Influence Bioethanol from Corncob Waste on a Four-Stroke Motorcycle on Performance

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Abstract. This research utilizes Corncob waste for making ethanol for gasoline fuel mixture. The fuel variations in this study were from a mixture of E5, E10, E15, E20, and E25 with a compression ratio of 10:1, 11:1 and 12:1. The engine speed includes 1400 rpm, 2400 rpm, and 3400 rpm. Data collection includes torque, consumption time of 25 ml of fuel, exhaust gas, engine, and oil temperature. The results showed an increase in torque from all bioethanol fuel mixtures.

Keywords: Bioethanol, Corncob Waste, Gasoline, Compression Ratio, Performance.

1 Introduction

The development of the times brings the impact of increasing the frequency of human activities and demands maximum results [1]. To make it happen, supporting facilities are needed, one of which is transportation facilities [2]. Along with the large number of public demand for vehicles, causing an increase in the number of vehicles in Indonesia [3]. In the last seven years, the number of vehicles has doubled, with an average increase of 11% per year. On the one hand, the rise in the number of cars has a positive impact on economic development. On the other hand, this also has a negative impact, namely the limited energy needed to move the vehicle. Meanwhile, Indonesia's oil supply is estimated to only be able to meet the needs of the next 23 years [4].

Moving on from this phenomenon, now many alternative energies have been developed to overcome the big problem being faced, namely bioethanol [5]. Bioethanol is an alternative fuel which in recent years is widely known by the public. The use of bioethanol as vehicle fuel is a safe alternative, because bioethanol produces lower emissions and can reduce dependence on petroleum [6]. Bioethanol can be produced from plant raw materials containing starch, cellulose and carbohydrates [7]. Sources of alternative energy raw materials generally come from food crops such as cassava, sweet potato, sugar cane, corn and others. One of the potential raw materials to be used as raw materials is corn cobs [8].

In Indonesia, corn is a food commodity with an increased production level. Based on data compiled by the Central Statistics Agency (2022), in 2020, corn production in Indonesia was

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22.5 million tons. The use of corn plants so far only refers to seeds. Plant parts such as cobs have generally not been used optimally [9]. The utilization of corn cobs as raw material to produce bioethanol is closely related to the chemical components contained in it, namely the presence of crude fibre and cellulose, which can be converted into bioethanol. Corn cobs contain 46% cellulose, 36% hemicellulose and 16% lignin [10]. With a reasonably high cellulose content, corn cobs allow it to be used as a raw material for bioethanol. Bioethanol from corn cobs as gasohol fuel has not been used; even corn cobs are discarded and become waste [11]. So far, it is often seen in the corn fields piles of corn cobs that have been mounted on fire just like that. If this continues, of course, it will increase the amount of useless waste that is detrimental to the environment if it is not handled properly [12].

2 Method

The object of research in this study is the New Honda Revo X 2018 four-stroke motorcycle. The fuel variations in this study are a mixture of E5, E10, E15, E20, and E25 with compression ratios of 10:1, 11:1 and 12:1. . The engine speed includes 1400 rpm, 2400 rpm, and 3400 rpm. In this case, the data to be taken is the performance of the use of RON 92 fuel and bioethanol fuel. The data collection technique in this research is through direct data collection on the motorcycle being tested using a dyno test tool to obtain torque and power data.

3 Results and Discussion

Through the research, objectives are to be achieved, namely to determine how much influence the use of bioethanol from corncob waste as a mixture of RON 92 on four-stroke motorcycles has on performance. The research was carried out at three rotations, namely 1400 rpm, 2400 rpm, and 3400 rpm, with three repetitions of the test at each rpm; below will describe the effect of using bioethanol from corncob waste as a fuel mixture for RON 92.

3.1 Torque

Torque is the force of turning an object about an axis or measures the piston's rotational force applied to an engine crankshaft. Every machine that is designed and built output that varies depending on the application. The torque output of a vehicle's engine depends on its stroke-to-bore ratio, compression ratio, combustion pressure and speed in rpm. Engines with a longer stroke than engines with a broader diameter tend to produce more torque, and different engine configurations make other torque characteristics. Generally, a petrol engine usually starts at around 1000 to 1200 rpm and reaches a peak in the range of 2500 to 4000.

