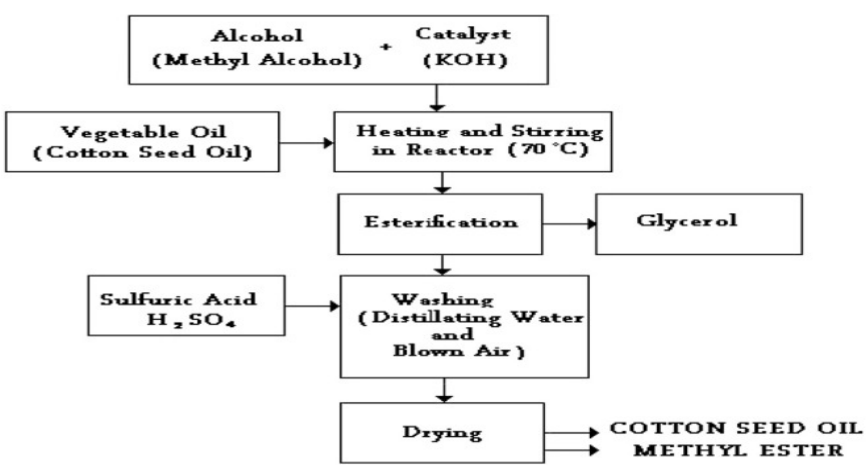


Figure 1: Flow chart of COME [5]

CALOPHYLLUM INOPHYLLUM PRODUCTION

The oil is initially warmed to 50ºC then 0.7% (by wt. of oil) sulphuric acid is to be added to oil and methyl alcohol about 1:6 molar proportion (by molar mass of oil) is added. Methyl alcohol is added in excess quantity to accelerate the reaction. This reaction was continuing with stirring at 650 rpm and temperature was controlled at 55-57ºC for 90 min. The fatty ester is isolated after regular cooling [6].

At second level, the isolated oil from the isolating funnel needs to experience trans esterification. Meth-oxide (methanol + sodium hydroxide) is added with the above ester and heated to 65°C The same temperature is kept for 2 hr. with connected stirring and after that, it undergoes natural cooling for 8 hr. Glycerol will store at the bottom of the flask, and it is isolated out by a separating pipe. The remainders in the flask are the esterified vegetable oil (biodiesel) [7].

PROPERTIES OF BIOFUELS

Table.1 Physical-chemical Properties of Biofuels

Properties	Unit	Diesel	Honne Oil	Karanja Oil	Cotton Oil
Density	gm/cc	0.84	0.895	0.865	0.85
Viscosity(at 40 0C)	cst	2.5	4.43	4.78	4.35
Calorific Value	KJ/Kg	43,560	39650	38540	39,648
Specific Gravity		0.84	0.9	0.925	0.91
Flash Point	ºC	52	173	225	207
Fire Point	ºC	61	181	236	219

Table.2 blending percentage of fuel

Notation	Fuel Quantity (Liter)	Bio-Diesel Quantity (ml)			Diesel Quantity (ml)
		Honne	Karanja	Cotton	
O1	1	300	400	-	300
O2	1	100	500	-	400
O3	1	200	600	-	200
O4	1	300	-	400	300
O5	1	100	-	500	400
O6	1	200	-	600	200

EXPERIMENTAL SETUP

The experiment is completed at constant rated speed, comparing the performance of C.I engine by varying its Injection pressure on Diesel and Using Different Blends of Calophyllum Inophyllum, Cotton Seed Oil, Karanja. The specimens are arranged by utilizing 1000 ml measuring container and a graduated test tube.

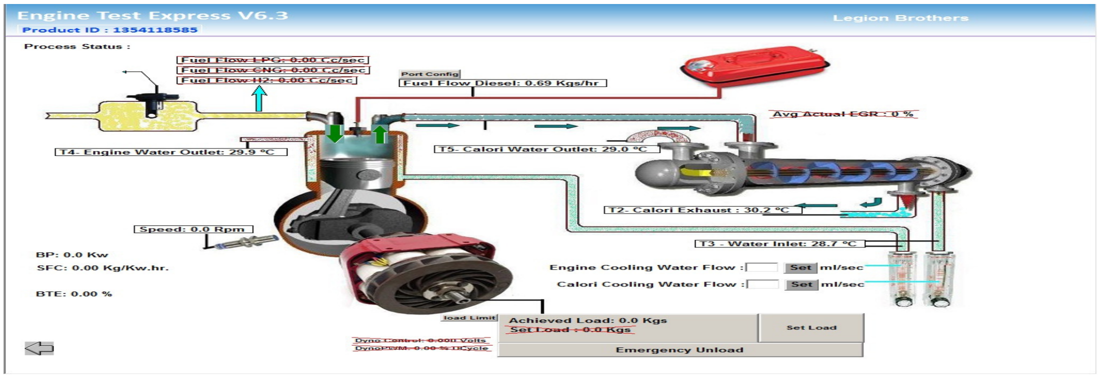


Figure 2: Schematic Diagram of the Experimental Set-up.

