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# HEATING TREATMENT OF INCOMING AIR COMBUSTION CHAMBER ON THE E20 FUEL MIXTURE

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***Abstract.*** This research was conducted to improve engine performance with a mixture of ethanol and gasoline, because the mixture of ethanol and gasoline fuel causes the value of the flash point and evaporation of fuel heat to be higher. To overcome this, the air entering the combustion chamber is carried out by being heated to 26°C (standard), 30°C, 40°C and 50°C, the fuel used is the E20 with engine revolutions of 2000 to 8000 revolutions per minute. The results showed that the highest torque of E20 fuel at 30°C with a value of 9.004 Nm increased by 0.27%. At the highest power, it is located at 30°C with a power of 5.99 kW 0.5%. For the lowest consumption in the 2000 round, it was found in the 30°C temperature treatment with a value of 1.4 Kg / Hp.Hour and for exhaust gas emissions the lowest hydro carbon value was found in the 30°C temperature treatment while the lowest value of carbon monoxide was found at the 50°C temperature treatment. These results show that the air heating treatment can improve engine performance.

*Keywords : Temperature,Combustion, Treatment*

## 1. INTRODUCTION

Oil production is vulnerable in this regard can be seen in the production of domestic oil refineries. Energy versification is needed in the current energy crisis by developing alternative bio ethanol fuels to provide for national energy consumption needs. Researchers have begun to pay attention to the use of a mixture of ethanol and gasoline as vehicle fuel since the last 40 years[1]. The use of ethanol is generally widely used as an alternative fuel for transportation by mixing gasoline and ethanol with percentage levels, but the mixture of gasoline and ethanol fuel has a weakness due to the latent heat of ethanol and gasoline fuels has a difference of three times that of gasoline latent heat the treatment of the fuel system is needed when using a mixture of ethanol fuel and gasoline so that the use of ethanol fuel mixture can be applied to gasoline-fueled engines[2][3]. The advantage of ethanol is that it can reduce the value of CO and HC when mixed with gasoline[4]. Based on the problems above to get maximum performance in a gasoline-fueled engine, one of the things that can be done is to warm up the air into the combustion chamber aims to it is expected that the performance of engines with ethanol and gasoline fuel mixture can be better than gasoline engines[5][6][7]. Therefore it is necessary to obtain the right temperature of the inlet air of the combustion chamber on the mixture of ethanol and gasoline fuel.

## 2. METHODS

The method used in this research is an experimental method. This experimental method was used to determine the effect of a mixture of pertalite and ethanol fuel on the performance and exhaust emissions of the Beat esp engine.

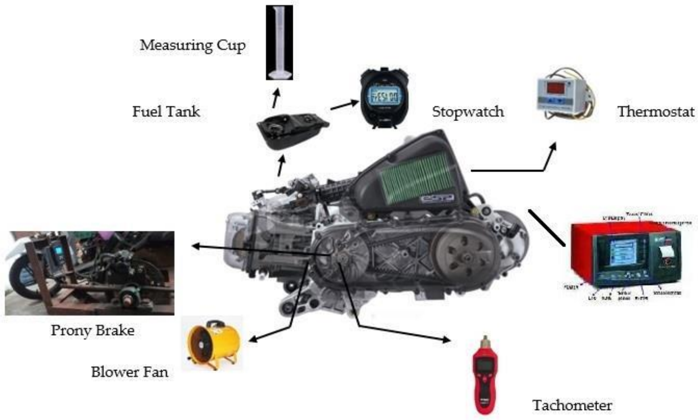


Figure 1. Experiment Setup

In this research, the fuel used was E20 fuel = 20% Ethanol + 80% Pertalite, while the ethanol used is 99.75% and the air heater treatment were placed in the air filter box by wrapping the air inlet pipe with nickel wire with a diameter of 0.3 mm, to regulate the heat of air entering the combustion chamber, using a thermostat. The temperatures used in this research were 26°C (standard), 30°C, 40°C and 50°C. This temperature was chosen because the fuel used uses a low concentration of E20 with a fuel composition of 20% ethanol and 80% pertalite. The parameters observed in this research are engine performance and exhaust emissions, engine performance testing using a Prony brake tool, this tool serves to measure the force generated by the engine crankshaft and then converted to torque for for testing exhaust emissions the observed results are CO and HC using a gas analyzer that is placed in the exhaust hole when the engine is started.

