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EXPERIMENTAL INVESTIGATION ON 4-S CI ENGINE USING PUMPKIN SEED BIO-DIESEL AS AN ALTERNATIVE FUEL BY VARYING THE INJECTION TIMING

Dr. B. OMPRAKASH
Assistant Professor,
Mechanical Engineering Department,
JNTUA College of Engineering, Ananthapuramu, A.P, India

Dr. R. GANAPATI
Associate Professor,
Mechanical Engineering Department,
ANURAG Engineering College, Kodada, Telangana, India.

***Abstract*: Bio fuel, which comes from renewable resources, burns cleanly. Bio fuel can replace diesel in compression-ignition engines. A diesel engine with PSBO and diesel mixes was used to examine how Optimal injection timing improves efficiency and reduces pollution.The injection timing was adjusted from what is typically used with diesel oil. The diesel engine used for the tests was a single cylinder, direct injection, four stroke design.According to the data, the best performance and lowest emissions are achieved at an injection timing of 27°bTDC.**

Keywords:Injector Timing, Blends, Performance, and Emissions in Diesel Engines

Introduction

Rapid depletion of fossil fuels has accelerated the need to investigate potential replacement energy sources. There has also been a worldwide uptick in people realizing the dangers of breathing polluted air, such as that produced by vehicles' exhaust systems. To achieve these goals, many countries have implemented strict regulations on vehicle exhaust. Engine manufacturers are adopting a wide range of design changes to engines and pollution control devices to meet these stringent emission and fuel economy rules.

Vegetable oils made from biomass are a highly potential replacement fuel for diesel vehicles used in agriculture. Due to their high viscosity, vegetable oils reduce diesel engine performance and increase smoke emissionsand carbon residue. The transesterification technique can be used to enhance the functionality of vegetable oils. Bio-fuels can be a good alternative to diesel for most poor countries, permitting them to put aside more foreign currency and aiding in the fight against environmental deterioration. Ethanol, edible and non-edible vegetable oils, biomass, biogas, etc. are all examples of fuel obtained from biological sources., while others must be manufactured to more closely resemble conventional fuels in the desirable qualities.

Injection One of the most influential factors in the efficiency and pollution levels of a diesel engine is the timing of its combustion events. Therefore, the The effect of varying injection timing on diesel performance and emissions was explored in the present work.

Literature Review

Because of its similarity to diesel fuel, biodiesel has been studied as a potential replacement fuel for diesel engines in the transportation industry. Due to their promising qualities, vegetable oils as fuel have prompted a lot of study all across the world. Seventy types of oil seeds were identified by Duke and Bagby as having high output potential[2], whereas Jamieson listed around 350 oil-bearing crops [1].

Due to their better qualities compared to other alternative fuels like ethanol and methanol, vegetable oils are a very enticing alternative fuel to diesel oil[3].Vegetable oils are produced in a straightforward, cost-effective manner in all agricultural nations, including India.

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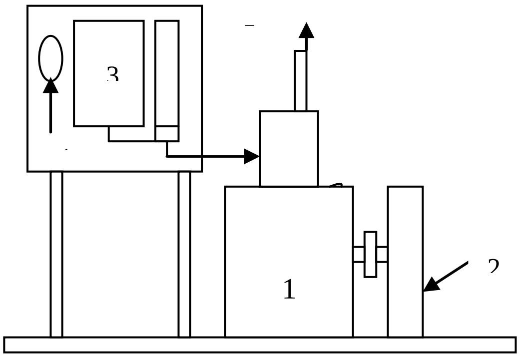
Research [4, 5] has demonstrated that vegetable oils that have not been chemically changed are not an effective Diesel engine fuel, essentially. Jatropha oil, Karanji oil, Rice bran oil, Rapeseed oil, etc. have all been studied for their potential use in diesel engines.

Due to their low volatility, The cetane number of vegetable oils is between 35 and 40, which is too low to be used in a diesel engine. Vegetable oil has a lower heating value than other oils because of the oxygen in it. ten percent on diesel fuel costs. Derivatives of vegetable oils are similar in viscosity to diesel fuel. Vegetable oil can be used in CI engines using a variety of methods, including mixing with diesel, undergoing transesterification in order to produce a methyl, ethyl, butyl, or other ester.[5, 7]. Methyl ester, produced by reacting vegetable oils with methanol, is the most widely used ester [8].

