

MAKALAH ILMIAH

**Heating Treatment of Air in Combustion Chamber For The
Use of Mixture Ethanol and Gasoline Fuel**



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Heating Treatment of Air in Combustion Chamber For The Use of Mixture Ethanol and Gasoline Fuel

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Abstract. This research was conducted to improve the engine performance with ethanol and gasoline mixture, because from fuel mixture with high concentrate causes value of flash point and heat evaporation fuels becomes higher. To overcome these, the air that entrance in combustion chamber heated up to 26°C, 30°C, 40°C and 50°C, the fuel used are E0, E30 and E50 on 2000 to 8000 rotation. The result of research shows E0 fuel highest torque on 30°C with a value 8,98 Nm had 0,22% increase, E30 fuel highest torque on 50°C with a value 9,5 Nm had 1,05% increase and E50 fuel highest torque on 50°C with a value 7,77 Nm had 0,64% increase. On E0 power is 5,96 kW on 30°C had 0,33% increase, the highest power of E30 is 6,29 kW on 50°C had 1,9% increase and the highest power of E50 on 50°C with a value 4,49 kW had 0,89% increase. For the highest consumption is 2000 rotation, for E0 fuel on 50°C with a value 1,43Kg / Hp.Hour, E30 with a value 1,48 Kg/ Hp.Hour on 26°C and E50 with a value 2,03 Kg/ Hp.Hour on 26°C, this result shows that air heating treatment can improve the engine performance.

1. Introduction

The application of the use ethanol fuel as a fossil substitute on vehicle becomes one of main steps to reducing pressure on vehicles in using gasoline as main fue[1], but the use of ethanol and gasoline mixture with high concentration can causing problems, that is can reduce the vehicle performance.

The constrains on vehicle if using ethanol fuel as a main fuel is the decreasing of engine performance, that causes by the difference of ethanol and gasoline fuel, which are latent heat of ethanol fuel has triple bigger than gasoline fuel [2], while generally vehicle has technology for gasoline fuel, if the vehicle user wants to use ethanol as a main fuel or mixture fuel, so it must change the technology on vehicles.

The current technology that has been done to adjust the use of pure ethanol fuel or the mixture of gasoline and ethanol is changing the ignition angle and compression ratio on vehicle [3], on this case changing the ignition angle aim to adjust gasoline and ethanol fuel flash point, because the flash point value of gasoline and ethanol fuel were different, it is expected that by changing the ignition angle of ethanol fuel can burned perfectly and also can increase the vehicle performance [4][5].

In the process of changing ignition angle it needed tools that can change the ignition angle on vehicle, it need to consider in the use of ethanol fuel because the ignition angle changing process must be done by using that tools. While changing the compression ratio to be higher aim to maximize



energy from ethanol fuel because it needs the higher compression than gasoline fuel compression ratio, the changes of compression ratio must be change the vehicle specification significantly because it has to reduce the thickness of head cylinder [2][6].

In the treatment process to maximize vehicle performance by using of ethanol fuel there is one treatment that can be used without changing the component or system on vehicle that is heating the intake air in the combustion chamber, air intake heating aim to give energy on the air that will come into the combustion chamber [7] so that the intake air in combustion chamber has hot temperature because ethanol fuel has lower temperature than gasoline, the way of air intake works almost same with turbo charge process, but on this research the heating uses a nickelin wire that wrapped around air intake pipe, so when the air mixing with ethanol in the combustion chamber make the ethanol fuel temperature increasing by the mixture of hot air in the combustion chamber [3].

In this research the intake air heated in an air filter box before entering the combustion chamber, air heated using heater from nickelin wire without changing the engine component, in this research only added the heater on air intake pipe in the air filter. In this case it expected can increase the engine performance by using the mixture of ethanol and gasoline fuel with high concentration without changing the engine component.

2. Experimental Method

The heating air using nickelin wire that controled by a digital thermostat that used to controled the intake air temperature in the combustion chamber. The experiment was conducted on experimental with air intake temperature 26°C (standart), 30°C, 40°C and 50°C for every air temperature treatment, the fuel used are E0, E30 dan E50, and for crankshaft rotation that used 2000 Rpm – 8000 Rpm by the multiplier 1000 for every found increase.

