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Performance Analysis of IC Engine using Rice bran Biodiesel (R40) by Combustion test

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ABSTRACT - Combustion, also known as burning, is the basic chemical process of releasing energy from a fuel and air mixture. The engine consists of a fixed cylinder and a moving piston. The expanding combustion gases push the piston, which in turn rotates the crankshaft. Combustion test is carried out to determine the performance of the IC engine by measuring the Brake power, Brake thermal efficiency and Mechanical efficiency. The readings are noted down for running the IC engine with Rice bran biodiesel (R40), for 2hrs, 4hrs and 6hrs respectively. It is observed that brake thermal efficiency and mechanical efficiency increases with increase in brake power and mechanical efficiency is more than brake thermal efficiency.

Keywords - Rice bran, Brake power, Brake thermal efficiency, Mechanical efficiency.

I. INTRODUCTION

Combustion is defined as a reaction between a fuel, oxygen and heat (or source of ignition) that causes the rapid oxidation of a fuel. More simply stated, it means the process of burning a fuel. In an internal combustion engine (ICE), the ignition and combustion of the fuel occurs within the engine itself. There are two kinds of internal combustion engines currently in production: the spark ignition gasoline engine and the compression ignition diesel engine. Spark ignition gasoline and compression ignition diesel engines differ in how they supply and ignite the fuel. In a spark ignition engine, the fuel is mixed with air and then inducted into the cylinder during the intake process. After the piston compresses the fuel-air mixture, the spark ignites it, causing combustion. The expansion of the combustion gases pushes the piston during the power stroke. In a diesel engine, only air is inducted into the engine and then compressed. Diesel engines then spray the fuel into the hot compressed air at a suitable, measured rate, causing it to ignite.

II. LITERATURE REVIEW

Wang Wenzhong, HU Yuanzhong, WANG Hui & LIU Yuchuan [1] found that Piston and piston ring lubrication is a factor that strongly affects the performance of the reciprocating internal combustion engine. Their work is based on a unified numerical approach assuming that the pressure distribution obeys Reynolds equation in hydrodynamic lubrication region, while in asperities contact regions, the contact pressure can be obtained through the so called reduced Reynolds equation.

Arka Ghosh [2] has worked on the essentials of combustion chamber, their design, influence in combustion process, timing, etc. They emphasize research on newer designs requirement for combustion chambers.

Balvinder Budania and Virender Bishnoi [3] have developed "A New Concept of I.C. Engine with Homogeneous Combustion in a Porous Medium". They have proposed a new combustion concept that fulfils all requirements to perform homogeneous combustion in I.C. engines using the Porous Medium Combustion Engine, called "PM - engine".

S. Jaichandar and K. Annamalai [4], have discussed the effect of use of biodiesel fuel on engine power, fuel consumption and thermal efficiency are collected and analyzed with that of conventional diesel fuel.

Maro JELIĆ and Neven NINIĆ [5] have discussed the "Analysis of Internal Combustion Engine Thermodynamic Using the Second Law of Thermodynamic". They used the numerical simulations in modeling the ICE engine processes together with the analysis by the second law of thermodynamics and got a very potent tool for better insight and optimization of spark- and compression-ignition engines achieving lower fuel consumption and lower emissions.

III. METHODOLOGY

In present work the conventional design of the IC Engine is considered for the combustion process. The investigations of the performance of the IC engine is done by measuring the Brake thermal efficiency and Mechanical efficiency for a given set of Brake power. The readings are noted down for running the IC engine with Rice bran biodiesel (R40), for 2hrs, 4hrs and 6hrs. The mechanical efficiency of an IC

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engine is proportional to combustion pressure and heat release. The force on the components is an important design parameter in combustion study of IC engines.

IV. RESULTS AND DISCUSSION

The data pertaining to brake power, brake thermal efficiency and mechanical efficiency values for 2 Hrs run on Rice Bran fuel are tabulated in Table 1.

Table 1 BP, BThE and ME values for Rice Bran (R40) 2Hrs Run

Rice Bran - (R40) 2Hrs Run		
BP (kW)	BThE (%)	ME (%)
0.5	4.19	8.60
1	18.09	45.92
2	27.97	60.24
3	32.17	72.1
4	30.20	73.46

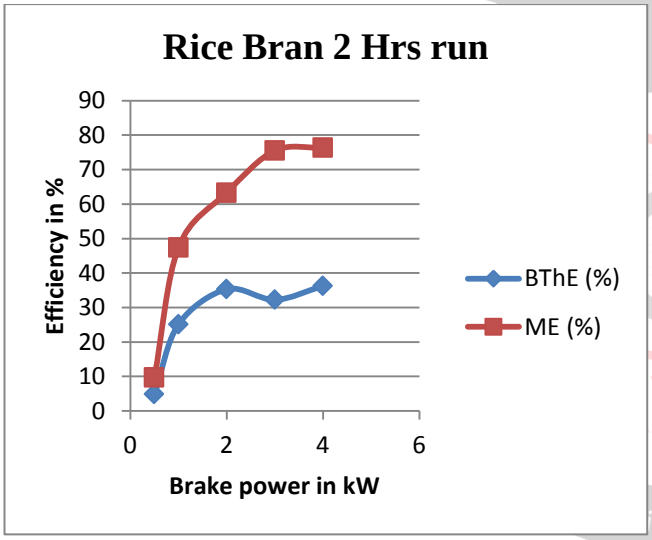

Figure 1 Variation of BThE and ME values with BP for Rice Bran (R40) 2Hrs Run

The Figure 1 represents variation of brake thermal efficiency and mechanical efficiency values with brake power. It is observed that brake thermal efficiency and mechanical efficiency increases with increase in brake power and mechanical efficiency is more than brake thermal efficiency.