Both Senthil et al. [9] and Venkataramana et al. [10] We looked into the viability of running a diesel engine on a blend of methyl ester of soybean oil and Jatropha oil. Methyl esters were found to derived from soybean oil and Jatropha oil could serve as viable diesel substitutes.The impact of injection pressure on engine performance when using rice bran oil as bio diesel is investigated by Nagaraja et al. [11].



In this study, a diesel engine was fueled with a mixture of diesel (80%) and Diethyl Ether (20%) known as B20. Key performance characteristics were tested using a range of injection times. Better injection timing was chosen after analyzing the experimental data.

EXPERIMENTAL SETUP

The study employed a diesel engine with one cylinder, four valves per cylinder, water cooling, natural aspiration, and direct injection. Table 1 contains information on the engines. Fig.1 depicts a schematic of the experimental setup.

An eddy current dynamometer was used to apply a load to the engine. The two main parts of an eddy current dynamometer are the inductive pick-up sensor and the digital rpm indication were used to determine and display the rotational velocity of the engine. A burette and a timer were used to determine the gasoline flow rate on a volumetric basis. In order to determine the temperature of the exhaust gas, a thermocouple and a digital temperature readout were employed.

In order to gauge the pressure inside the cylinder, a digital data collecting system and a piezoelectric transducer were utilized. In order to pinpoint the TDC, a signal is generated by an optical encoder.

EXPERIMENTAL PROCEDURE

There were three stages to the experimentation. In the initial stage, trials were conducted with an injection timing of 27°bTDC. Compression ratio of 17.5:1 and cooling water flow rate of 200 liters per hour were kept constant during the entire inquiry. A steady 1500 rpm was maintained for the engine. The injection pump's fueling rack allowed for manual adjustment of fuel flow rate to keep the engine running at a steady pace. All measurements were taken after the engine was established. Important observations and emissions were obtained at steady state. Then, the workload was changed from light to heavy. In the second and third stages, we deviated from the injection timing suggested for neat diesel operation by increasing and decreasing it, respectively. After the system stabilized, crucial measurements and emissions were taken from zero to full power.

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RESULT AND DISCUSSIONS

The diesel engine's fuel injection system ran smoothly when using B20 Blend. Three alternate injection timings are provided, and the results for gas mileage and pollution output in engines are detailed below.

The thermal efficiency of a brake is measured as the amount of baking power relative to the amount of heat supplied.The effect of load on the thermal efficiency of the brakes is depicted in Figure 2. At 27 °bTDC, the thermal efficiency of the brakes is maximized. Possible explanation: enhanced atomization and air mixing with the fuel. When air and fuel are mixed more thoroughly, combustion improves, leading to greater thermal efficiency in the brakes. When the injection timing is off, the thermal efficiency of the

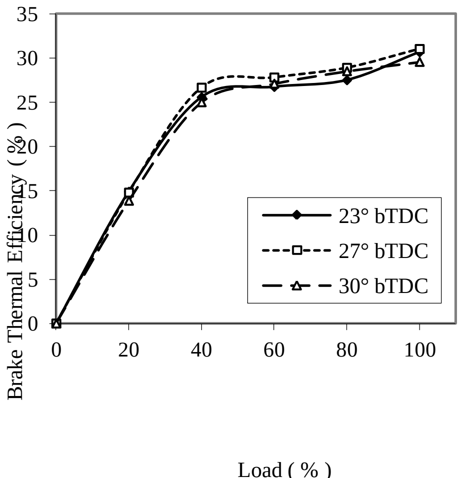

Fig.2. Effect of Injection Timing on Brake Thermal Efficiency

Fig.3 depicts the relationship between BSEC and load fluctuation. With a 27 °bTDC injection timing, the BSEC is reduced. However, different injection timings lead to greater BSEC; this may be because of increased fuel discharge for the same plunger displacement in the fuel injection pump. This leads to a risein BSEC.