RESULT AND DISCUSSION

I) BRAKE THERMAL EFFICIENCY

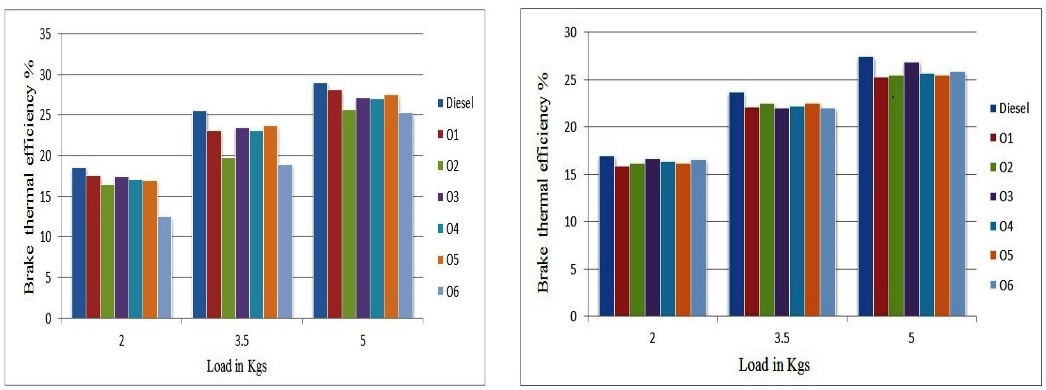


Figure 3: brake thermal efficiency VS load for Injection Pressure 180bar and 220 bar respectively

Above graph displays the variation of brake thermal efficiency versus load for Injection Pressure 180bar and 220 bar respectively. It is found that the brake thermal efficiency is steadily increased with the increases in load. The thermal efficiencies of biodiesel fuel blends are reducing with comparison to diesel fuel. This is mainly because of lower heating value and inferior combustion of Bio fuels.

II) EXHAUST GAS TEMPERATURE

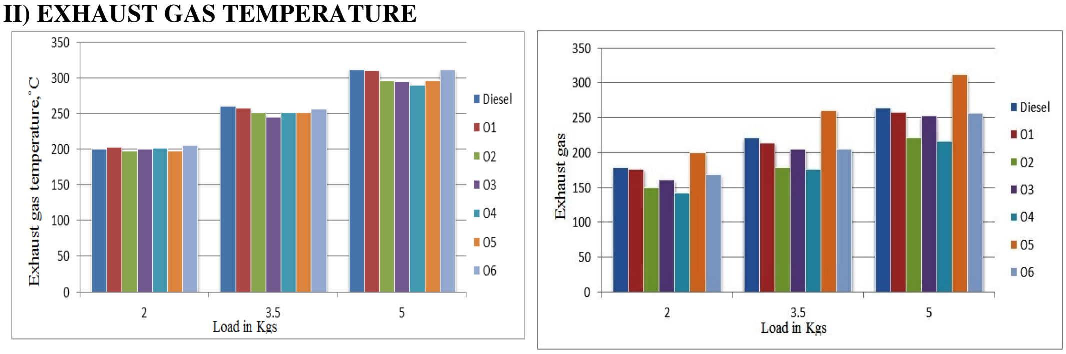
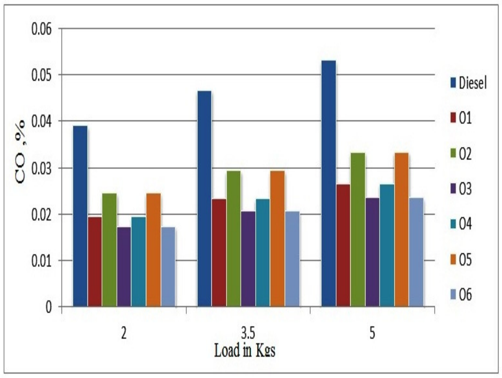


Figure 4: Exhaust gas temperature versus load for Injection Pressure 180bar and 220 bar respectively

Above graph gives the variation of Exhaust gas temperature versus load for Injection Pressure 180bar and 220 bar respectively. The exhaust gas temperature reduces with increase in the bio fuel blend percentage and the values are smaller in comparison to diesel fuel as shown in the graphs. Lower viscosity is the main reason for lower exhaust gas temperatures for Bio fuels-diesel blends. Because lower the viscosity lower the penetration of the fuel into the combustion chamber, which results in the smaller amount of heat is produced.

