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Rice Bran oil As a Possible Resource for Biodiesel

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***Abstract*— The application of biofuels in compression ignition engine have now become well liked from the point of reduced emission and fuel consumption. This present paper is focussed on analysing experimentally the performance and emission characteristics of ricebranoil biodiesel in compression ignition engine biodiesel is composed by tranesterification of ricebran oil with the help of sodium hydroxide (NaOH) and methanol which developed into 90% of rice bran oil biodiesel. Experimental analysis were carried out in a four stroke compression ignition engine under varying load conditions to check the engine performance and emission levels of the compression ignition engine for rice bran oil biodiesel blends R10,R15 and R20 and compared with straight diesel. It was discovered that lesser CO and HC emission and higher NO_X emission when biodiesel is used as fuel .The brake thermal efficiency of biodiesel were comparatively lower than straight diesel and the specific fuel consumption was higher for biodiesel blends when compared with straight diesel.**

***IndexTerms*—rice bran oil biodiesel, tranesterification, performance, emission**

1) INTRODUCTION

Depletion of fossil fuels, increasing emission from vehicles, increased vehicle population, day to day rise in fuel price and global warming due to emission have pushed researchers in finding new alternate sources which are gaining important nowadays the explore for a promising alternate fuel which is eco friendly has been the greater challenge .vegetable oil is one of the alternatives which can be used as fuel for automotive engines either in form of straight vegetable oil or in form of methyl ester [1] Straight vegetable oils has been projected as an engine friendly fuel by many researchers have recently lost its attraction ,being high viscous, high molecular weight and low volatility cause poor fuel atomization, vaporization leading to incomplete combustion resulting in problems like severe engine deposits ,injection cooking and piston ring sticking[2].Biodiesel, biogas and bio ethanol are all examples of biofuels one important feature is that they can be blended at any propotion with any fuel obtained from petroleum whose properties conform to the end use [3]. Biodiesel has higher oxygen content in it .It reduces emission like hydrocarbon ,carbon monoxide and nitrogen oxide emission. Bio Diesel from edible oils create food crisis for the increasing population [4]. Crude rice bran oil was converted into biodiesel by the process of transesterification the extracted biodiesel properties were compared and studied with those of straight diesel to learn its adaptability for use in compression ignition engine the rice bran oil was blended with diesel in following ratios R10,R15,R20 (10% ,15%,20% by proportion) .The analysis were carried out on a kriloskar TAF single cylinder four stoke vertical air cooled diesel engine with varying load (from no load to full load) and constant rpm the output of the engine performance and emission were thus observed and studied

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2) MATERIALS AND METHOD

Rice bran oil was acquired from Pune India the chemicals like sodium hydroxide (NaOH) and methanol were purchased from chemical shops

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A. Transesterification

Rice bran oil was transformed into its methyl ester by transesterification process with the help of sodium hydroxide and methanol the process was carried out in a round flask the crude ricebran oil was heated upto 55^0c for 1hour and 30 mins. Naoh was mixed completely with methanol to produce sodium methoxide this sodium methoxide solution was mixed with rice bran oil and stirred completely. Now the entire solution is maintained at 55^oc for 45 mins and the entire solution is transferred into separating flask a reaction period of 24 hrs was allowed to form glycerol and rice bran oil methyl ester. Now after separation the ROME (Rice bran oil methyl ester) was washed with 10% distilled water to remove impurities the properties of ROME is given in table (1).

Table 1Properties of Rice bran oil methyl ester (ROME) and Straight Diesel

FUEL PROPERTIES	RICE BRAN OIL BIODEISEL	STRAIGHT DIESEL
Density	0.874	0.835
Viscosity	4.85	3.26
Flash point	159	77
Calorific value (KJ/KG)	41385	44587
Cetane number (^{0}C)	52.6	47.6

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Figure (1) Rice bran oil

Figure (2) Glycerol separation

3). EXPERIMENTAL SETUP

The analysis was carried out in a single cylinder four stroke air cooled engine. The layout of the experimental set up is shown in figure (3) and the specification of the engine is given in table (2). An electrical dynamo is coupled with the engine which is used for loading .A cryton five gas analyzer is used for measuring hydrocarbon, Carbon monoxide, nitrogen oxide and oxygen content in the exhaust gases. ROME blends was blended with straight diesel in 10%, 15% and 20% blends. Performance and emission analysis was conducted for these blend ratios.

