PERFORMANCE AND EMISSION CHARACTERISTICS OF DIESEL ENGINE USING RICE BRAN OIL METHYL ESTER BLEND WITH ADITIVE DIETHYL ETHER (DEE)

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A B S T R A C T:
The main aim of this work is to find an alternative fuel for diesel engine & to analyse the performance emission combustion characteristics. The increase in growth of population made to find the new fuel for the existing fuel. Because the existing fuel is depleting. The alternate fuel can be used without any modification in the existing engine & it should be available in affordable cost. Engine emission should be compared because it should not create pollution problem.

IndexTerms: **Transesterification, biodiesel, DEE, BTE**

1. INTRODUCTION

Properties of RBO bio diesel were studied and compared to ASTM standards. The consequent engine test showed a similar power output compared with regular diesel but consumption rate was slightly higher. Emission tests showed a decrease in Co, HC, NOX(8%) ,smoke(8%) and slight increase in BTE(5.2%) when compared to biodiesel .Additive(DEE) is volatile. so it mixes easily with biodiesel . It improves the combustion efficiency of the fuel. Cetane number is high for the additive. It reduces the ignition delay during exhaust stroke of the engine. High oxygen content leads to complete combustion of the fuel.DEE reduces the viscosity of the fuel. So fuel can be atomized easily. Calorific value of the fuel increases with additive. It improves the brake thermal efficiency of the fuel. Increase in population has made increase in utilization of fossil fuel. But the amount of fossil fuel is decreasing. An Alternative fuel is needed for the use. This fuel should not affect the environment. Tranesterification is a simple method for fuel production.

The process of converting Triglycerides into mono esters & glycerol is called transesterification .Many alcohols (methanol, ethanol, propanal&butanol) are available in the market. Among other Alcohols methanol is used commercially. Because of its low cost.In the year 1975 vegetable oil was used directly in engine. If vegetable oil is used directly used in engines it would create several problems. The process transesterification converts the vegetable oil to BD & it is in usable form to compression Ignition Engines. BD has higher oxygen content & it reduces emission (CO, HC, PM) Bio Diesel from edible oils create food crisis for the increasing population. Rice bran oil is not much used for cooking.

2. MATERIALS

2.1 Materials used:

Crude Rice bran oil(refined) ,homogeneous alkaline base catalyst(NaoH),Methanol.

2.2 Apparatus:

Transesterification consists of conical flask, magnetic stirrer with hot plate.
Separating funnel, Iron Stand, Thermometer.

2.3 Transesterification:

RBO was heated to (50-55˚c).Then25ml of methanol &NaoH 1% Of weight is mixed with that. The mixture is heated for ahour.Then it is poured in the separating separating funnel. After 3hrs the mixture seperates into two layers. Top layer is methyl ester & bottom layer is glycerol. The top layer is separated, & then washed twice with (hot distilled water at 100˚c). The washed esters were filtered using sodium sulphate (powder) for removing water droplets).

3.RESULTS& DISCUSSION:

3.1Alkali - Catalyzed Transesterification:

Tests were carried out at varying conditions of molar ratio, catalyst amount, reaction temperature & reaction time. The optional reaction condition based on a series of experiments was observed.

3.2 Influence of molar ratio on conversion efficiency:

When the molar ratio was high, the separation of glycerin because there is an increase in solubility if glycerin remains in the solution, it gives lower esters.

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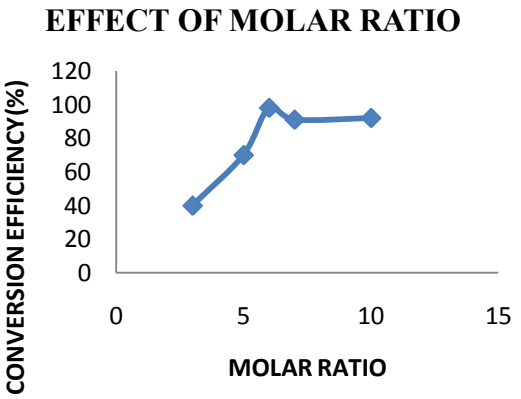

Fig .1.Molar ratio vs conversion efficiency

3.2.1 Influence of catalyst amount on conversion efficiency:

The amount of catalyst that should be added to the reaction varies from 0.5 to 1% w/w. The NAOH amount in the range of 0.5-1% w/w was used in this experiment. Esterification of RBO with the catalyst 1% w/w NAOH gave the best yields of the esters. With further increase in catalyst quantity, there was little decrease in the conversion efficiency. Excess amount of catalyst lead to the formation of gels. The formation of emulsion with therefore block the reaction.