Compression Ratio 10:1

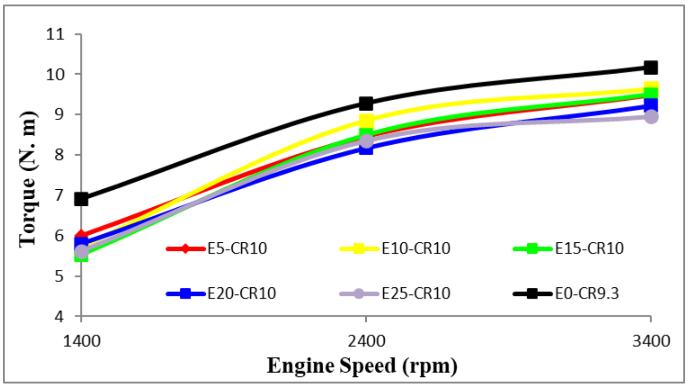

Fig. 1. The torque is produced from the bioethanol fuel mixture with a configuration of CR10.

An increase in the CR10 indicates a decrease in all bioethanol fuel mixtures compared to RON 92 fuel which uses a standard compression ratio. The bioethanol fuel mixture produces the best torque in the E10 mix. This decrease was due to the bioethanol fuel and RON 92 not being thoroughly mixed [13].

Compression Ratio 11:1

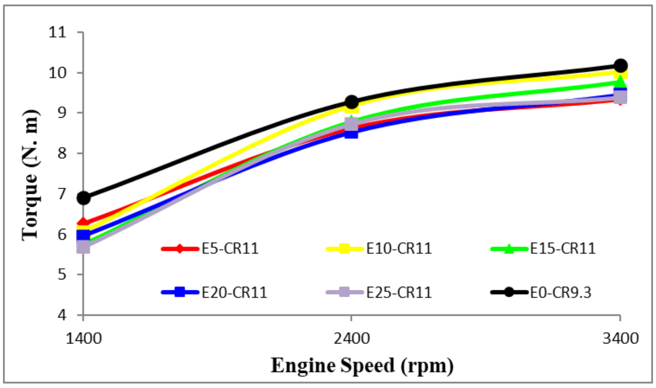

Fig. 2. The torque is produced from the bioethanol fuel mixture with a configuration of CR11.

The picture above shows that the best torque increase from bioethanol fuel is found in the E10 bioethanol fuel mixture. The torque produced from the E10 variety is almost equivalent to the torque of the 92 RON fuel. Meanwhile, the lowest torque is obtained from the E20 bioethanol mixture. From testing with CR of 10:1, 11:1, and 12:1, the best torque is found in the CR11 with E10 bioethanol fuel.

Compression Ratio 12:1

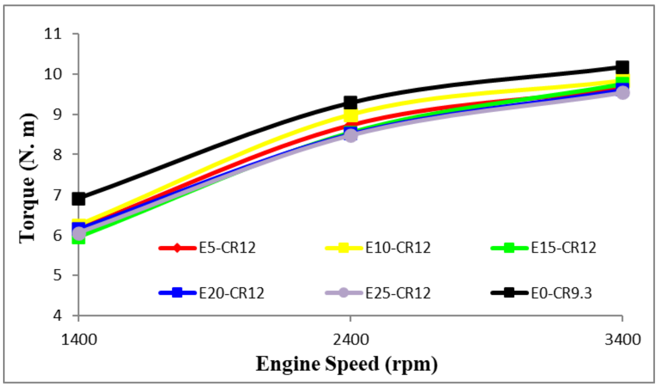

Fig. 3. The torque is produced from the bioethanol fuel mixture with a configuration of CR12.

The torque produced by bioethanol fuel from a mixture of E5 to E25 has yet to be able to make a torque more significant than the torque of RON 92 fuel. The test results show that the higher the bioethanol fuel mixture at a CR12, the lower the torque produced.