## 3. RESULTS AND DISCUSSION

The table below shows the results obtained during the research and visualized using the graphs contained in the explanation and performance analysis.

Table 1. Value of Research Results

| Torque | | | | | Power | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RPM | 26°C | 30°C | 40°C | 50°C | RPM | 26°C | 30°C | 40°C | 50°C |
| 2000 | 3,75 | 3,78 | 3,75 | 3,74 | 2000 | 0,78 | 0,79 | 0,78 | 0,78 |
| 3000 | 5,51 | 5,57 | 5,51 | 5,47 | 3000 | 1,73 | 1,74 | 1,73 | 1,71 |
| 4000 | 6,8 | 6,8 | 6,83 | 6,79 | 4000 | 2,84 | 2,84 | 2,85 | 2,84 |
| 5000 | 8,2 | 8,26 | 8,25 | 8,23 | 5000 | 4,29 | 4,32 | 4,31 | 4,3 |
| 6000 | 8,98 | 9,004 | 8,98 | 8,94 | 6000 | 5,64 | 5,67 | 5,63 | 5,61 |
| 7000 | 8,14 | 8,17 | 8,17 | 8,13 | 7000 | 5,96 | 5,99 | 5,98 | 5,95 |
| 8000 | 6,46 | 6,49 | 6,46 | 6,41 | 8000 | 5,41 | 5,43 | 5,4 | 5,36 |

| Fuel Consumption | | | | |
|---|---|---|---|---|
| RPM | 26°C | 30°C | 40°C | 50°C |
| 2000 | 1,41 | 1,4 | 1,42 | 1,43 |
| 3000 | 0,63 | 0,63 | 0,64 | 0,65 |
| 4000 | 0,38 | 0,38 | 0,38 | 0,38 |
| 5000 | 0,27 | 0,27 | 0,28 | 0,28 |
| 6000 | 0,21 | 0,21 | 0,21 | 0,21 |
| 7000 | 0,2 | 0,2 | 0,2 | 0,2 |
| 8000 | 0,22 | 0,22 | 0,22 | 0,22 |

| Gas Emission | | | | |
|---|---|---|---|---|
| CO | 2,81 | 3,16 | 2,95 | 2,57 |
| HC | 393 | 354 | 465 | 524 |

### 3.1 Torque

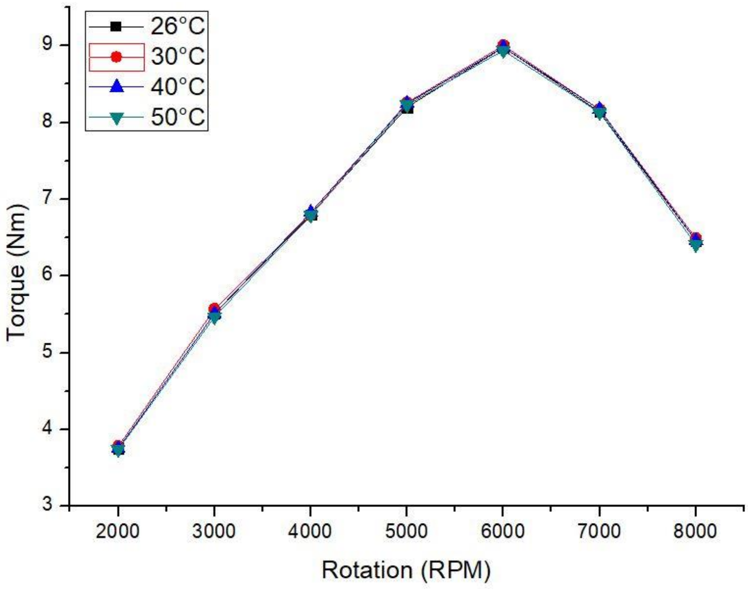


Figure 2. Torque Result

From picture 2, it can be seen that the highest torque is generated at the inlet air heating treatment with a temperature of 30°C at a revolution of 6000 with a torque value of 9.004 Nm and experiences a percentage increase of 0.27%, compared to without air heating treatment, this is because air heating can add energy during the combustion process so that the maximum combustion point is reached and for the lowest torque value is found in the inlet air heating treatment with temperature 50°C with a torque value of 8.94 Nm and experienced a percentage decrease of 0.44%, this is because the heating temperature that is too high can cause detonation in the combustion chamber to burn so that the pressure in the combustion chamber during the compression stroke is reduced. The temperature of the air in the combustion chamber greatly affects engine performance because the air temperature can affect the flash point value of the fuel in the combustion chamber, for gasoline fuel has a flash point value of -42°C and for ethanol fuel 12°C[5], so that the use of fuel mixture of ethanol and gasoline requires additional energy in the form of proper air heating so that the combustion process in the combustion chamber becomes homogeneous and burns optimally[8].

