PERFORMANCE OF DIESEL ENGINE BY USING COCONUT AND SUNFLOWER OIL AS BIODIESEL

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Abstract

The earth is having limited resources of fossil fuels which lead to energy Crisis in the next few years. so it will become compulsory for us to investigate the alternative fuels to overcome the energy crisis. India is having wide variety edible and non edible oilseeds, these seeds having a good potential for fulfilling the energy demand. Coconut and sunflower plants are highly cultivated and high yields plants. It is suited for our environment.

The present paper investigates the engine performance for diesel engine using coconut and sunflower blends. In these, we also use the coated piston to improve the performances of the engine. Brake thermal efficiency, indicated thermal efficiency, mechanical efficiency and brake specific fuel consumption are compared. With 20% of coconut or sunflower blend having minimum BSFC with maximum brake thermal efficiency. It is recommended for the existing engine with 20% coconut or sunflower oil blend without any engine modification and have beneficial effects in terms of alternative diesel fuel.

Keywords: engine performance, coconut oil, sunflower oil.

1. Introduction

The world is presently confronted with twin crisis of fuel depletion and environment degradation. Indiscrimination extraction and lavish consumption of fossil fuels[1] have led to reduction in underground-based carbon resources. The search for alternative fuels, which promise a harmonious correlation with sustainable development, energy conservation, efficiency an environmental preservation[2] has become highly pronounced in present context. Even though new technologies have come up which have made solar, wind or tidal energy sources are easily usable but still they are not so popular due to problems n integration with the existing technology and processes. Gasoline and diesel driven automobiles are main reason for global warming. Various bio fuel energy resources are explored include biomass, biogas, primary alcohol, vegetable oils as blends with diesel, bio-diesel etc.

Vegetable oils are good alternatives to fossil fuels for use in diesel engines. They are renewable in nature ad may generate opportunities for rural employment when employed on large scale. Since vegetable properties are similar to diesel, they can be used to run compressed ignition engines with little or no modifications. These alternatives resources are environment friendly but they need to be evaluated case to case basis for their advantages, disadvantages, properties, specific applications. Some of these fuels can be used directly while others are needed to be formulated to bring the relevant properties closer to conventional fuels. Due to recent widespread use of fuels in various sectors, this study concentrates on accessing the viability of using alternative fuels in the existing internal combustion engines without any modifications.

An acceptable alternative fuel for engine has to fulfill the environment and energy security needs without sacrificing operating performance. Vegetable oils can be successfully used in CI engines without engine modifications and fuel modifications. Technologies must be developed for the use of vegetable oils as an alternative fuel. Vegetable

oil cannot be used directly in its raw form in engine. So blends are made with diesel called bio-diesel. System design approach has taken care to see that these modified fuels can be utilized in the existing diesel engine without substantial hardware modification.

Vegetable oils are non toxic renewable sources of energy, which do not harm the nature. Vegetable fuels can be used as an emergency energy sources in the event of any of any petroleum shortages. Extensive studies on alternative fuels for diesel engines have been carried out since the fossil based fuels are limited. Common vegetable oils are sunflower, cottonseed, olive, soybean, corn, nut etc.

1.1 COCONUT AND SUNFLOWER OIL

In these paper we used the coconut and sunflower oils, the physical properties of coconut and sunflower are given below

Properties	Coconut oil	Sunflower oil
Density (Kg/m^3)	1.085	0.918
Viscosity (Ns/m2))	33.8	34
Flash point (°C)	232	220
Calorific value(KJ/kg)	38583	39342

1.2 PISTON COATING

Thermal barrier coatings are duplex systems consisting of a ceramic topcoat and a metallic intermediate bond coat. Thermal barrier coatings help to achieve higher efficiency of combustion engines (internal combustion engines and gas turbine engines) due to an increase of their operating temperature.
The topcoat consists of ceramic material whose function is to reduce the temperature of the underlying, less heat resistant metal part. The bond coat is designed to protect the metallic substrate from oxidation and corrosion and promote ceramic topcoat adhesion

Coated piston

Plain piston

1.3 NOTATIONS

CB = COCONUT BLEND
SB = SUNFLOWER BLEND
BHP = BRAKE HORSE POWER
BSFC = BRAKE SPECIFIC FUEL CONSUMPTION

1.4 Blends

The main aim of this project work is to evaluate performance characteristics of diesel and blends in CI engine. The procedure is to calculate performance characteristics with pure (100%) diesel and then compare the performance with blends. This procedure is conducted with and without piston coating.