III) CARBON MONOXIDE EMISSION



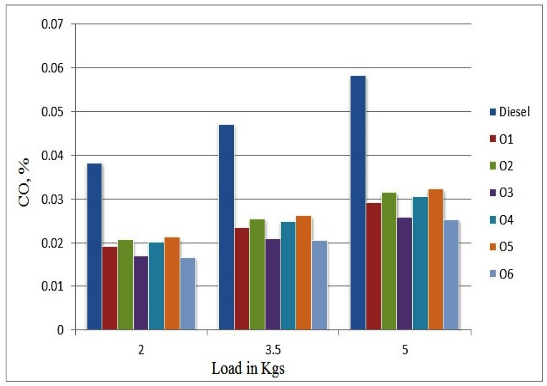
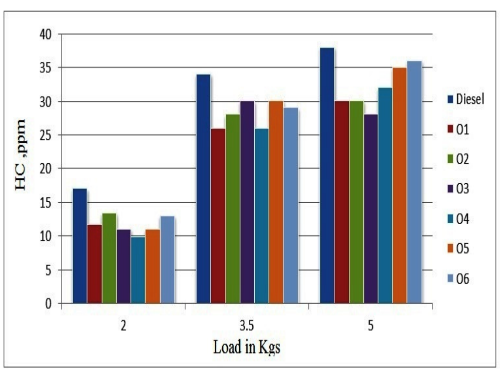


FIGURE 5: % CO VS LOAD FOR INJECTION PRESSURE 180BAR AND 220 BAR RESPECTIVELY.

Above graph demonstrates the variations of %CO with load for Injection Pressure 180bar and 220 bar respectively. By comparing we can state that the emission of carbon monoxide increases for Injection Pressure 180bar to the injection Pressure 180bar .This is because of fuel air mixture fills inside the cylinder is very lean and some of the mixtures nearer to the wall and crevice volume, the flame will not propagate.

IV) HYDROCARBON EMISSION



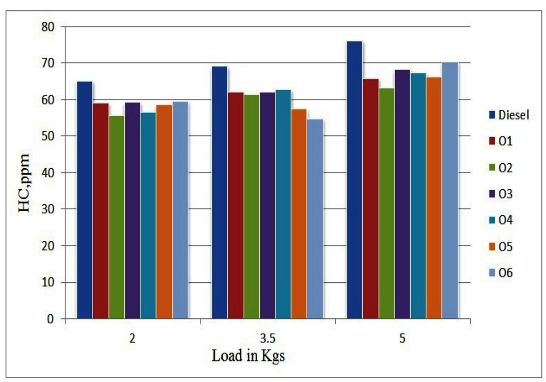


Figure 6: HC VS load for Injection Pressure 180bar and 220 bar respectively.

Above graphs demonstrate the variation of HC opposite of load for Injection Pressure 180bar and 220 bar respectively. Unburnt hydrocarbon discharged is mainly due to the incomplete combustion. By comparing Injection Pressure 180bar to the emission of hydrocarbon increases for Injection Pressure 220 bars. This is because of two reasons. First one is, the fuel spray doesn't spread deeper in the combustion chamber and second one is gaseous HC's will remain alongside the cylinder wall and the crevice volume and left Unburnt.

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CONCLUSION

The complete studies based on exhaust emission and engine performance of Cotton seed oil, Karanja, Honne biodiesel were performed. The following conclusions can be made:

- In biofuel blend O2, BTE was dropped by 13 % compared to 100% Diesel fuel at 180 bars.
- In biofuel blend O5, BTE was dropped by 11.32 % compared to 100% Diesel fuel at 180 bars.
- In terms of BTE O5 is better than O2 at 180 bars.
- In biofuel blend O2, BTE was dropped by 15.44 % compared to 100% Diesel fuel at 220 bars.
- In biofuel blend O5, BTE was dropped by 13.25 % compared to 100% Diesel fuel at 220 bars.
- In terms of BTE O5 is better than O2 at 220 bars.
- It was seen that with the increase in the blend, exhaust temperature increased.
- Emission of NOx found to be increased with the increase in the blending percentage.
- But, CO and HC found decreased with the increase in the percent of bend.

From the end of work it, we can deduce that the bio fuels namely cotton seed oil, Karanja and Honne can be used as Alternative fuel. Values of BTE and BSFC are near to diesel fuel values. As the overall emissions of biodiesel is less than that of diesel, they are more Eco-friendly.. As compared to Honne - Karanja biodiesel, Honne – Cotton seed oil biodiesel is preferred because they show better performance characteristics. From the economy point of view Honne – Cotton seed oil biodiesel has less cost compared to Honne - Karanja, as Cotton seed oil biodiesel is produced from waste Cotton seed.

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