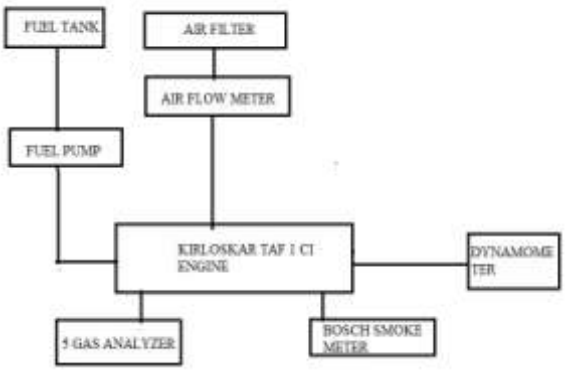


Figure (3) Block Diagram of Experimental setup

Table (2) Specification of Test Engine

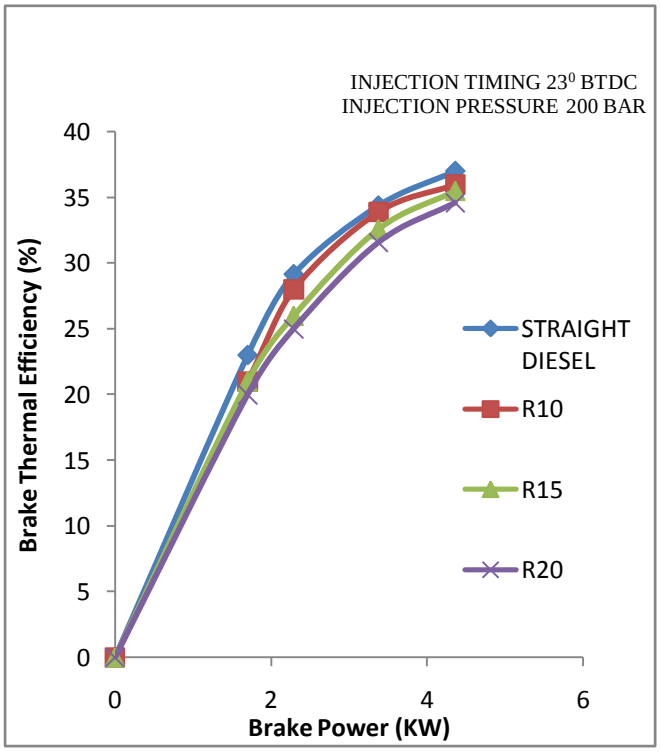
ENGINE MAKE	Kriloskar
MODEL NO	TAF 1
ENGINE TYPE	Single Cylinder Four Stroke Vertical Air Cooled
BORE (D)	87.5 mm
STROKE (L)	110 mm
NO OF CYLINDERS	1
COMPRESSION RATIO	17:5:1
INJECTION TIMING	23^0 BTDC
INJECTION PRESSURE	200 Bar

4) RESULTS AND DISCUSSSION

A .Performance Characteristics

Brake Thermal Efficiency

Brake thermal efficiency indicates the efficiency of the engine and it is one of the ideal factors to quantify the engines efficiency. The variation of brake thermal efficiency for straight diesel and ROME blends is shown in figure (4). The brake thermal efficiency of biodiesel blends was lower when compared with straight diesel the brake thermal efficiency at maximum load with straight diesel as fuel was 36% and there was significant drop of 4% when ROME blends were used as fuel. It is evident that when increase in biodiesel blends resulted in decrease in brake thermal efficiency .This may due to higher viscosity and lower volatility of ROME blends



\Figure (4) Variation of Brake thermal efficiency with output power

Brake Specific Fuel Consumption

The variation for brake specific fuel consumption for straight diesel and ROME blends is shown in figure (5). It is defined in terms of specific fuel consumption in kilogram per kilowatt hour. BSFC is an important factor which determines the engine performance it is evident in the graph that SFC is greater for ROME blends when compared with diesel. This is is because when engine is operating it consumes more fuel with ROME blends as fuel than with straight diesel to progress same power output due to lesser calorific value of biodiesel.

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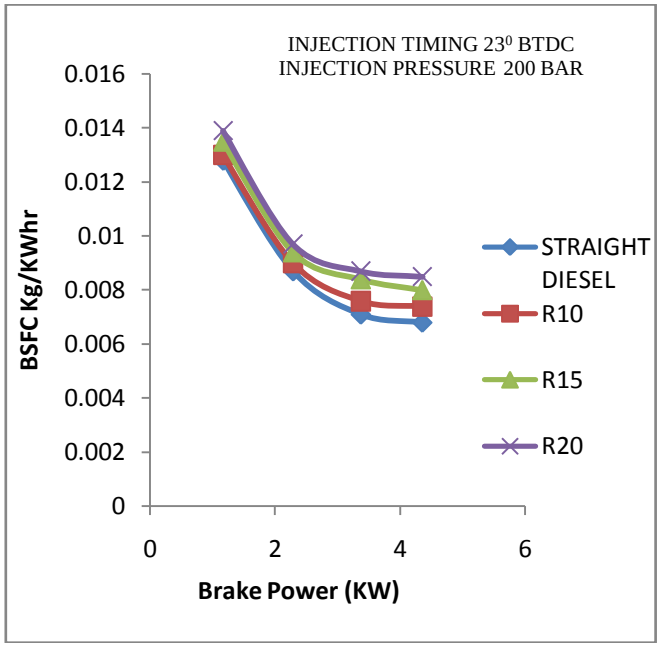