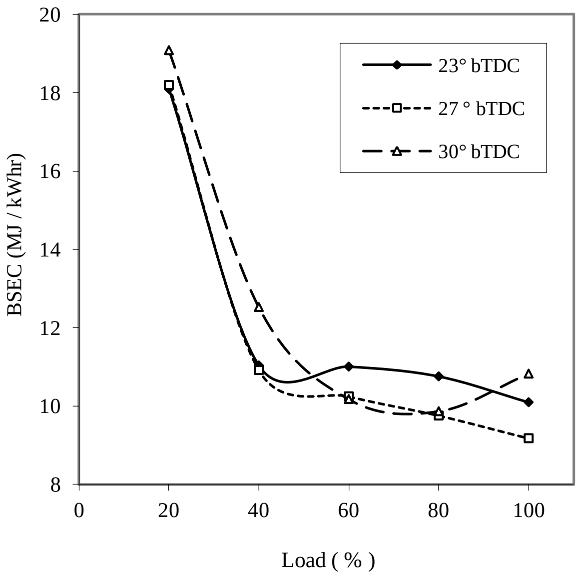

Fig.3 Effect of Injection Timing on BSEC

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Exhaust gas temperature as a function of load is seen in Figure 4. It can be seen in the figure that the EGT rises along with the load. Increased EGT can be expected with an injection timing of 30 °bTDC. Higher combustion temperatures could be the result of a complete burn of the fuel. It's possible that this contributed to a rise in EGT. At larger loads, EGT is reduced with the alternative injection timings. The shorter reaction time between adding gasoline and air explains.

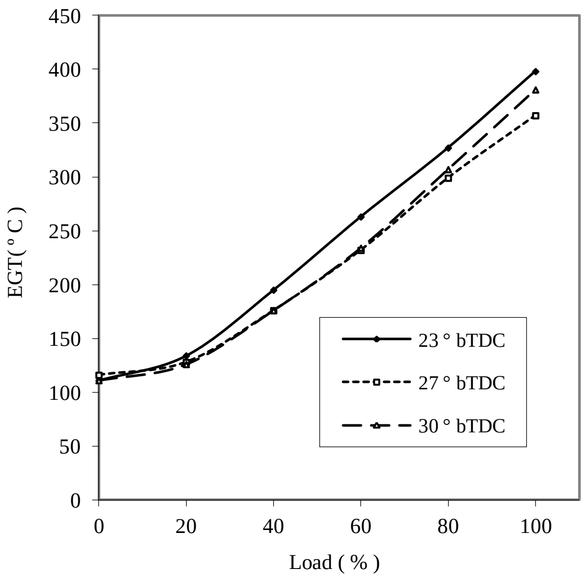

Fig.4 Effect of Injecdtion Timing on EGT

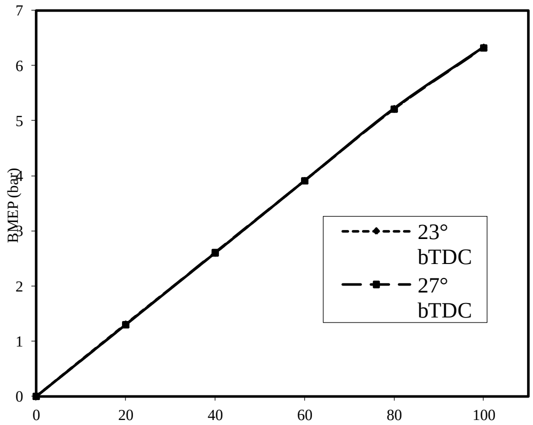

Fig. Effect of Injection Timing on BMEP

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Figure 5 depicts the change in Brake Mean Effective Pressure (BMEP) as a function of load. BMEP is relatively constant across a wide range of loads. However, the BMEP is increased by a little margin when the injection is made at 27°bTDC.

CONCLUSIONS

The B20 blend worked perfectly in the 4-S diesel engine. Based on the findings of the experiments, we draw the following inferences.

Engine running nicely on B20 Blend.

- Higher brake thermal efficiency is achieved with an injection timing of 27 °bTDC compared to other injection timings.
- When compared to earlier injection times, the exhaust gas temperature at 27 °bTDC is higher.
- When compared to other injection times, the BMEP of 27 °bTDC is slightly later.

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