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Study Of Bioethanol Heating As Fuel For Machine Performance

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ABSTRACT: *One of the new renewable energies that can replace gasoline is wet and hydrous bioethanol. Assessments are being conducted, especially bioethanol which still has a high water content (a mixture of pure bioethanol and aquades). Conditioning the conditioning of bioethanol fuel, one of which is the heating process in the use of motorcycle engine fuel. Heating is carried out with variations of 36oC, 40oC and 46oC on the fuel variations of E75W25, E80W20 and E85W15. The research method is a research sample is a motorcycle, the heat source comes from the heater, power supply, heat control. Heather able to set at a predetermined temperature. Peeformance engine data is retrieved using dynotest. The valve forming system is a full valve opening. The results of this study are that at levels 75, 80 and 85 can start the engine. While the engine performance, the data taken is torque and power. The results of this study at 7000 rpm engine speed and on heating variations, the data obtained there is a decrease in performance compared to gasoline fuel.The reduction is equal. For torque gasoline fuel at 7000 rpm 7.66 Nm. On heating 36^{o}C compared to gasoline there was a difference / decrease of E75 = Δ 3.92 (51.1%), E80 = Δ 0.71 (9.3%), E85 = Δ0.64 (8.4%). For 40^{o}C heating there was a decrease in E75 = Δ2.32 (30.3%), E80 = Δ0.7 (9.14%), E85 = Δ 1.03 (13.44%), for 46^{o}C heating there was a decrease in E75 = Δ3.21 (41.9%) , E80 = Δ0.68 (8.9%), E85 = Δ0.68 (8.9%). So the highest torque at 7000 rpm engine speed at 80% ethanol content at 46^{o}C heating of 0.68% (7.11 Nm). Engine power obtained 36^{o}C heating, has a difference: E75 = 3.9 (48.7%), E80 = 0.7 (9.2%), E85 = 0.4 (0.1%). At 40oC heating, the difference was: E75 = 2.3 (69.7%), E80 = 0.7 (9.21%), E85 = 0.4 (0.09%). On heating 46oC has the difference: E75 = 3.2 (57.9%), E80 = 0.6 (7.9%), E85 = 0.7 (0.1%). So the maximum power occurs in ethanol levels of 85% with the result of 0.09% decrease.*

KEYWORDS: Warming, Pure bioethanol, aquades, Performance, Motorcycle.

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I. INTRODUCTION

Ethanol (C2H5OH) is a pure substance which has broader transition properties. Volatile, flammable. Ethanol contains oxygen atoms so it is included in partially oxidized hydrocarbons. Ethanol can dissolve with water in all proportions, while gasoline and water cannot mix [4]. One of the main problems when ethanol is used as fuel is a fairly high water content and is capable of causing corrosion of materials in mechanical components, especially for components made of copper, brass or aluminum. [2]. In the fuel distribution system to the carburetor through the rubber channel. When using ethanol, there needs to be a treatment that is using fluorocarbon rubber [9]. In terms of combustion characteristics, the ignition temperature itself and the ethanol flash point are higher than gasoline. The latent heat of evaporation of ethanol is 3-5 times higher than that of gasoline with conditions like this making the intake manifold temperature lower, and increasing volumetric efficiency. The heating value of ethanol is lower than gasoline. Therefore, we need 1.6 times more alcohol fuel to achieve the same energy output. The stoichiometric air-fuel ratio (AFR) ethanol is about 2/3 of gasoline, so the amount of air needed for perfect combustion is less for alcohol [I].

Ethanol has a higher octane number than gasoline so that it can cause operations at a higher compression ratio because of that increase in power output, efficiency and fuel consumption. Furthermore, the latent heat of evaporation is also high. As a consequence of the low heating value in ethanol and high latent heat of evaporation, engine volumetric efficiency can be increased. However, This problem can be avoided with the intake intake manifold. Although the vapor pressure of pure ethanol is low, Reid vapor pressure (RVP) of the gasoline-ethanol mixture rises depending on the proportion of ethanol in the mixture [6, 11].

The use of ethanol in the amount of 85% and 15% of gasoline has been used and is operating successfully but the disadvantage of using E85% is the distribution of E85% fuel in relation to the distribution device [7].