1) Diesel Blends:
a. Pure diesel (100%)
b. Diesel (80%) + CB (20%)
c. Diesel (60%) + CB (40%)
d. Diesel (40%) + CB(60%)
e. Diesel (20%) + CB (80%)
f. pure coconut blend (CB 100%)
g. Diesel (80%) +SB (20%)
h. Diesel (60%) +SB(40%)
i. Diesel (40%) +SB(60%)
j. Diesel (20%) + SB (80%)
k. pure sunflower oil (100%)
2) Piston Coating:
a. Without piston coating
b. With piston coating (ZrO2)

2 Experimental procedure

A single cylinder 4 – stroke water cooled diesel engine having 5HP as rated power at 1500 rpm was used for the present work. The engine is coupled to belt to apply mechanical loading. A photo sensor along with digital sensor is used to measure speed of the engine. The fuel flow rate is measured on volumetric basis using burette and stopwatch. Thermocouples in conjunction with a digital temperature indicator were used for measuring the engine and exhaust gas temperatures. The engine is water cooled

The engine specification are

Bore 80mm

Stroke 110 mm

RPM 1500

BHP 5 HP

Compression ratio 16:1

Generator efficiency 80 %

Coefficient of discharge 0.6

Procedure of the experiment:

The various steps in doing the experiment are

The tank is filled with the fuel blend taken. The pipe should be checked that there should be no air bubbles and the pipe is connected to the engine.

The decompression lever is pressed on so that there will be no air trapping in between cylinder and the piston. Make sure the water is supplied to the engine.

Then the engine is started by rotating the crank by means of hand crank lever by throwing of the decompression lever at sufficient speed.

The engine is allowed to pick up the speed and run at speed, smoothly for a few seconds.

Record the time taken for 10cc of fuel consumption at no load and the manometer reading on the panel board.

Then the engine is slowly loaded using belt on the drum connected to the engine. The drum is cooled with water supply.

After applying of load the time required for 10cc of fuel is measured and difference in manometer is observed.

The same procedure is repeated for different blends with plain piston and coated piston .

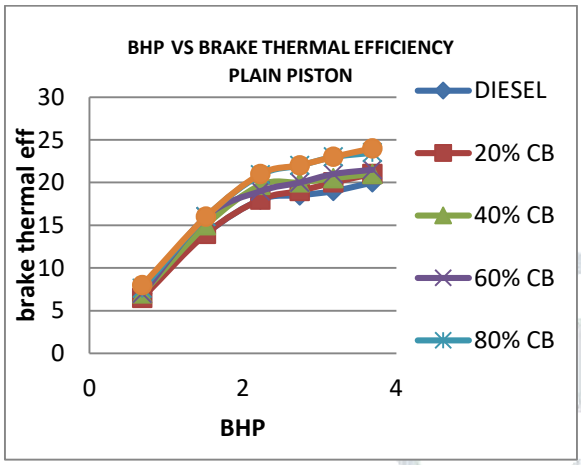
Experimental setup

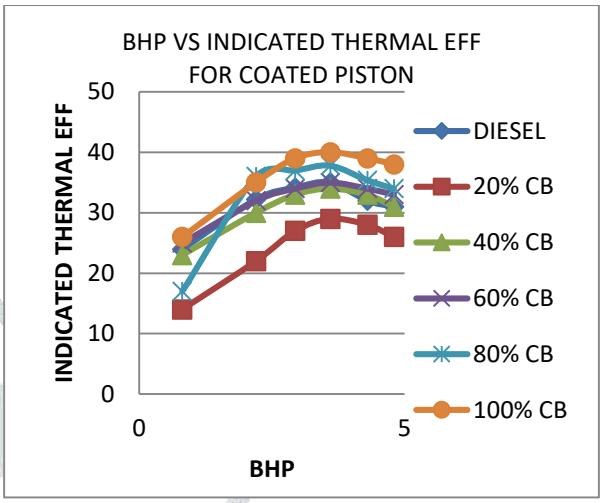
3 Results and discussion

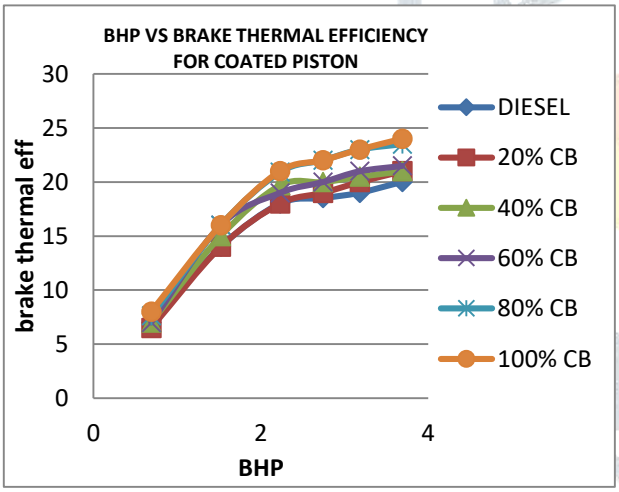
The results are obtained from plain and coated piston of all blends of coconut and sunflower oil are analyzed. The results thus obtained are compare with that of base line diesel engine . Based on the output results the discussion are presented in the following