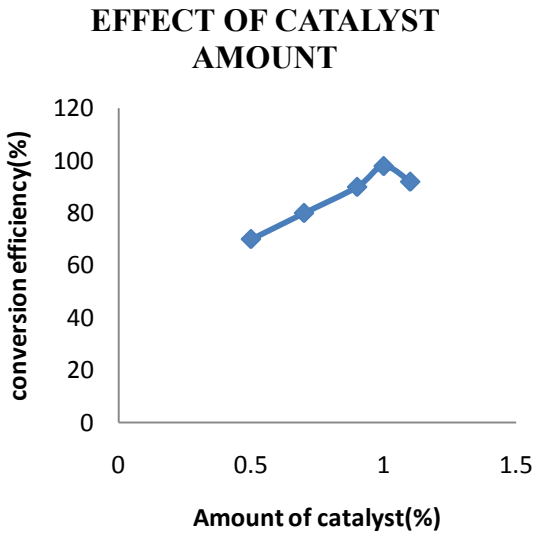

Fig.2. Amount of catalyst vs conversion efficiency

3.2.2 Influence of Reaction Temperature On Conversion Efficiency:

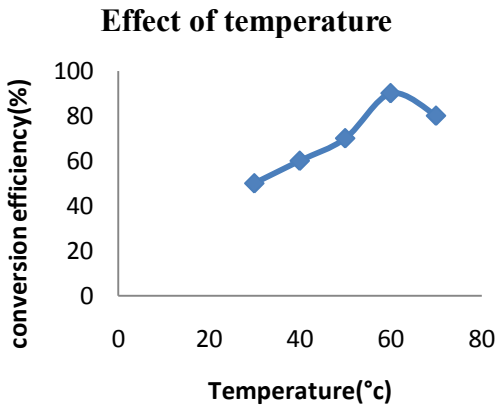

Fig.3. Temperature vs conversion efficiency

The maximum yield of ester was obtained at 60°c, a further temperature increment decreased the conversion efficiency. If the reaction temp is above 60°c, it tends to loss of methanol & accelerates saponification of the glycosides.

3.2.4 Influence of Reaction Time on Conversion Efficiency:

The influence of reaction time on conversion efficiency. The conversion efficiency increased with reaction time but the ester yields were almost same after 45mins. For economical reasons the best process is the one that reaches the highest conversion in the shortest period of time.

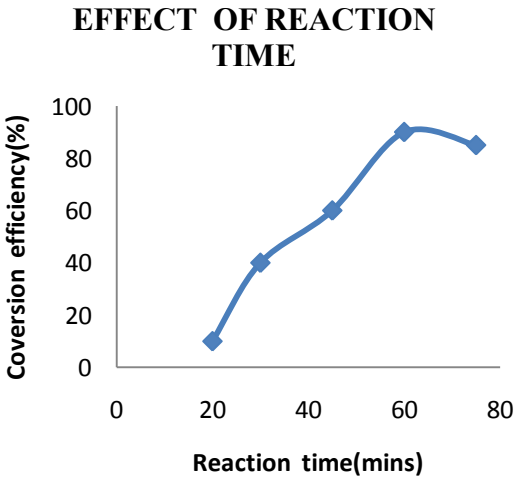

Fig.4. Effect of reaction time vs conversion efficiency

Results obtained from the present experiments reveal that 45mins is sufficient for the completion of the reaction.

3.3 Optional Parameters of Conversion Efficiency:

The optional parameters of conversion efficiency obtained by range analysis methanol / oil molar ratio 6:1, catalyst amount 1% w/w reaction temp 60°c, reaction time 60mins. The conversion efficiency was 98.7%.