The data pertaining to brake power, brake thermal efficiency and mechanical efficiency values for 4 Hrs run on Rice Bran fuel are tabulated in Table 2.

Table 2 BP, BThE and ME values for Rice Bran (R40) 4Hrs Run

Rice Bran - (R40) 4Hrs Run		
BP (kW)	BThE (%)	ME (%)
0.5	4.73	7.67
1	24.11	46.07
2	33.63	61.03
3	31.55	73.62
4	27.02	75.65

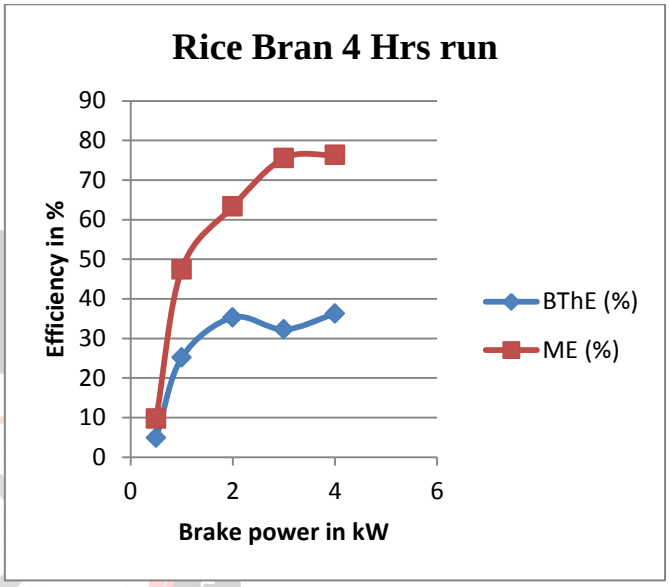

Figure 2 Variation of BThE and ME values with BP for Rice Bran (R40) 4Hrs Run

The Figure 2 represents variation of brake thermal efficiency and mechanical efficiency values with brake power. It is observed that brake thermal efficiency and mechanical efficiency increases with increase in brake power and mechanical efficiency is more than brake thermal efficiency.

The data pertaining to brake power, brake thermal efficiency and mechanical efficiency values for 6 Hrs run on Rice Bran fuel are tabulated in Table 3.

Table 3 BP, BThE and ME values for Rice Bran (R40) 6Hrs Run

Rice Bran - (R40) 6Hrs Run		
BP (kW)	BThE (%)	ME (%)
0.5	4.85	9.7
1	25.12	47.42
2	35.3	63.32
3	32.25	75.52
4	36.25	76.35

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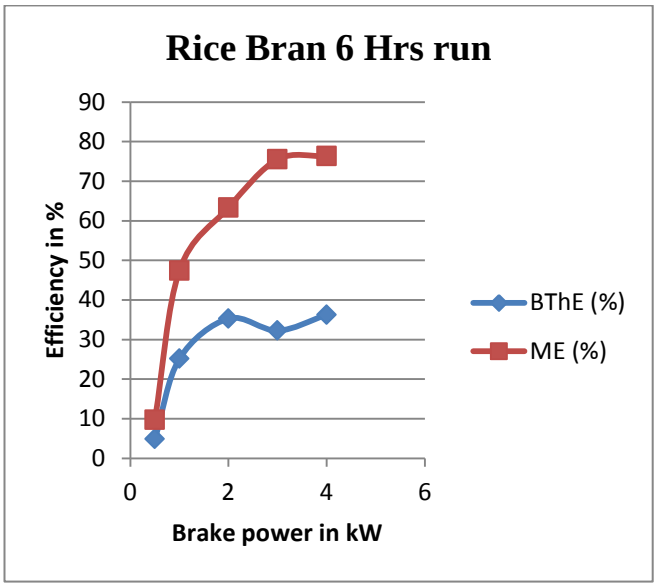

Figure 3 Variation of BThE and ME values with BP for Rice Bran (R40) 6Hrs Run

The Figure 3 represents variation of brake thermal efficiency and mechanical efficiency values with brake power. It is observed that brake thermal efficiency and mechanical efficiency increases with increase in brake power and mechanical efficiency is more than brake thermal efficiency.

V. CONCLUSIONS

The investigations of the performance of the IC engine is done by measuring the Brake thermal efficiency and Mechanical efficiency for a given set of Brake power. The readings are noted down for running the IC engine with Rice bran biodiesel (R40), for 2hrs, 4hrs and 6hrs. The mechanical efficiency of an IC engine is proportional to combustion pressure and heat release. The force on the components is an important design parameter in combustion study of IC engines. It is observed that brake thermal efficiency and mechanical efficiency increases with increase in brake power and mechanical efficiency is more than brake thermal efficiency.

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