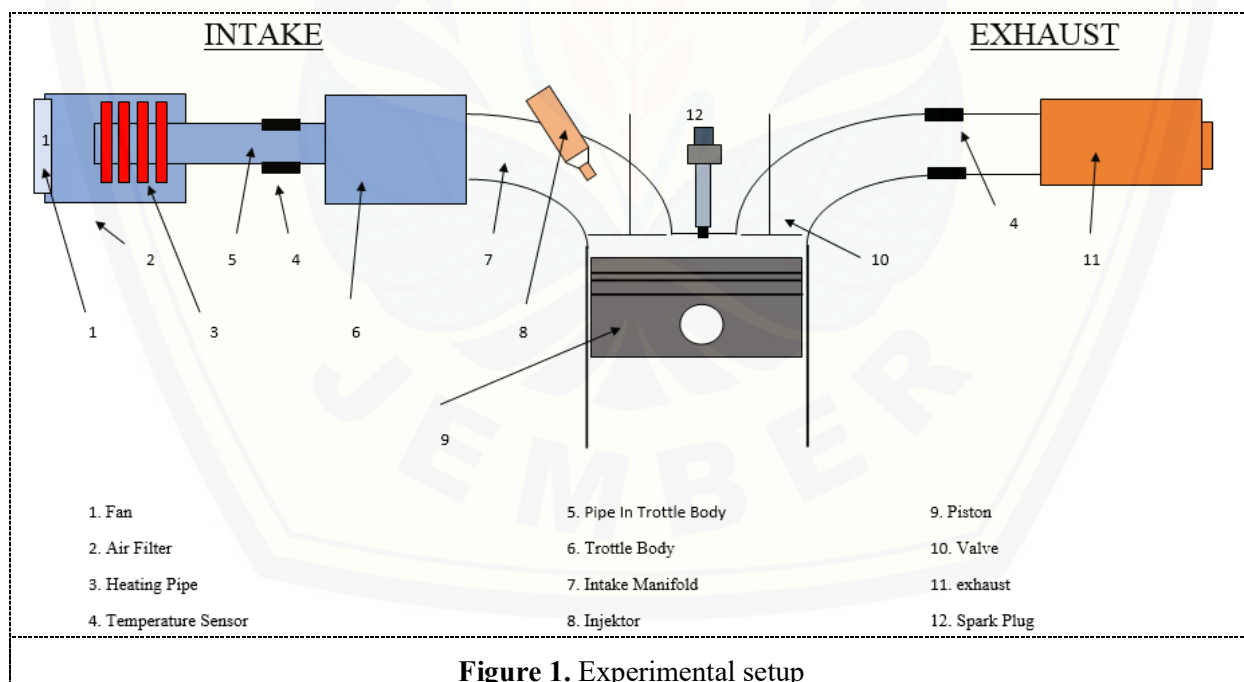


Table 1. Fuel properties

Properties	Ethanol	Gasoline
Molecular formula	C ₂ H ₅ OH	C ₇ H ₁₇
Molecular weight	46 kg/kmole	100-110 kg/kmole
Density	785 kg/m ³	720-780 kg/m ³
Latent heat of vaporization	904 kJ/kg	350kJ/kg
Calorific value	26800 kJ/kg	43850 kJ/kg
Stoichiometric air/fuel ratio	9.0	14.6
Octane number	106-110	91-96

Table 2. Percentage ethanol and gasoline fuel

Fuel	Percentage
E0	Gasoline 100% + Ethanol 0%
E30	Gasoline 70% + Ethanol 30%
E50	Gasoline 50% + Ethanol 50%

The research done by using gasoline engine by tested the engine performance and specific fuel consumption, in this research the engine performance testing using prony brake tools.

Tabel 3. Engine specification

Type Engine	: 4 stroke, SOHC With air cooling, eSP
Stroke Volume	: 108,2 cc
Fuel System	: Injeksi (PGM-FI)
Diameter x Stroke	: 50 x 55,1 mm
Type Tranmision	: Otomatic, V-Matic
Compression Ratio	: 9,5 : 1
Maximum Power	: 6,38 KW (8,68 PS)/7.500 rpm
Maximum Torque	: 9,01 N.m (0,92 kgf.m)/6.500 rpm

3. Result

By using experiment setup on Figure 1 on fuel E0, E30 dan E50 by heating temperature treatment 26°C, 30°C, 40°C dan 50°C get the result a torque, power and specific fuel consumption is presented in the Figure 2, Figure 3 dan Figure 4.

