Performance Analysis of IC Engine using Honge Fuel (H40) by Combustion Test

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Abstract— In an internal combustion engine (ICE), the ignition and combustion of the fuel occurs within the engine itself. The engine then partially converts the energy from the combustion to work. 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 Honge Fuel (H40), for 2hrs, 4hrs and 6hrs. It is observed that both brake thermal efficiency and mechanical efficiency increases with increase in brake power and also mechanical efficiency is more than brake thermal efficiency.

Keywords: Honge oil, Brake power, Brake thermal efficiency, Mechanical efficiency

I. INTRODUCTION

Combustion, also known as burning, is the basic chemical process of releasing energy from a fuel and air mixture. In an internal combustion engine (ICE), the ignition and combustion of the fuel occurs within the engine itself. The engine then partially converts the energy from the combustion to work. The engine consists of a fixed cylinder and a moving piston. The expanding combustion gases push the piston, which in turn rotates the crankshaft. Ultimately, through a system of gears in the power train, this motion drives the vehicle's wheels.

There are two kinds of internal combustion engines currently in production: the spark ignition gasoline engine and the compression ignition diesel engine. Most of these are four-stroke cycle engines, meaning four piston strokes are needed to complete a cycle. The cycle includes four distinct processes: intake, compression, combustion and power stroke, and exhaust.

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 Wenzhonget,al [1] used the method of reduced Reynolds equation to find contact pressure in hydrodynamic lubrication of contact regions of piston and cylinder. The main factors which affects the performance of IC engine are piston and piston ring lubrication.

O M I NWAFOR, [2] investigated the diesel engine knock. Many factors have been identified to note the knock characteristics of engines. The factors were ignition delay, engine speed and load, gas flow rate and turbulence.

A.S. Ramadhas et.al [3] have discussed the use of vegetable oils as alternative fuels. They found that vegetable oils are less polluting than fossil fuels. In This review they discussed characterization of vegetable oils and environmental work in different countries.

Avinash Kumar Agarwal, [4] studied on biofuels and effect of biofuels on the performance of IC engines was investigated. Blending of biodiesel of any proportion with diesel was tested on IC engine performance and emissions. They also studied the economic feasibility of biodiesels.

Maro JELIĆ et.al [5] have developed the numerical simulations in modelling IC engine along with the thermodynamic second law analysis. They achieved lower values of fuel consumption and emissions.

C D Rakopoulos et.al [6] investigated aspects of transient heat transfer of material properties of the wall of the engine. They developed the thermodynamic model with various insulation schemes.

N.R. Banapurmatha et.al, [7] investigated the performance and emission characteristics of diesel engine run by Honge, Jatropha and Sesame oil methyl ester and found that use of biodiesel can be used in its pure form.

E. Abu-Nada I et.al [8] they developed a thermodynamic model to investigate piston friction during cold starting and running condition. They found that high viscosity of oil could reduce efficiency by more than 50%.

AtulDhar et.al [9] presented the measurement and instrumentation of the effect of thickness of lubricating oil between piston ring and cylinder liner. They validated the instrumentation for the measurement in running engine. The validation between 0.2 to 0.8mm was reported.

Sutaria B.M et.al [10] studied the performance of IC engine for tribological parameters developed using Reyholds equation. Friction force ofpiston, piston ring and lubrication oil film thickness were compared with the published articles.

III. METHODOLOGY

Combustion is a process in which chemical energy of a fuel is converted into heat energy with the release of high pressure. The method of fuel air mixture formation is the governing parameter for the whole combustion process and the further processes related to it. The combustion in SI and CI engine hence varies due to the method of air fuel mixture formation. Also, due to this difference, the parameters governing the combustion will vary. The first basic difference is the fact that in SI engine, spark initiates the combustion, while in CI engine initiation of combustion is solely

dependent on self ignition of the fuel being used. The performance of an IC engine is determined by brake thermal efficiency and mechanical efficiency of the engine. The 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 Honge Fuel (H40), 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.

IV. RESULTS AND DISCUSSION

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

Honge- (H40) 2hrs Run		
BP (kW)	BThE (%)	ME (%)
0.5	1.88	8.7
1	20.4	45.38
2	27.17	63
3	25.68	70.9
4	26.91	74.3

Table 1: BP, BThE and ME values for Honge (H40) 2hrs Run

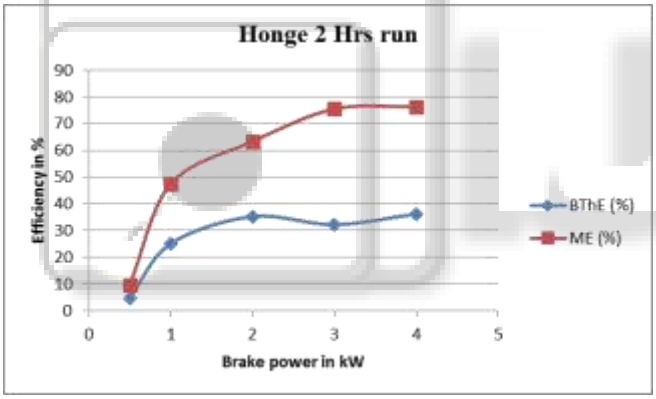

Fig. 1: Variation of BThE and ME values with BP for Honge (H40) 2Hrs Run

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 has greater value than brake thermal efficiency.