3.2 Brake Mean Effective Pressure (BMEP)

Brake mean effective pressure is the constant theoretical pressure on the piston during the working stroke, producing the same net work per cycle as that from an internal combustion engine at the crankshaft.

Compression Ratio 10:1

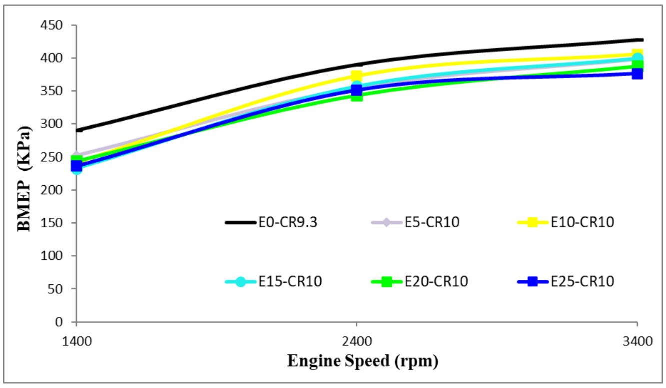

Fig. 4. Brake Mean Effective Pressure resulting from a mixture of bioethanol fuel with a CR10.

The picture above shows that the BMEP produced by all bioethanol fuel mixtures is lower than RON 92 fuel.

Compression Ratio 11:1

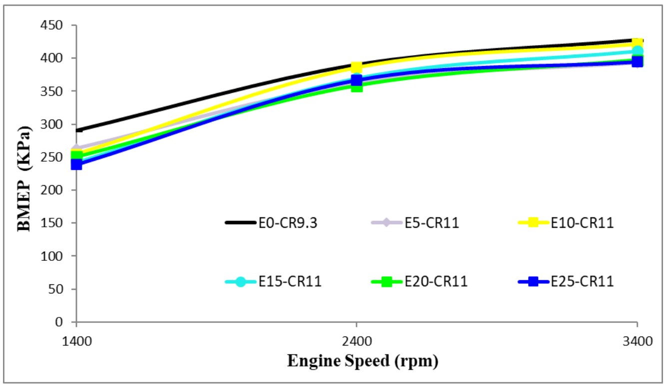

Fig. 5. Brake Mean Effective Pressure resulting from a mixture of bioethanol fuel with a CR11.

The BMEP of bioethanol fuel shows a value equivalent to RON 92 fuel. The best BMEP value is found in E10 bioethanol fuel. CR11 has the best engine efficiency of the other two compression ratio variations.

Compression Ratio 12: 1

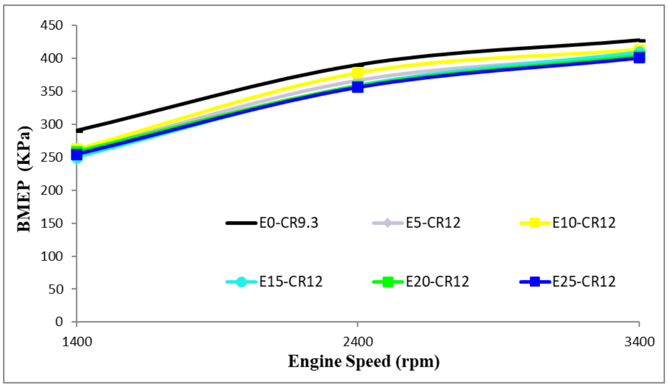

Fig. 6. Brake Mean Effective Pressure resulting from a mixture of bioethanol fuel with a CR12.

For BMEP, the CR12 is better than the CR10. The difference in the BMEP value of the mixture of bioethanol fuel and RON 92 fuel in the graph looks thin, especially for E10 bioethanol fuel.

3.3 Specific Fuel Consumption (SFC)

Specific Fuel Consumption measures the fuel efficiency of any prime mover that burns fuel and generates rotation, or shaft, power. It is usually used to compare the efficiency of an internal combustion engine with the output shaft. SFC can also mean the level of fuel consumption in producing power. Thus, the smaller the SFC, it can be said that the motor is fuel efficient and shows that the engine is more efficient.