3.1 COCONUT OIL BLENDS

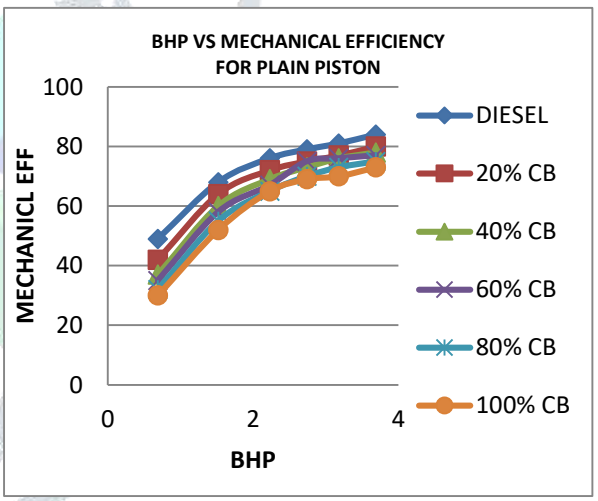
Brake thermal efficiency







MECHANICAL EFFICIENCY



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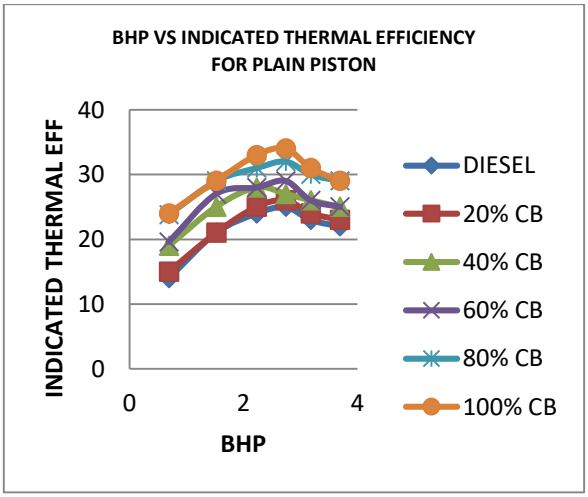
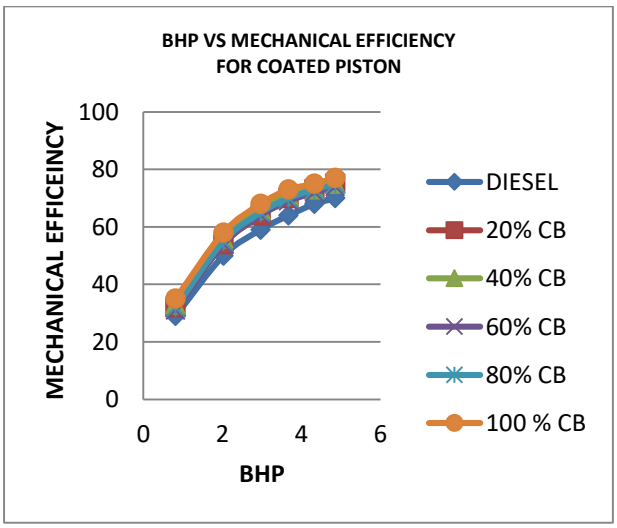
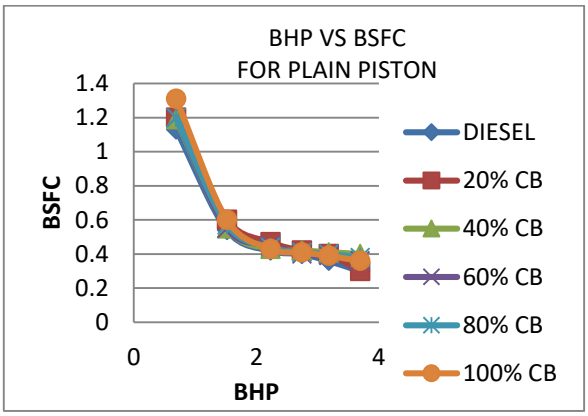
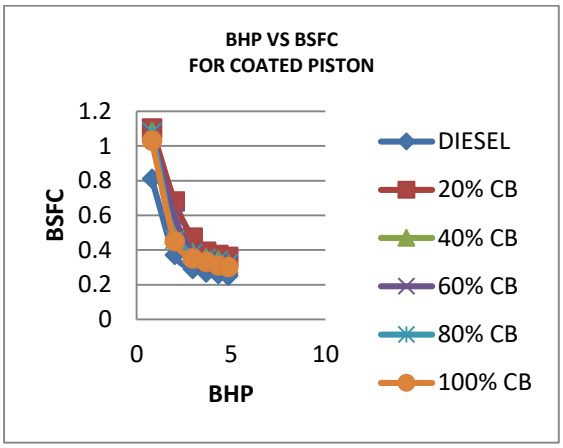