Simon Brewster, et.al conducted anhydrous (E100) and Comparative esting hydrated ethanol fuel (E93h, E87h, E80h) with a turbocharged multi-cylinder direct injection engine, compression ratio of 10.4: 1. The variables of this study were carried out at high load, and initial rpm at 2000 rpm and 100 kPa multiple pressures, continued at 140 and 170 kPa and 1900 kPa. The results can be concluded, a multi-cylinder engine with turbocharged direct injection can be operated at high loads with the same output and efficiency, with anhydrous or hydrated ethanol.The main difference arising from the amount of water content in the fuel decreases, the rate of combustion that requires forward movement in ignition, the mass flow rate of the fuel increases, the reduction in engine emissions Nox and HC increase. Emissions produced by anhydrous and hydrated ethanol will produce similar CO2 emissions as shown by efficiency. In the exhaust and when warm, CO and NOx emissions may be relatively unaffected by water levels, while emissions from HC can increase.

Gupta, et al, (2010), conducted research on engine performance using E10, E100 fuel types, 90% ethanol 10% water, 80% ethanol 20% water at 5000 rpm engine speed, variations in position of throttle. The results showed the power and torque at E100 were higher than E10. The water content in the fuel affects the amount of power or torque produced. Sfc on E100 will increase compared to E10 usage, while the heat efficiency of E100 fuel and ethanol content is 90% higher compared to the use of E10 fuel.

Chavan and Pisal, (2011) modified the carburetor fuel system, especially on main jets on two-stroke engines. Using bioethanol fuel with a compression ratio of 8.8: 1 and modification of the carburetor at enlargement of the main jet diameter of 0.4 mm to 0.9 mm. The results showed a decrease in the alcohol content of the fuel generally had the effect of decreasing heat efficiency.

Megaritis, et al., (2007) conducted a study on the effect of water percentage on bioethanol on the Rover K1.81 series engine with HCCI technology, single cylinder. The results showed the amount of water concentration in bioethanol had an effect on combustion. The less the concentration of water, the smaller the effect of water in combustion, the increase in water concentration also causes the decline in lamda (λ). The water contained in the biethanol-water mixture results in a decrease in temperature in the cylinder during the compression step.

II. MATERIALS AND METHODS

2.1 Research engine

The engine used for this research is a gasoline motorcycle engine. The engine specifications can be seen in table 1.

2.2 Fuel

The fuels used in this study are:

a. E85W15 means the ratio of fuel is 85% ethanol and 15% water
b. E80W20 means the ratio of fuel 80% ethanol and 20% water
c. E75W25 artinya perbandingan bahan bakes 75% ethanol then 25% air

Suhu pemanas yang ditetapkan adalah suhu 36^{o}C, 40^{o}C then 46^{o}C . As a comparison the fuel used is premium.

2.3 Heating

Bioethanol heaters are designed as shown in Figure 2. Existing components are: tubes, heaters, power supplies, temperature control devices.

Fig 1. Ethanol heater

2.4 Media penelitian

Motorcycle engine data specifications used are as in table 1.

Table 1. Specs of the Suzuki Shogun FD 11 Motorcycle in 1997

Machine	
Engine type	4 Stroke, 2 valve SOHC, air cooling
Number/position of cylinder	Single cylinder / horizontal
Compression ratio	9.3 : 1
Bore x stroke	53.5 x48.8 mm
Maximum power	9.8 Hp / 7000 rpm

For taking power and torque data using dynotest

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Fig 2. Motorcycle and dynotest

In this research, the ability of carburetors to test fuel supply is tested. The result is that the jet carburetor pilot hole must be enlarged. This is consistent with the low level of QL ethanol, while the QL can be seen in table 2.

Table 2. Fuel heat value

	Procentation	Heating Value At Temperature Cal / g)		
No	E	T36	T40	T46
1	75%	4645.88	4685.17	4714.87
2	80%	5140.53	4846.45	4813.34
3	85%	5709.11	4928.97	5896.23

III. RESULTS AND DISCUSSION

The results of the torque by heating of 36°C, 40°C, 46°C on fuel variations can be seen in figures 3, 4 and 5.