Compression Ratio 10:1

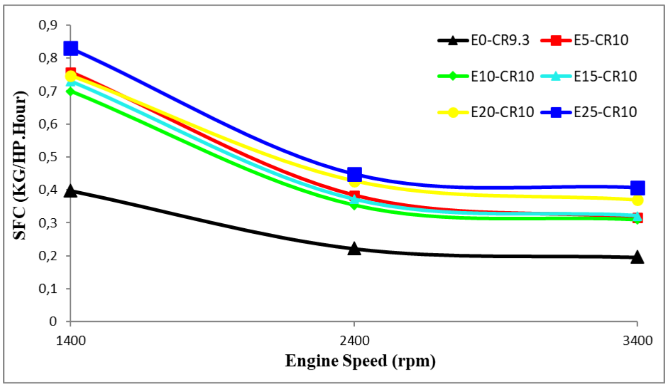

Fig. 7. Specific Fuel Consumption produced from a mixture of bioethanol fuel with a CR10.

The SFC shown in the picture above shows that the average SFC value of the overall bioethanol fuel is higher than that of RON 92 fuel. This is because the most wasteful fuel mixture is found in E25 bioethanol fuel.

Compression Ratio 11:1

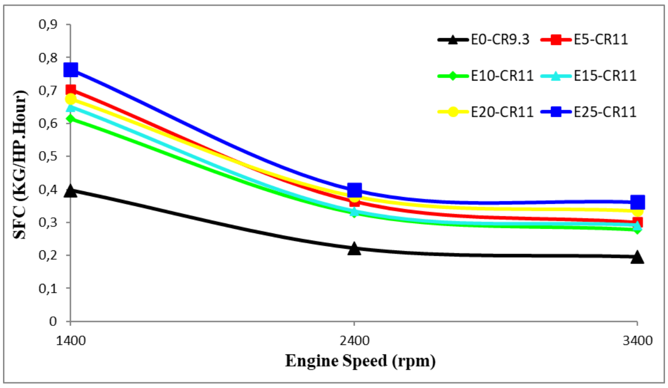

Fig. 8. Specific Fuel Consumption produced from a mixture of bioethanol fuel with a CR11.

CR11 shows the same results as the CR10, although the SFC value of the CR11 is slightly lower. The bioethanol fuel mixture with the lowest SFC value is found in the E10 mix.

Compression Ratio 12: 1

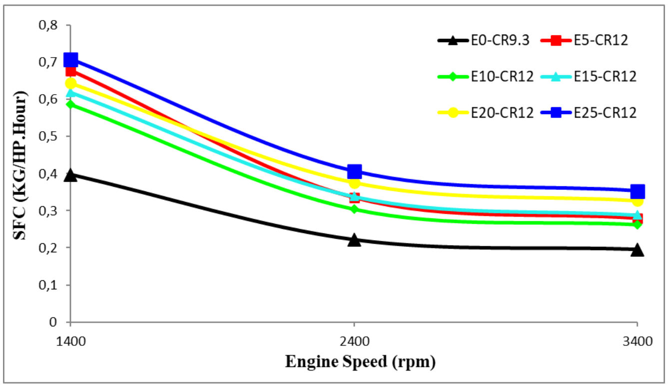

Fig. 9. Specific Fuel Consumption produced from a mixture of bioethanol fuel with a CR12.

The 12:1 compression ratio is the lowest SFC compared to other compression ratio variations. The difference can be seen in the image of the E10 bioethanol fuel approaching the SFC value of RON 92 fuel. While the highest SFC value is found in the E25 bioethanol fuel mixture. This is due to the high oxygen content in ethanol, thereby increasing the SFC of bioethanol fuel [13].

4 Conclusion

The effect of using corncob waste bioethanol as a mixture of RON 92 on performance on a Four Stroke Motorcycle. The test results show that optimal torque and power are achieved by using a variety of E10 with a CR11; an increase in the variation of a higher compression ratio in the engine affects the torque and power. For specific fuel consumption, the optimal value is obtained by using the E10 mixture with a CR12.

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