Analysis of Rice Bran (R30) Biodiesel on Tribological Property of IC Engine New components

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ABSTRACT

The importance of the alternative fuels is gaining importance as the design change of combustion process is very minimum or negligible. Choosing suitable alternate fuel for diesel engine may play a significant role in reducing surface wear of diesel engine components, and also in saving fuel costs. The comparison of the R_a values is done to investigate the surface roughness of the IC Engine new components considered for the study. The duration of the test considered is 2 hours, 4 hours and 6 hours running of IC Engine. Blend of 70% Diesel + 30% Rice bran oil has better lubrication properties exhibited as compared to diesel. The results reveal that R_a value is improved significantly for the fuel blended with Rice bran oil. Blending of the bio fuels not only reduces the emission, but also helps in maintaining the mechanical properties of the components of the engine.

Keywords: *Rice bran oil, Diesel, IC engine, Alternative fuels*

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I. INTRODUCTION

In internal combustion engine the different components typically the piston experiences force due to high-temperature and high-pressure gases produced by combustion and then this force is transferred to some component of the engine to transform chemical energy into useful mechanical energy. There are several researches undergoing to study the performance of the engines using alternative fuels. Surface wear of diesel engine components results not only in higher cost of replacement or repair but also affects the performance of the engine. Choosing suitable alternate fuel for diesel engine may play a significant role in reducing surface wear of diesel engine components, and also in saving fuel costs. Hence there is a chance for the improvement of performance of diesel engine that incorporates the alteration of existing technology with suitable alternate fuel. These bio fuels are chemical fuels as the fossil fuels and generate heat to perform mechanical work, hence, are the most desirable alternative to the fossil fuels. But the existing design of the combustion engines must sustain the same operating parameters, material strength of the different components and emission of the engine as that of the fossil fuel run engine.

II. LITERATURE SURVEY

H.S.Ray et.al., [1] have worked on Biogas as Alternate Fuel in Diesel Engines". They reviewed the current status and perspectives of biogas production, including the purification & storage methods and its engine applications. Lower hydrocarbon (HC), smoke and particulates emission has been reported in diesel engines operating on biogas diesel dual fuel mode.

C D Rakopoulos et.al.,[2] have discussed the Study of the short-term cylinder wall temperature oscillations during transient operation of a turbo- charged diesel engine with various insulation schemes. The work investigates the phenomenon of short-term temperature (cyclic) oscillations in the combustion chamber walls of a turbocharged diesel engine during transient operation after a ramp increase in load. The investigation reveals many interesting aspects of transient engine heat transfer, regarding the influence that the engine wall material

properties have on the values of cyclic temperature swings.

Er. Milind S Patil et.al., [3] have worked on Performance Test of IC Engine Using Blends of Ethanol and Kerosene with Diesel. They used 3.75 kW diesel engine AV1 Single Cylinder water cooled, Kirloskar Make to test blends of diesel with kerosene and Ethanol. This paper presents a study report on the performance of IC engine using blends of kerosene and ethanol with diesel with various blending ratio. Parameters like speed of engine, fuel consumption and torque were measured at different loads for pure diesel and various combination of dual fuel. Break Power, BSFC, BTE and heat balance were calculated. Paper represents the test results for blends 5% to 20%.

M. Lackner, F. Winter [4] have discussed the Laser Ignition in Internal Combustion Engines. Laser ignition tests were performed with the fuels hydrogen and biogas in a static combustion cell and with gasoline in a spray-guided internal combustion engine. A Nd:YAG laser with 6 ns pulse duration, 1064 nm wavelength and 1-50 mJ pulse energy was used to ignite the fuel/air mixtures at initial pressures of 1-3 MPa. Compared to a conventional spark plug, a laser ignition system should be a favorable ignition source in terms of lean burn characteristics and system flexibility. Yet several problems remain unsolved, e.g. cost issues and the stability of the optical window.