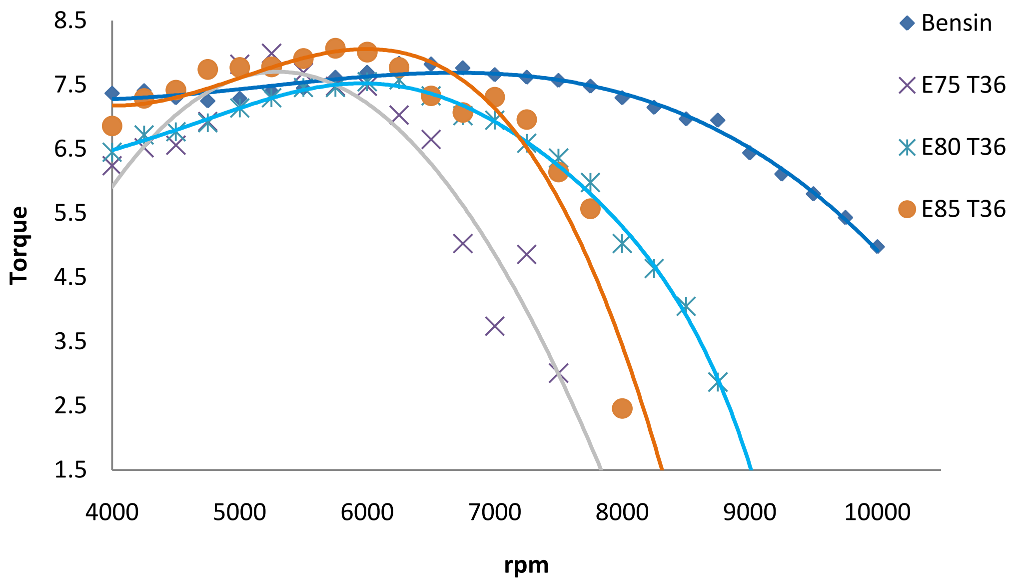

Fig 3. Relationship of Torque to rpm at 36°C heating

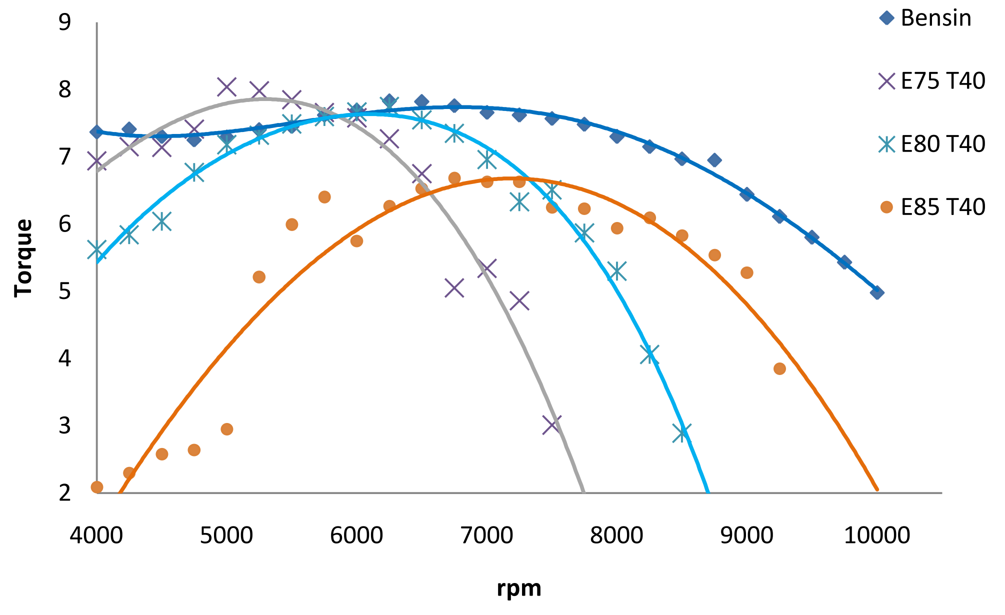

Fig 4. Relationship of Torque to rpm at 40°C heating

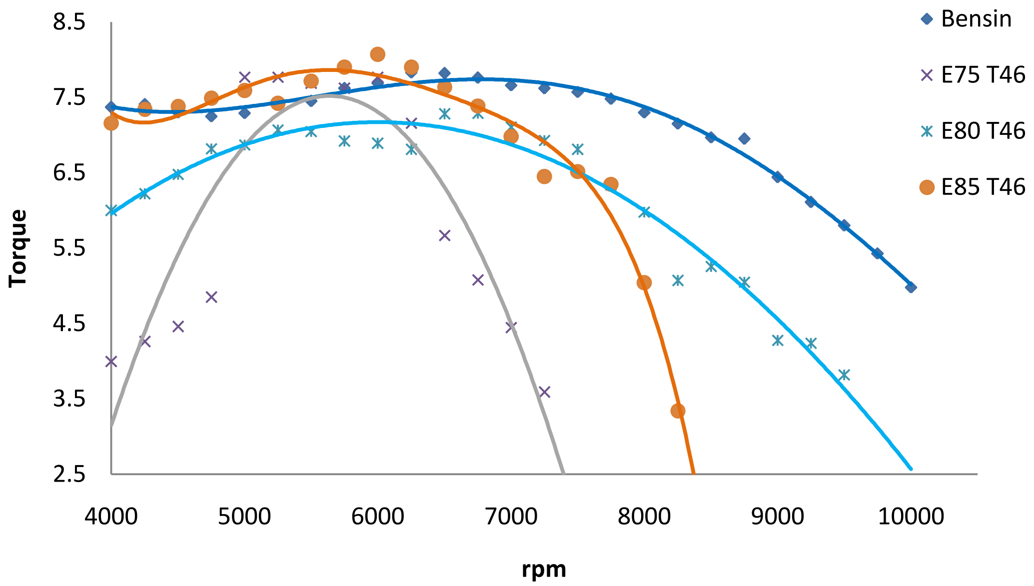

Fig 5. Relationship of Torque to rpm at 46oC heating

3.1 Torque

Figures 3, 4 and 5 show the torque against engine speed at a percentage of bioethanol fuel levels of 75%, 80% and 85%, for various variations in heating temperature of the fuel. (36oC, 40oC, 46oC). Figures 3, 4, 5 show that as engine speed increases there is an increase in torque to the maximum value and then a decrease in torque even though engine speed continues to increase, followed by an increase in fuel consumption. Fuel in the combustion process during low rotation can burn thoroughly causing an increase in combustion temperature followed by increased pressure and force received by the piston, resulting in increased torque. The decrease in torque is caused by the amount of fuel that does not burn at high rotations because the combustion speed takes time even though at high rotation there is less time available.

Ethanol boiling point 78.3oC. Heating the fuel causes the density (ρ) to decrease, this is because the amount of fuel volume increases. The decrease in density causes the amount of fuel that enters the combustion chamber to be less, so the higher the heating temperature of the fuel will cause the fuel consumption to decrease. Increased engine torque to the maximum torque value at low speed caused by combustion that leaves no fuel.