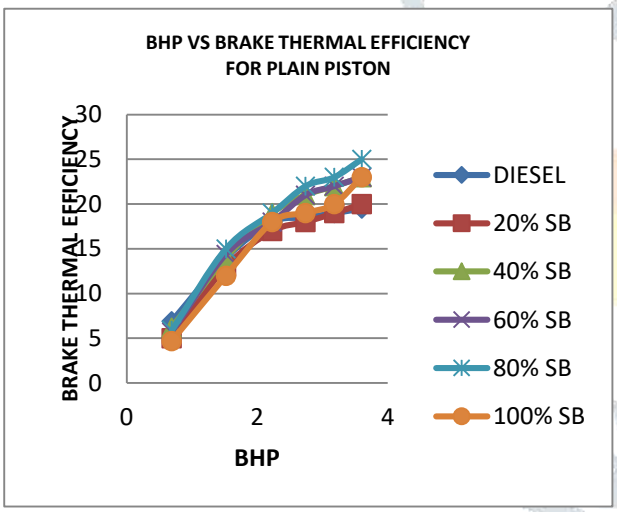
BSFC

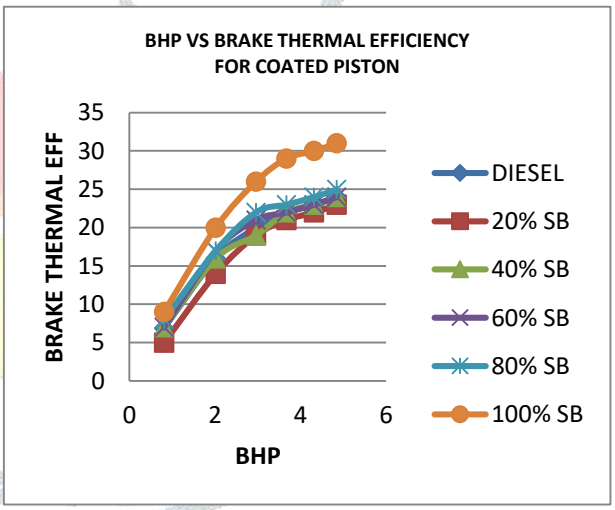




3.2 SUNFLOWER OIL BLENDS

BRAKE THERMAL EFFICIENCY





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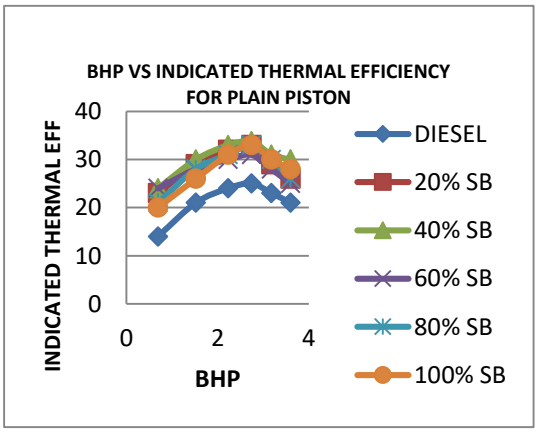