### 3.2. Power

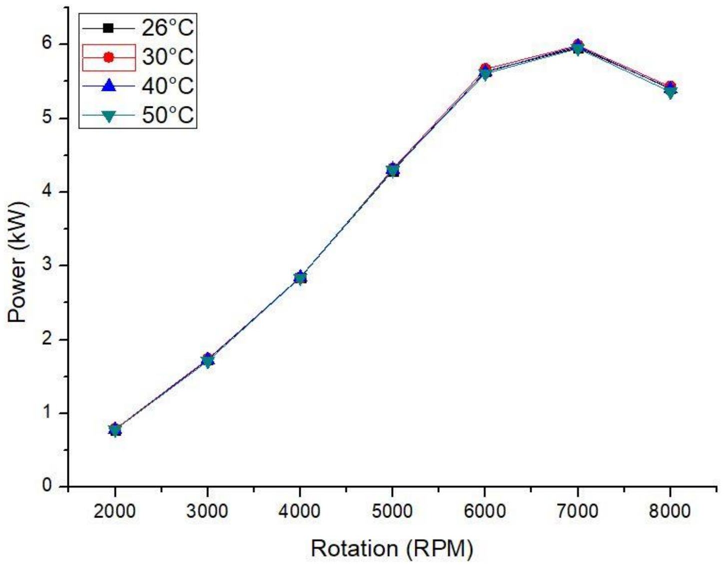


Figure 3. Power Result

From figure 3, it shows that the highest power is generated at the inlet air heating treatment with a temperature of 30°C at a revolution of 7000 with a power value of 5.99 kW and experienced a percentage increase of 0.5% compared to without air heating treatment and for the lowest power value was found in the inlet air heating treatment with a temperature of 50°C with a power value of 5.95 kW and experienced a percentage decrease of 0.16%, from this result shows the power results are directly proportional to the torque results obtained during this research, but the number of percentage increases and decreases in power is not the same in number as the percentage increase and decrease in torque, but the temperature treatment with the highest value and the lowest value of power is equal to the value of the treatment produced by torque[7][9][10].