3.1. Torque

From Figure 2 shows the highest torque that produced by E0 fuel is 8,98 Nm on temperature 30°C with increased torque 0,22%, for E30 the highest torque 9,5 Nm on temperature 50°C with increased torque 1,05% and E50 fuel the highest torque 7,77 Nm on temperature 50°C with increased torque

0,64%. The change of air temperature can changed engine performance, in this research the change of air intake combustion chamber can increased torque from engine, especially for the use E30 and E50 fuel, because for ethanol fuel has high flash point is 12°C while gasoline -42°C so that the air heating can increase the air temperature and fuel in the combustion chamber so that the mixture of ethanol and gasoline become a homogeneous can burning perfectly[8].

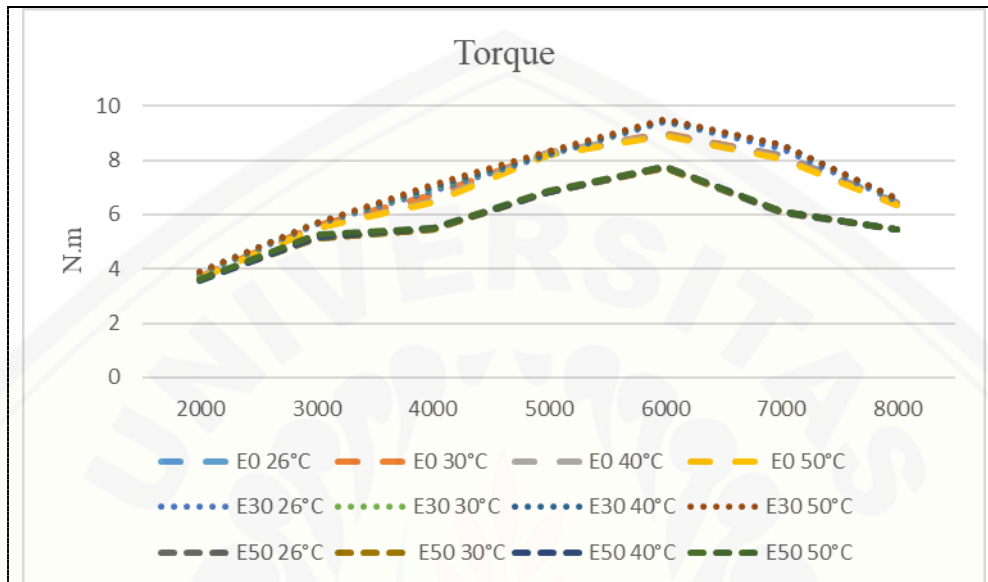


Figure 2. Result of engine torque

3.2. Power

From Figure 3 shows the highest power from fuels E0, E30 and E50 on 7000 rotation that each has value 5,96 KW on temperature 30°C the power has increased 0,33% on E0 , for E30 6,29 KW on temperature 50°C has power increased 1,9% and on E50 with velue 4,49 KW on temperature 50°C the power has increased 0,89%. The result is effected by calorific value, flash point and air temperature treatment which can effected the power output that produced by engine[9][5][10].