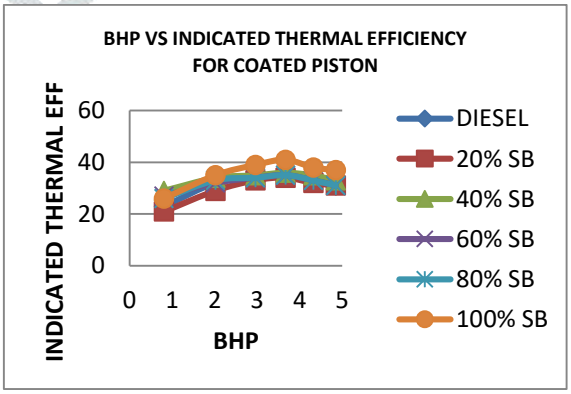

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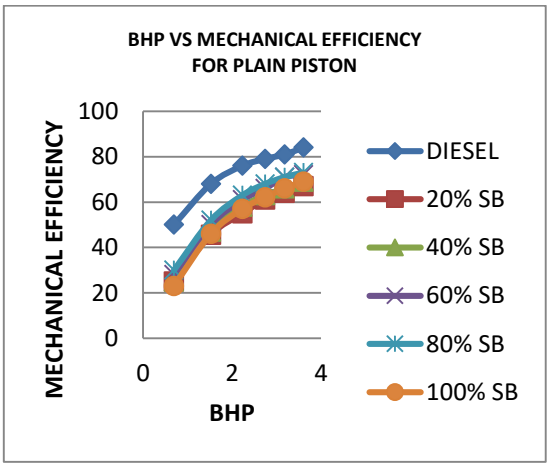

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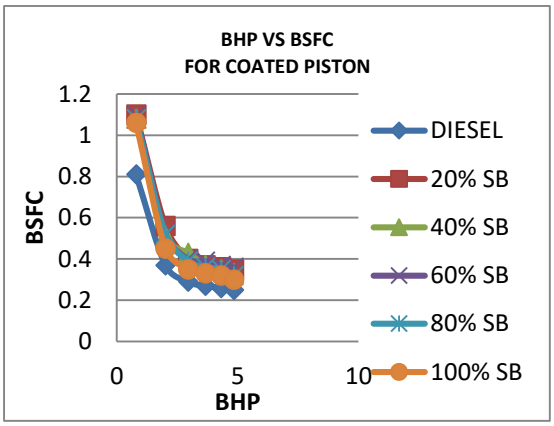

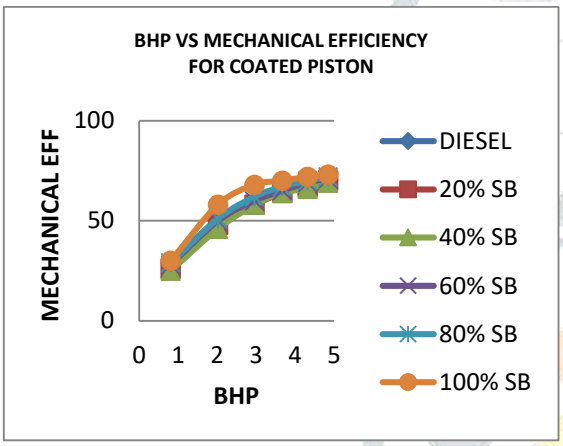

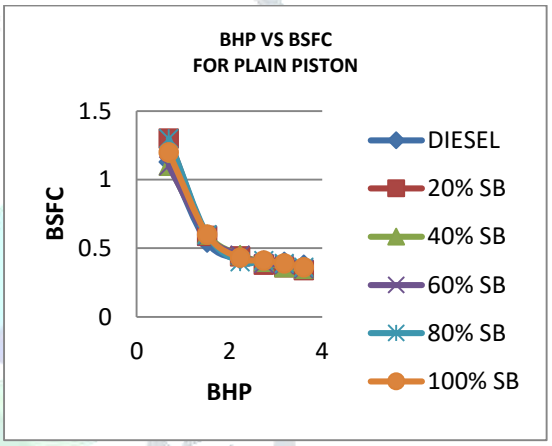

4 CONCLUSION

The performance of four stroke single cylinder diesel engine fuelled with diesel and coconut or sunflower oil blends are evaluated with plain and coated piston respectively. The experiment results of this research work can be summarized as follows.

Compared to diesel fuel, brake thermal, indicated thermal and mechanical efficiency for biodiesel blends were decreased, the bsfc values for biodiesel blends were higher when compared to diesel fuel in plain piston

For coated piston, the efficiencies of brake thermal and indicated thermal are increases when compared to the plain piston and bsfc was decreases when compared to the plain piston.

It is recommended for the existing engine with 20% coconut or sunflower oil with 80% diesel blend without any engine modification and have beneficial effects in terms of alternative diesel fuel. Due to use of coconut oil and sunflower oil as blended fuel economical condition of farmer can also be improved. By using above blended fuel importing of petroleum products from other country is reduced to some extent. It may help to improve the Indian economy.

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