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3.4 Fuel Properties of RBO Diesel

Table.1. Fuel properties

Property	Unit	RBO Diesel	ASTM STD
Density (at15°c)	kg/m^3	884	875-900
Viscosity (at 40°c)	m^2/s	4.8	1.9-6.0
Flash Point	oc	75	>130
Fire Point	0c	86	-
Calorific value	k cal / kgm	11084	-

3.5 PROPERTIES OF DEE

Table.2. Properties of DEE

PROPERTIES	UNIT	DEE
Density	**kg/m^3**	**713**
Kinematic viscosity	**cst**	**0.2230**
Calorific value	**Kj/kg**	**33892**
Cetane number	**-**	**85-89**
Oxygen content	**%weight**	**21**

3.6 ENGINE SPECIFICATION

Biodiesel is tested in single cylinder four stroke engines. It is cooled with water. Combustion chamber is fitted vertically. Bore is 80mm & stroke is 110mm.Power of engine is 5hp and constant speed engine (1800rpm).

Fig.5. photograph of testing engine

4. PERFORMANCE CHARACTERISTICS OF ENGINE FUELED WITH ADDITIVE (DEE).

The experiments were carried out for biodiesel,5% additive (DEE) &8% additive (DEE)With biodiesel.

- BMEP vs. SFC,
- BMEP vs BTE.

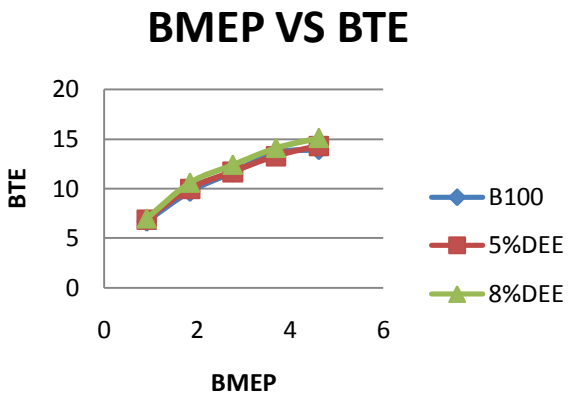

Fig.6. BMEP vs BTE

The graph shows When the brake mean effective pressure increases brake thermal efficiency increases. Reason can be due to the better interred mixing of fuel-air along with better combustion and maximum thermal efficiency is achieved.

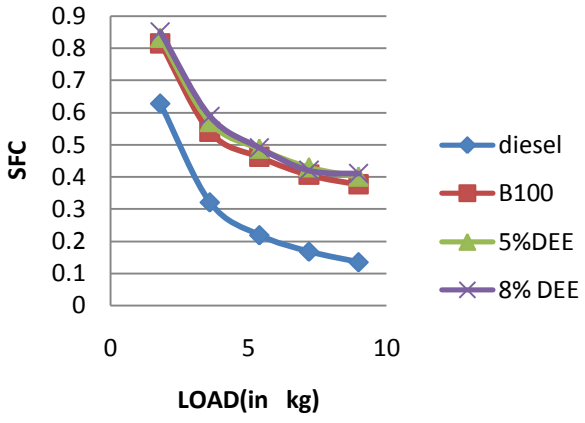

Fig.7. Load vs SFC

Graph shows when the brake mean effective pressure increases specific fuel consumption decreases. At high pressure atomized fuel mixes with additive so less fuel is needed.

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5. RESULTS AND DISCUSSIONS

5.1 Engine Emission Characteristics

1. Load (in kg) vs. % CO2
2. Load(kg) vs % co
3. Load (in kg) vs. % HC
4. Load (in kg) vs. % NOX

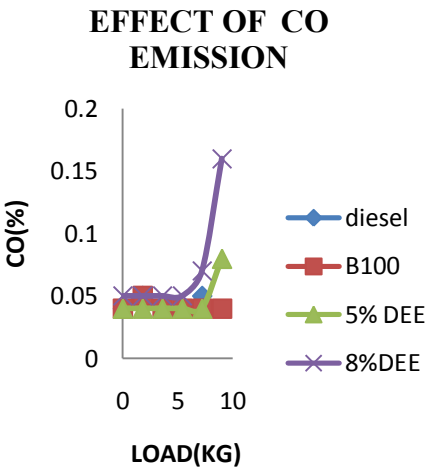

Fig.8. load Vs % CO

Graph shows % CO decreases after adding additive. This is due to complete combustion.