### 3.3. Specific Fuel Consumption

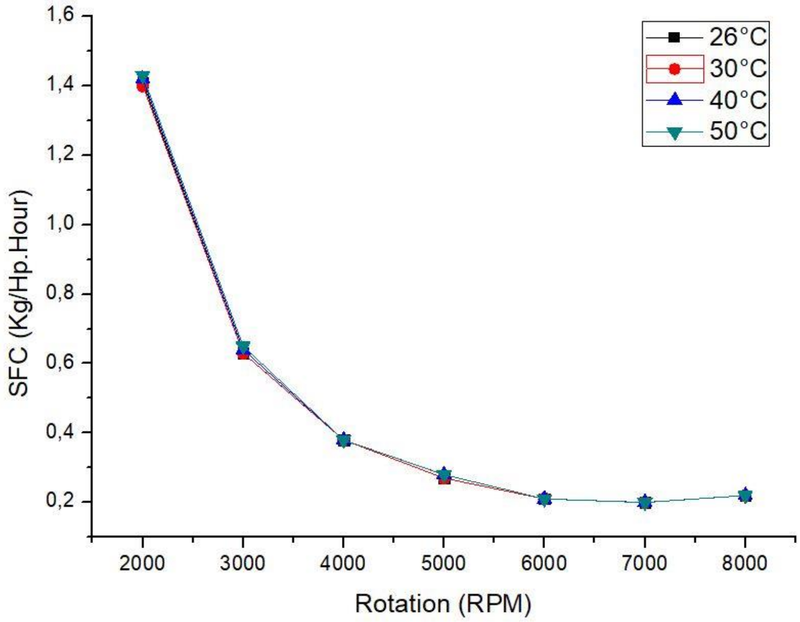

Figure 4. Specific Fuel Consumption

To measure fuel consumption the test is carried out by calculating the time it takes to spend 50 ml of fuel, this is done to find out the fuel consumption level of each fuel used. Figure 4 shows that in the 2000 round, the lowest consumption value is found in the heating treatment of the air temperature of 30°C with a value of 1.4 Kg / Hp.Hour and experienced a percentage decrease of 0.71% which indicates good results because for fuel consumption the more the decrease in the value of the percentage of fuel consumption, the better the results obtained. The highest consumption is found in the 50°C air temperature heating treatment with a consumption value of 1.41 Kg/Hp.Hour and a percentage increase of 1.41%, this indicates poor fuel consumption because the consumption value is higher than the consumption value without air heating treatment. Air heating causes the air temperature in the combustion chamber to increase so that the air and fuel in the combustion chamber become homogeneous, but improper air heating treatment on the use of a mixture of ethanol and gasoline fuel can cause the value of fuel consumption to increase, this is also the case in previous studies that air heating in the mixture of ethanol and gasoline fuel can affect fuel consumption[11][12][13].

### 3.4. Emission

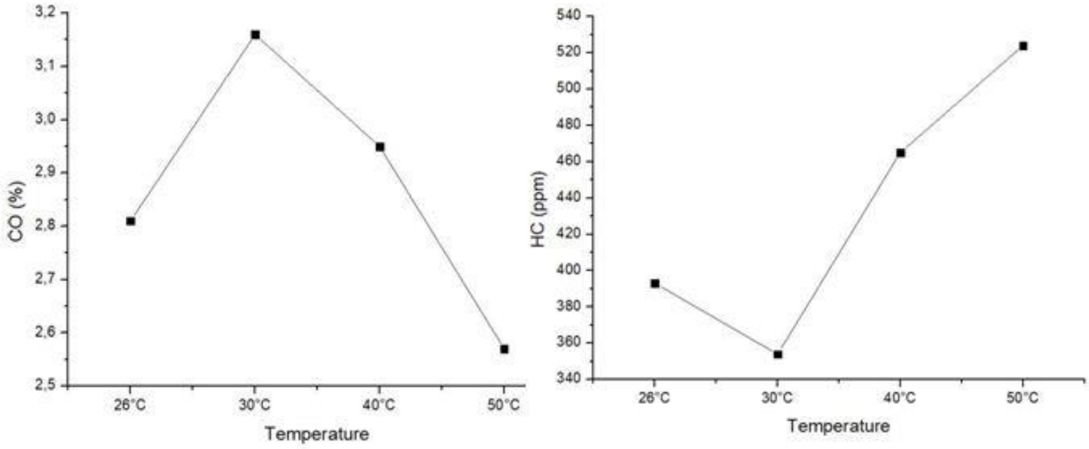


Figure 5. Emission

The increase in hydrocarbons caused by less than perfect combustion can be proven that the highest hydrocarbon value is found at a temperature treatment of 50°C with a hydrocarbon value of 524 ppm, while the lowest value is found in a temperature treatment of 30°C with a hydrocarbon value of 354 ppm, while for a carbon monoxide value the lowest value is found in a temperature treatment of 50°C with a carbon monoxide value of 2.57%. The increase in the value of carbon monoxide is caused by the low temperature in the combustion chamber[14]. with the treatment of air heating can increase the temperature in the combustion chamber so that the value of carbon monoxide becomes low.

## 4. CONCLUSION

In this research, the air heating treatment greatly affects the engine performance value as evidenced by the percentage of increasing torque by 0.27%, power by 0.5%, fuel consumption has decreased by 0.71%. For all the best results obtained on air heating treatment with a temperature of 30 °C and for exhaust gas emissions can be the lowest hydro carbon is found at a temperature treatment of 30 ° C while the lowest value of carbon monoxide is found at a temperature treatment of 50°C[15]. By adding an air heater, the use of E20 fuel can be done effectively without changing the engine compression and for further research, it is possible to heating treatmen of incoming combustion chamber by adding a higher concentration of ethanol mixture to pertalite fuel, because heating treatmen of incoming combustion chamber to a mixture of ethanol and pertalite fuel in this study is proven to improve engine performance.

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