Figure (5) Variation of Specific Fuel Consumption with output power

B .Emission Characteristics

Hydro carbon Emission

The variations in HC emission for straight diesel and ROME blends for varying load is shown in figure (6). Incomplete combustion and rich air fuel mixture is the cause for Hydro carbon emission from engine. It was analyzed that HC emission increased when straight diesel is used as fuel. But a ROME blend has lesser emission when compared with straight diesel. This is mainly due oxygen content constituted in biodiesel. The oxygen content in biodiesel helps the engine in obtaining better combustion thus leading to lesser HC emission.

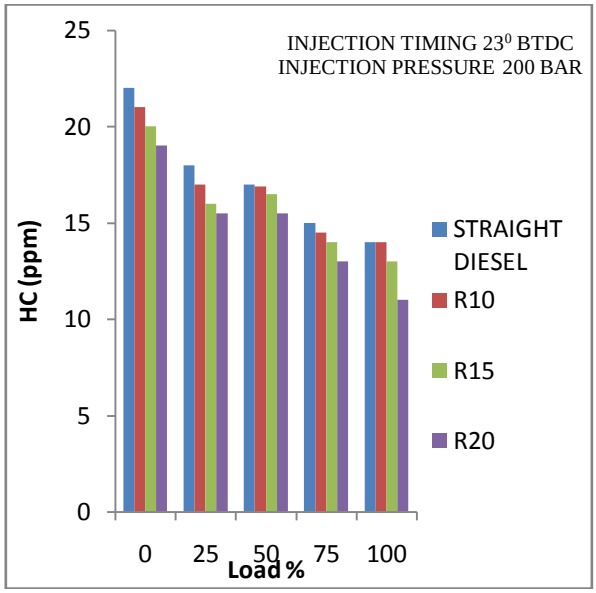

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Figure (6) Variation of Hydro carbon emission

Carbon Monoxide Emission

The variation in CO emission for straight diesel and ROME blends for varying load is shown in figure (7). The CO emission from engine projects how well the fuel is burnt inside the combustion chamber. Methyl ester based ROME blends burns effectively when compared to straight diesel the CO emission is higher for straight diesel when compared to ROME blends the traces of oxygen in biodiesel helps the CO to be oxidised and it converts CO to CO_2 to a certain extent.

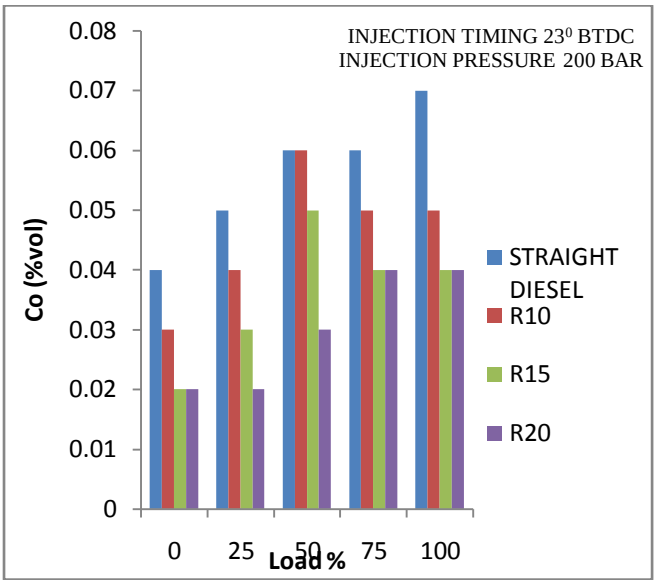

Figure (7) Variation of Carbon monoxide emission

Nitrogen oxide Emission

The variation in NO_X emission for straight diesel and ROME blends for varying load is shown in figure (8). The main cause of NOx emission is due to engine operating temperature and nitrogen content in air. NO_x emission is higher when ROME blends were used as fuel when compared straight diesel at varying loads. The rise in NO_X is due to higher bulk modulus of biodiesel resulting in dynamic injection. Viscosity, density and oxygen content and calorific value of ROME blends result in peak combustion temperature.