Sutaria B.M et.al.,[5] has worked on study of basic tribological parameters that influences performance of an internal combustion engine. Mathematical model is developed using average Reynolds equation. Parametric study is performed on 150 CC, 2 Stroke Internal Combustion Engine. The oil film thickness (OFT)piston friction forces (PFF), and Ring friction variations are simulated under different variable i.e engine speed, lubricants and different ring geometry. The simulated results of piston friction force, ring friction force and oil film thickness are compared with published literature.

III. METHODOLOGY

In the present work the wear of the piston and piston ring is investigated. The experiments have been conducted using diesel and then the fuel is blended with Rice bran oil. The detail of the study is given in the Table 1.

Table 1. Details of fuels used for the investigation.

Case No	% of Diesel	% of Rice bran Oil
1	100	0
2	80	20
3	70	30

The corresponding readings of surface roughness (R_a) values of the piston and piston ring have been recorded by using the surface measurement test equipment shown in the Figure 1. The duration of the test is 2 hours, 4 hours and 6 hours running of IC Engine.

Figure 1 Surface Roughness Measuring Equipment

IV. RESULTS AND DISCUSSION

The results have been tabulated for the R_a values considering the conditions of 100% Diesel (B0) and blend of 70%Diesel + 30% Rice Bran oil (R30) and the positions of the measurements for different new components of the IC Engine are as follows;

a. piston–two positions on the TDC, two positions on the land and two positions on the skirt.
b. piston ring -two points for two compression rings.

The data pertaining to the R_a values for piston are tabulated in Table 2. The average of two measurement points is taken to plot the variation of R_a values and is shown in the Figure 2.

Table 2 R_a values for new piston (B0 and R30)

Piston Positions	R_a values in microns					
	2 Hrs (B0)	2 Hrs (R30)	4 Hrs (B0)	4 Hrs (R30)	6 Hrs (B0)	6 Hrs (R30)
Piston TDC	0.564	0.510	0.612	0.425	0.633	0.412
Piston Land	0.365	0.352	0.41	0.359	0.51	0.310
Piston Skirt	0.651	0.611	0.721	0.530	0.744	0.610

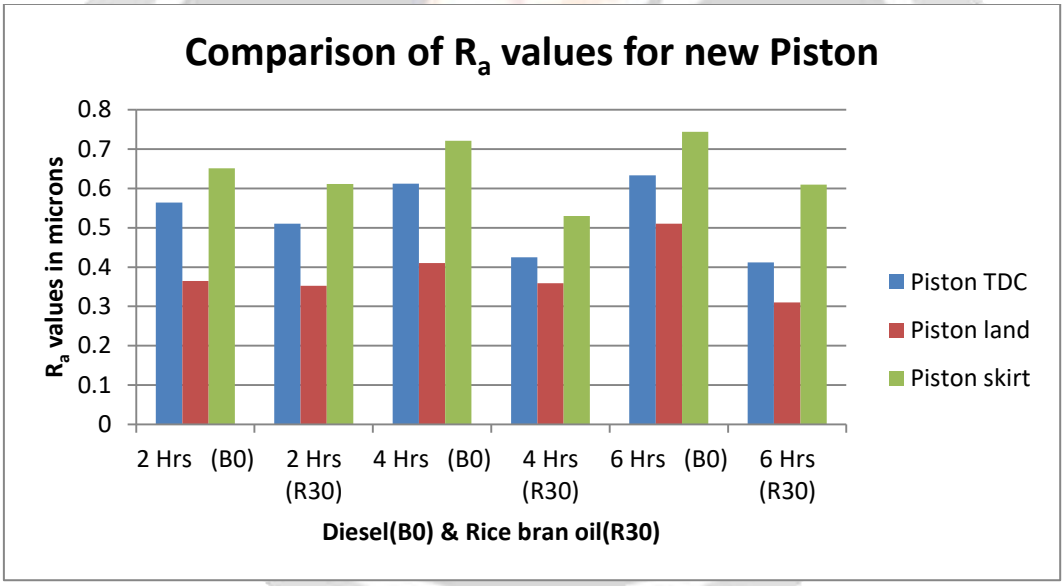

Figure 2 Comparison of R_a values for new piston (B0 and R30)

From the Figure 2 it can be concluded that R_a value of 0.310 microns is minimum at piston land -6Hrs run with Rice Bran Oil-(R30).