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

Honge- (H40) 4Hrs Run		
BP (kW)	BThE (%)	ME (%)
0.5	1.87	8.45
1	19.06	48.35
2	25.34	62.99
3	29.4	73.76
4	30.00	74.51

Table 2: BP, BThE and ME values for Honge (H40) 4 Hrs Run

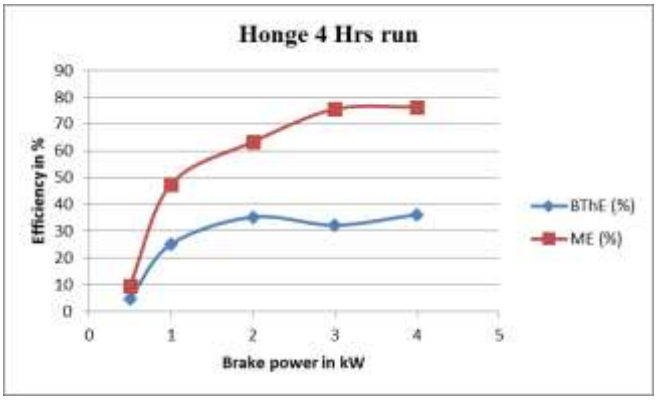

Fig. 2: Variation of BThE and ME values with BP for Honge (H40) 4 Hrs Run

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 Honge fuel are tabulated in Table 3.

Honge- (H40) 6Hrs Run		
BP (kW)	BThE (%)	ME (%)
0.5	1.86	9.05
1	18.18	51.22
2	27.65	63.33
3	29.60	73.88
4	31.50	75.79

Table 3: BP, BThE and ME values for Honge (H40) 6 Hrs Run

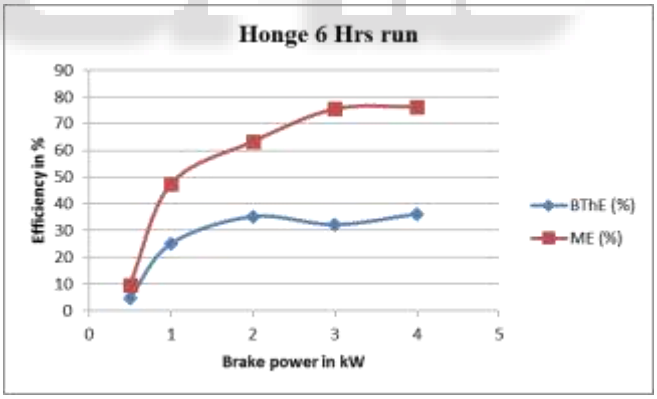

Fig. 3: Variation of BThE and ME values with BP for Honge (H40) 6 Hrs Run

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 increase with increase in brake power and mechanical efficiency is more than brake thermal efficiency.

V. CONCLUSIONS

The investigations on the performance of the IC engine are done by measuring the Brake power, Brake thermal efficiency and Mechanical efficiency. It is observed that brake thermal efficiency and mechanical efficiency increases

with increase in brake power and also, the mechanical efficiency is more than brake thermal efficiency.

REFERENCES

[1] WANGWenzhong, HU Yuanzhong, WANG Hui& LIU Yuchuan, Numerical simulation of piston ring in the mixed lubrication.*State Key Laboratory of Tribology, Tsinghua University,Vol. 116(3),* 470-478.
[2] O M I NWAFOR, (2002). Knock characteristics of dual-fuel combustion in diesel engines using natural gas as primary fuel Vol. 27(3), 375–382.
[3] A.S. Ramadhas, S. Jayaraj, and C. Muraleedharan,(2004).Use of Vegetable Oils as I.C. Engine Fuels.*Renewable Energy* 29 727–742.
[4] Avinash Kumar Agarwal,(2007).Biofuels (alcohols and biodiesel) applications as fuels for internal combustion engines.*Progress in Energy and Combustion Science* 33 233–271.
[5] Maro JELIĆ and Neven NINIĆ, et. al.,(2008). Analysis of Internal Combustion Engine Thermodynamic Using the Second Law of Thermodynamics.*Strojarstvo* Vol. 50 (2) 85-94
[6] C D Rakopoulos, E G Giakoumis, and D C Rakopoulos, (2008). Study of the short-term cylinder wall temperature oscillations during transient operation of a turbo-charged diesel engine with various insulation schemes9(3), 177-193.
[7] N.R. Banapurmatha,, P.G. Tewaria, R.S. Hosmathb, (2008). Performance and emission characteristics of a DI compression ignition engine operated on Honge, Jatropha and sesame oil methyl esters' *Renewable Energy* 33.
[8] E. Abu-Nada I. Al-Hinti A. Al-SarkhiB. Akash, (2008).Effect of Piston Friction on the Performance of SI Engine: A New Thermodynamic Approach.*Journal of Engineering for Gas Turbines and Power.*Vol.130(2) 022802.
[9] AtulDhar, Avinash Kumar Agarwal, Vishal Saxena,(2009).Measurement of dynamic lubricating oil film thickness between piston ring and liner in a motored engine.*Sensors and Actuators.* A 149 7–15.
[10] Sutaria B.M, Bhatt D.V and Mistry K.N,(2009). Simulation and Modeling of Friction Force and Oil Film Thickness in Piston Ring – Cylinder Liner Assembly of an I. C. Engine.*Proceedings of the World Congress on Engineering Vol II WCE 2009,* July 1 - 3, London, U.K.