Figures 3, 4, 5 show the engine torque fueled by ethanol at various levels of variation at 7000 rpm engine speed, the higher the ethanol content shows the engine torque results are increasing. Ethanol level shows viscosity level, the higher the ethanol level, the viscosity level is lower. Low viscosity will cause the form of fuel grains when atomization is getting softer so that the ignition delay times are faster and spontaneous combustion is faster too. At 7000 rpm at 36^{o}C heating E75 = 3.74 Nm, E80 = 6.95 Nm, E85 = 7.31. 40^{o}C heating: E75 = 5.34 Nm, E80 = 6.96 Nm, E85 = 7.31 Nm. 46^{o}C heating. E75 = 4.45 Nm, E80 = 7.11 Nm, E85 = 6.98 Nm. For gasoline torque at 7000 rpm 7.66 Nm. On heating 36^{o}C compared to gasoline there was a difference / decrease of E75 = Δ 3.92 (51.1%), E80 = Δ 0.71 (9.3%), E85 = Δ0.64 (8.4%).

Warming 40oC decreased E75 = Δ2.32 (30.3%), E80 = Δ0.7 (9.14%), E85 = Δ 1.03 (13.44%). 46oC heating occurred a decrease in E75 = Δ3.21 (41.9%), E80 = Δ0.68 (8.9%), E85 = Δ0.68 (8.9%). Rising ethanol levels and rising heating temperatures result in insignificant torque values due to rising ethanol levels at elevated temperatures indicating a homogeneous value of the fuel will be higher and easier to extract. A more homogeneous mixture causes the fuel to be more flammable so detonation is possible. Viscosity value decreases with increasing ethanol content and temperature of the cooking, low viscosity will make it easier to extract (celik, 2008). This can be seen at 7000 rpm at higher heating temperatures.