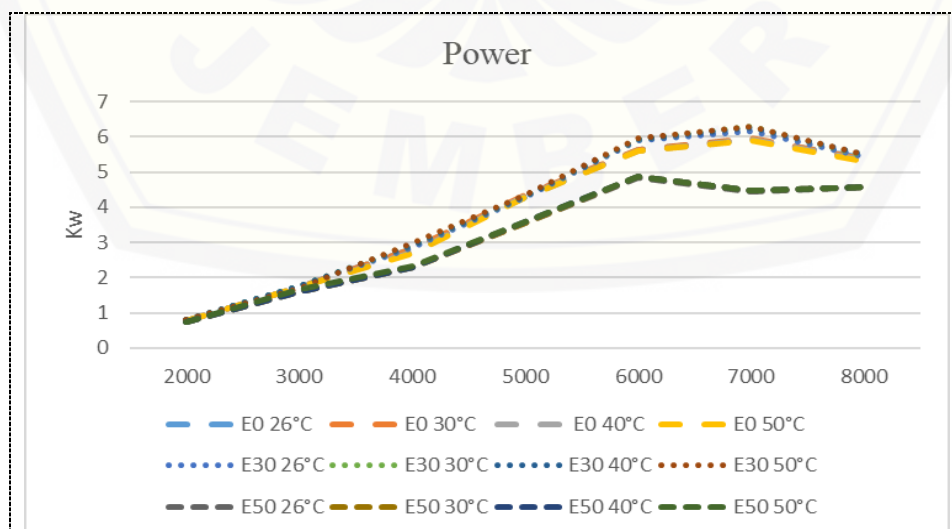


Figure 3. Result of engine power

3.3. Specific fuel Consumption

From Figure 4 to measuring the fuel consumption the test done by calculate time that needed to spend fuel E0, E30 and E50 for each fuel 50 ml, this case has done to know the fuel consumption level from each fuel used . On 2000 rotation the highest consumption E0 fuel on temperature 50°C with value 1,43 Kg/Hp.Hour, for E30 fuel the highest consumption on 2000 rotation on temperature treatment 26°C with value 1,48 Kg/Hp.Hour dan E50 fuel the highest fuel consumption on temperature 26°C with value fuel consumption 2,03 Kg/Hp.hour. The air heating also can decrease fuel consumption it proven on temperature 40°C on E30 fuel that become a lowest consumption from other fuels, the air heating makes air temperature in combustion chamber increased so the air and fuel in the combustion chamber become a homogeneous, if the use mixture of ethanol and gasoline with high concentration can increased the consumption of fuel use on engine, this case also happen on previous research that the consntration mixture of ethanol fuel and gasoline can effected the fuel consumption[6][11][12].

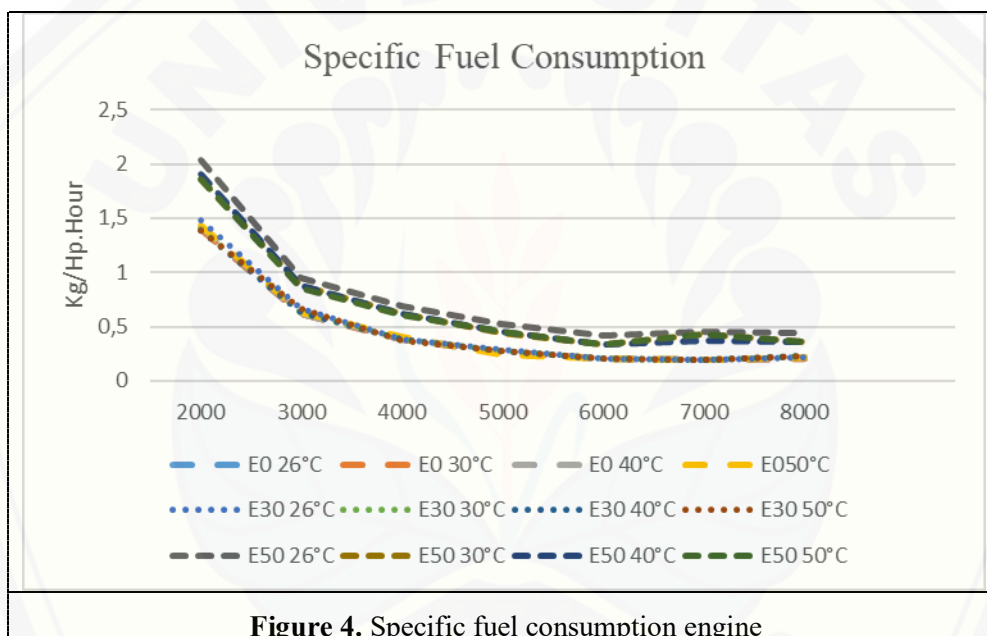


Figure 4. Specific fuel consumption engine

4. Conclusion

In this research found that the intake air combustion chamber treatment can change the engine performance become more increased on each the used of fuel E0, E30 and E50 heating treatment become a solution to increase the engine performance with a high fuel mixture concentration. It proven on this research the maximum increased torque is 1,05% on temperature 50°C with E30 fuel, increase in maximum power of 1,9% on temperature 50°C by using E30 fuel and the lowest specific fuel consumption on E30 on temperature 40°C with value 1,39 Kg/Hp.Hour.

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