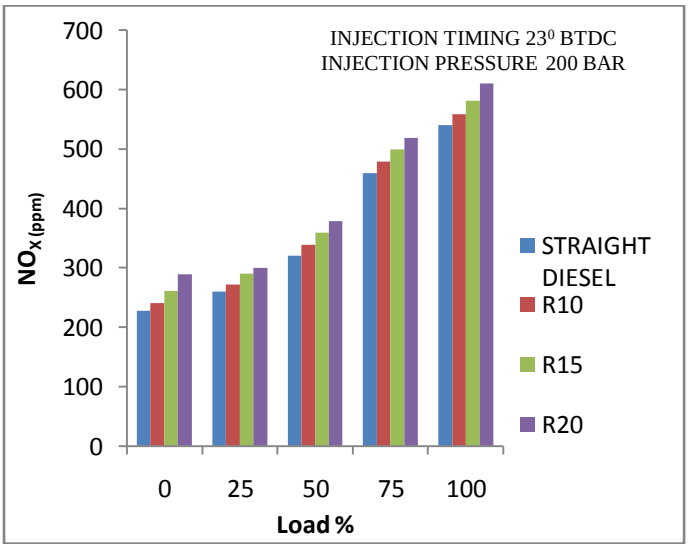

Figure (8) Variation of Nitrogen oxide Emission

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Oxygen Content in the exhaust

The variation in oxygen content for straight diesel and ROME blends for varying load is shown in figure (9).It is evident that ROME blends has higher oxygen content in the exhaust when compared with straight diesel.

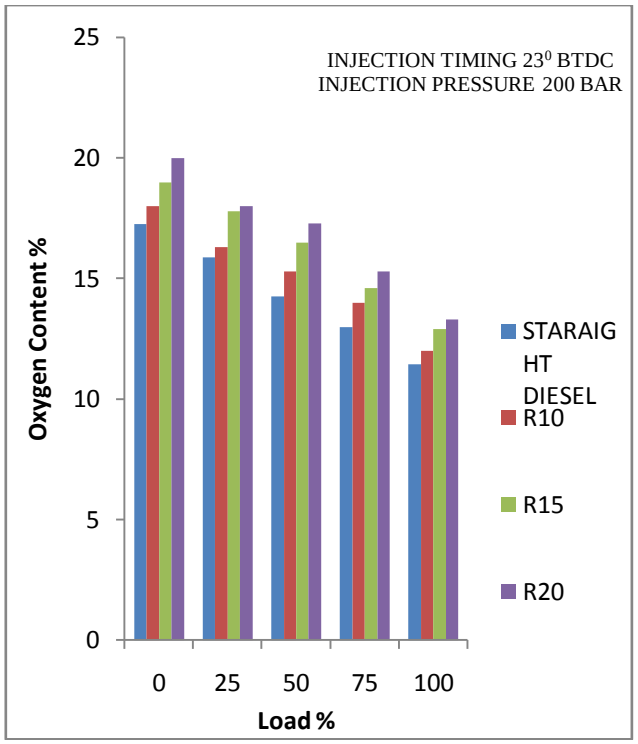

Figure (9) Variation of oxygen content in the exhaust

5). CONCLUSION

The main aim of this study is to analyse the adaptability of Rice bran oil biodiesel blends (ROME) in a four stroke compression ignition engine under varying load conditions. Performance analysis includes Brake thermal efficiency and Specific fuel consumption .Emission analysis include carbon monoxide ,hydro carbon, oxides of nitrogen and oxygen content in the exhaust under different loading condition.

Based on the experimental analysis the following are our conclusion

- Transesterfication process with methanol as alcohol and sodium hydroxide as catalyst resulted in 90%of ricebran oil methyl ester.
- Rice bran oil biodiesel has higher viscosity than straight diesel.
- Brake thermal efficiency for ROME blends were comparatively less when compared with straight diesel this is mainly due to high viscosity.
- The brake specific fuel consumption for ROME blends is higher than of straight diesel. This is because of higher boiling point, density and viscosity and lower calorific value.
- The CO emission is lesser for ROME blends when compared with straight diesel.
- The HC emission is lower for ROME blends when compared with straight diesel.
- NO_X emission were higher in ROME blends when compared with diesel this is mainly because of oxygen content density ,viscosity calorific value of the biodiesel and operating temperature.
- Radical changes in the combustion parameters were also spotted for ROME blends when compared with straight diesel as fuel.

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