3.2 Power

The results of the power data on the variation of fuel and heating temperatures can be seen in Figures 6, 7 and 8

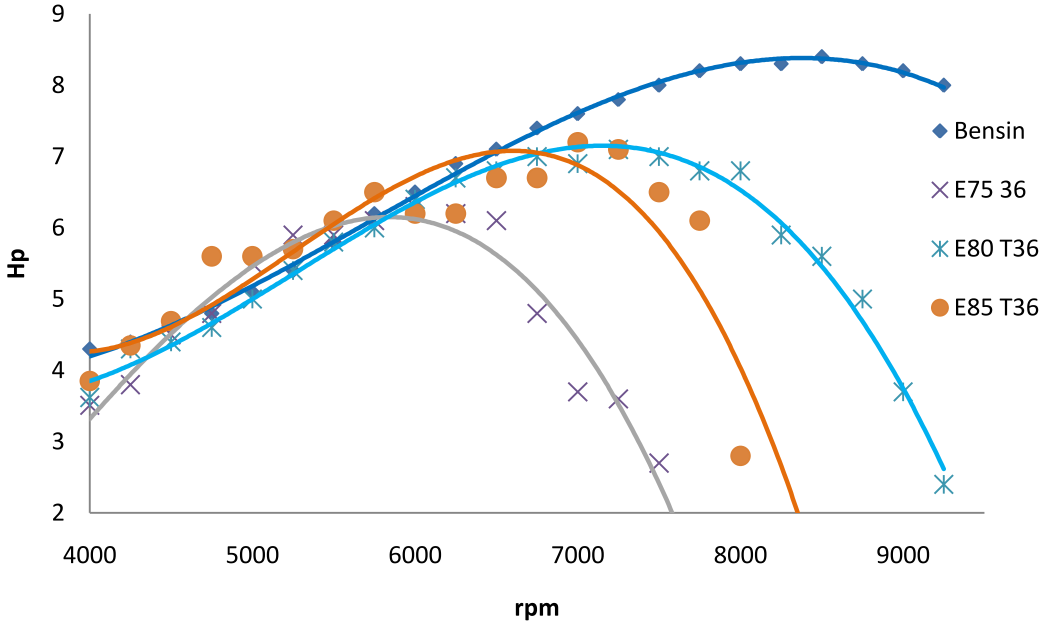

Fig 6. Relationship of power to rpm at 36°C heating

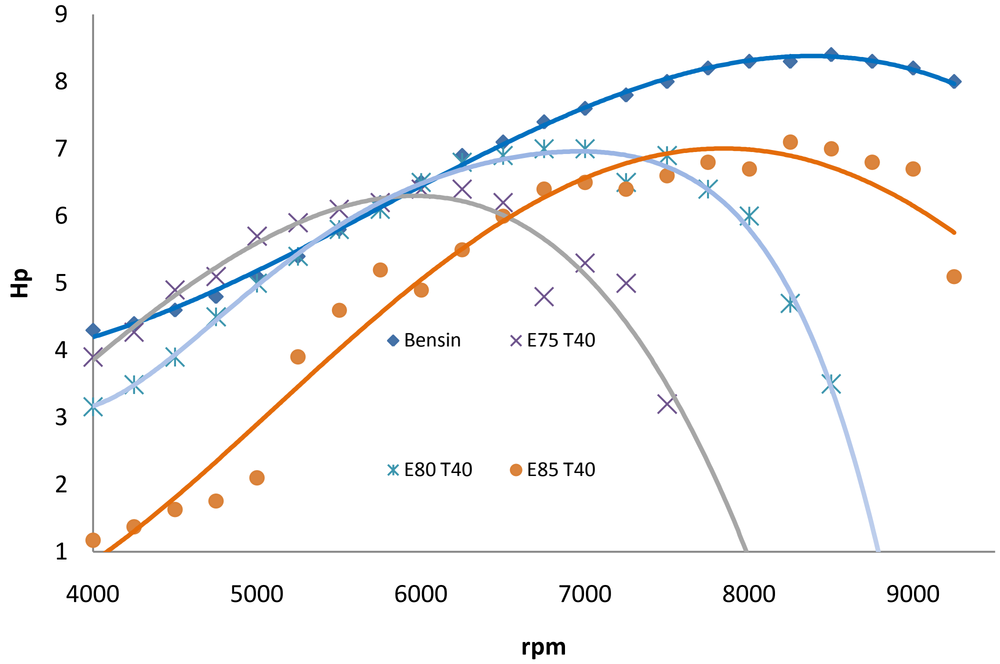

Fig 7. Relationship of power to rpm at 40°C heating

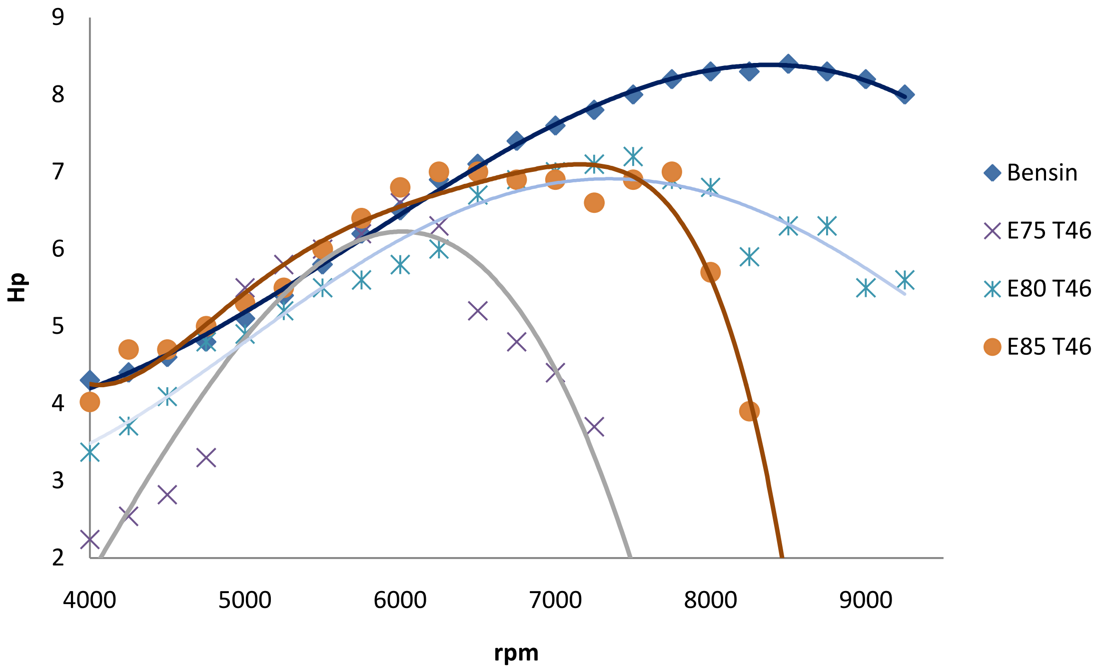

Fig 8. Relationship of power to rpm at 46°C heating

Figure 6, 7 and 8 show the results that bioethanol fuel at 7000 rpm compared to gasoline (7.6 hp) with heating 36oC, has a difference: E75=3.9 (48.7%), E80= 0.7 (9.2%), E85=0.4 (0.1%). At 40°C heating, the difference was: E75 = 2.3 (69.7%), E80 = 0.7 (9.21%), E85 = 0.4 (0.09%). On heating 46°C has the difference: E75 = 3.2 (57.9%), E80 = 0.6 (7.9%), E85 = 0.7 (0.1%). The condition of the power produced is the same as the torque trend. The effect of a high level of homogeneity and lower viscosity, the ease of donation will be possible so that the percentage increase in ethanol content and the increase in heating temperature is very influential and the power yield will be affected as well.

IV. CONCLUSION

The greater the percentage of ethanol and the greater the temperature of the heater will cause the level of homogeneity to increase and the viscosity value of the material will decrease so that the percentage increase in ethanol and a decrease in the value of the amount of viscosity decreases with increasing temperature and the percentage of ethanol will cause the viscosity to decrease.

The rise in homogeneity and the decrease in viscosity will have an impact on the fuel characteristics in the burning process (it is easy to be donated). The result of torque and power decreases.

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