The data pertaining to the R_a values for piston rings are tabulated in Table 3. The average of two measurement points is taken to plot the variation of R_a values and is shown in the Figure 3.

Table 3 R_a values for new piston rings (B0 and R30)

Piston Rings	R_a values in microns					
	2 Hrs (B0)	2 Hrs (R30)	4 Hrs (B0)	4 Hrs (R30)	6 Hrs (B0)	6 Hrs (R30)
Ring 1	0.71	0.287	0.729	0.401	0.732	0.302
Ring 2	0.62	0.208	0.651	0.431	0.662	0.205

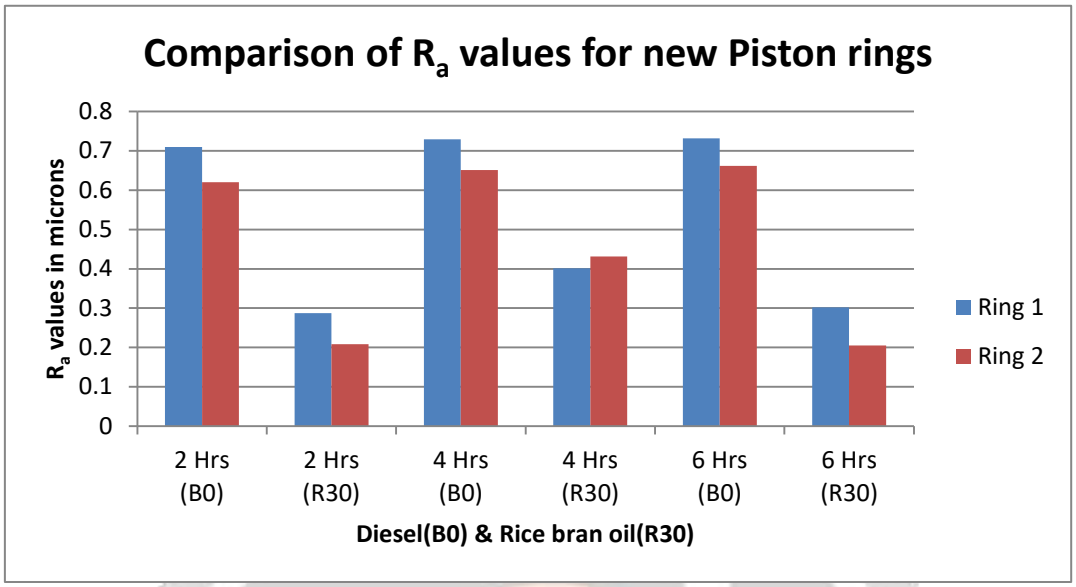

Figure 5.48 Comparison of R_a values for new piston rings (B0 and R30)

From the Figure 3 it can be concluded that R_a value of 0.205 microns is minimum for piston ring2 -6Hrs run with Rice Bran Oil-(R30).

V. CONCLUSIONS

The wear test reveal the effect of the combustion of diesel, blend of 70% Diesel+ 30% Rice bran oil on the wear of the materials of the IC Engine components viz., piston and piston rings. In the present study the surface roughness of the IC Engine components has been recorded for Diesel and blend of 70% Diesel + 30% Rice bran oil. The use of the blend of 70% Diesel+ 30% Rice bran oil has better tribological properties of the IC Engine components as compared to the diesel as a fuel.

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