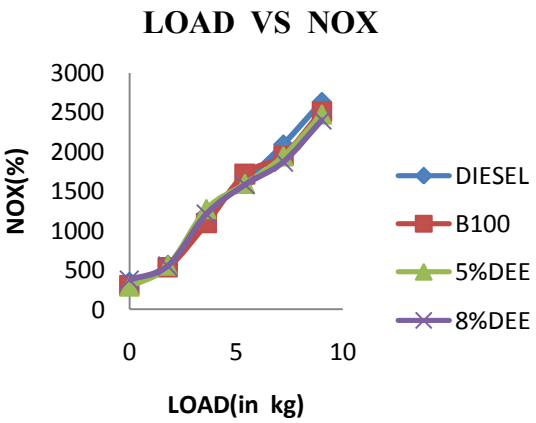

Fig.9. Load Vs %NOx

Graph shows the Reduction in NOX after Adding additive (DEE).

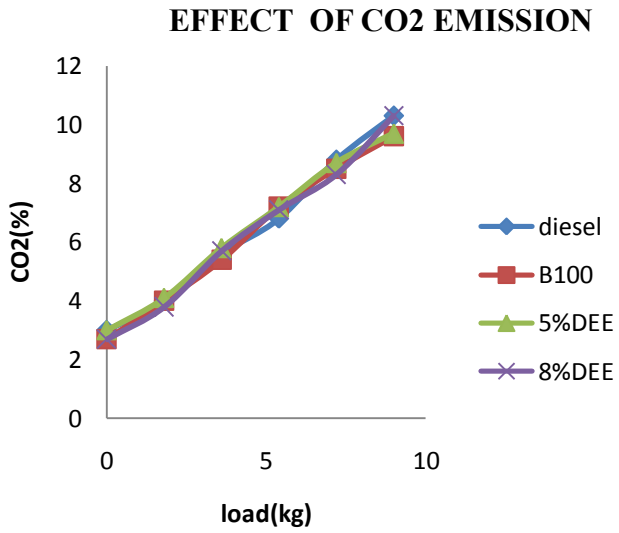

Fig.9.Load vs % CO2

Graph shows % CO2 increases after adding additive. This is due to complete combustion.

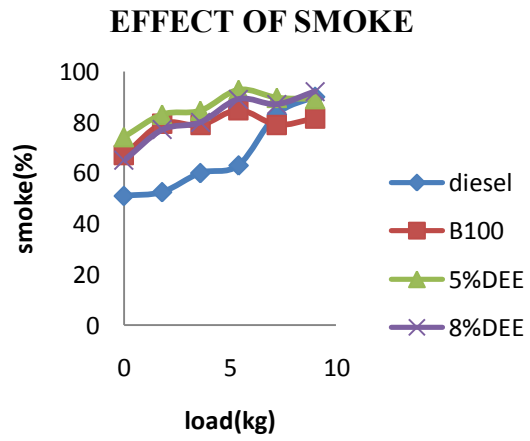

Fig.10.load vs smoke

The % of Smoke reduces after adding additive (DEE).This is due to complete combustion.

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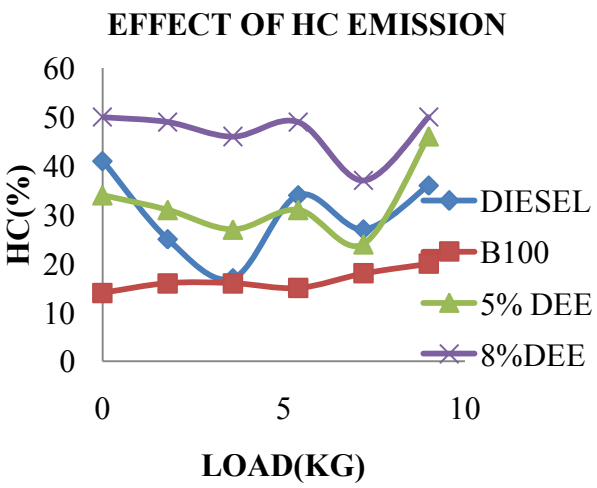

Fig.11.load vs % HC

graph shows the % HC decreases after adding additive.

CONCLUSION

1.The reduction in percentage of Nox
2.The reduction in percentage of smoke
3.This shows that complete combustion of fuel with the additive without any modification in the engine.

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