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Analysis of Yamaha Scorpio Engine Performance with Variation of Ethanol Fuel and Shell V Power

Zufri Hasrudy Siregar
Mechanical Engineering Study Program, Faculty of Engineering, Universitas Asahan, North Sumatra, Indonesia

Keywords:

Ethanol
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ABSTRACT

The number of motorized vehicles used will also be as much as the use of fossil fuels, as well as the increasing growth of vehicles that increases year by year, which does not affect fuel consumption but population growth. Fuel quality is measured by RON, where the higher the octane value, the better the fuel quality. RON simply describes how much pressure can be exerted before gasoline spontaneously ignites in the combustion chamber of the vehicle. This study aimed to determine the effect of Power, torque and fuel consumption with a mixture of Petalite, Shell V-Power and Ethanol with a test object, namely the Yamaha Scorpio motor. The research method used is a quantitative approach with a type of development research. The result of this study is that Shell V Power fuel, when mixed with ethanol will produce better engine performance, the greater the percentage of methanol introduced into the fuel, the better the performance produced, both torque, power, and fuel consumption, namely at rpm 1000,1500,2000,2500 methanol 8% the most optimal where the time is 174 Sec, Sec 105, Sec 86, Sec 51 Sec. And the force on the Load Cell is 0.535, 0.875, 1.102, 1.421 kgf.

Corresponding Author:

Zufri Hasrudy Siregar,
Mechanical Engineering Study Program, Faculty of Engineering,
Universitas Asahan,
Jalan Jend. Ahmad Yani, Kisaran, North Sumatera, Indonesia.
Email: rudysiregar7@gmail.com

1. INTRODUCTION

The use of conventional fuels, namely fossil fuels, is mainly used in motorized vehicles. Data from the Energy Information Administration (EIA) explained that petroleum consumption has increased from year to year [1]. The number of motorized vehicles that are used will increase the use of fossil fuels [2], but the increasing number of vehicles has no effect on fuel consumption but population growth [3]. Meanwhile, Indonesia's oil reserves are around 3.8 billion barrels in 2019, with a ratio of 9 years. [4] this can be seen in the Figure

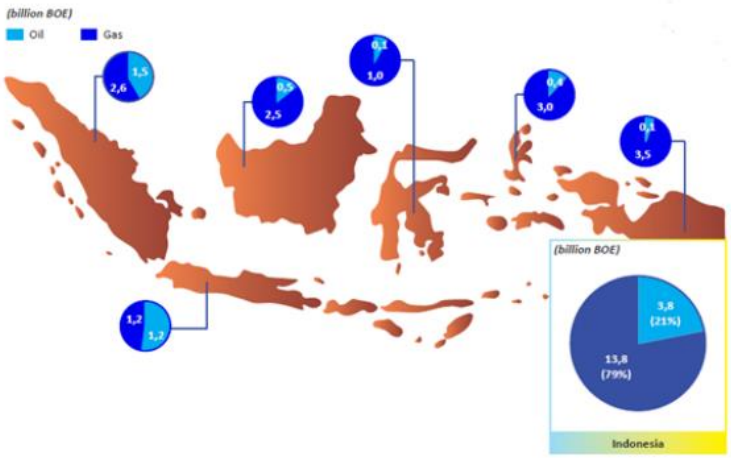

Figure 1. Indonesia's Oil and Gas Reserves [4]

Seeing these conditions, it is necessary to use a vehicle that is fuel efficient. Generally, vehicles in Indonesia have a cylinder volume of 150 cc using an injection system known as EFI (Electrical Fuel Injection) [5]. Limited energy resources are decreasing every year, so alternative energy is needed to overcome this; ethanol is an alternative choice that can be taken to overcome these problems. Based on research [6] that the use of ethanol as a Pertalite fuel mixture in vehicles increases engine power and reduces vehicle exhaust emissions, while vehicle exhaust emissions contribute to air pollution by 60-70%, which is fatal to life [7]. " Bioethanol is an environmentally friendly fuel because it is made from biofuels and has a higher octane number compared to fossil fuels such as premium " [8]. The choice of types of fossil fuels also varies with various brands, one of which is Sell V Power. The use of Shell V Power is more environmentally friendly than the use of Pertalite on a 125cc engine condition [9]

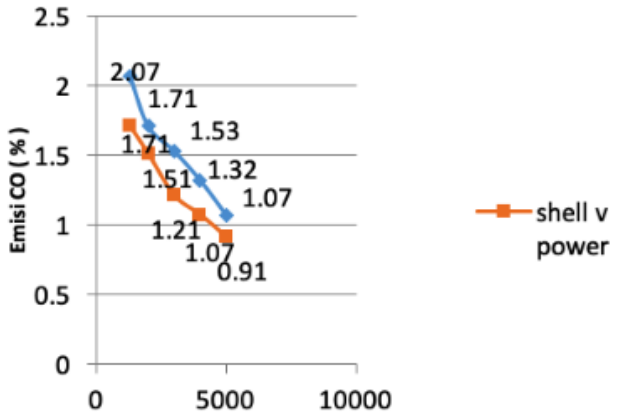

Figure 2. Graph of Relationship between Engine Speed (rpm) and CO Emissions (%) [9]

In addition to ethanol, which is used as an environmentally friendly fuel mixture, naphthalene, better known as camphor, can also be used as a fuel mixture that is useful for increasing the octane value and complete combustion in the motor combustion chamber. Research [10] concluded, "The fuel mixture of 1-litre petalite with 10 grams of naphthalene is the best for fuel consumption, torque and power compared to pure petalite fuel and a mixture of 1-litre petalite with 5 grams of naphthalene. " Another study concluded that mixing Pertamax fuel with ethanol with variations of 30%, 50%, 70% increased power to 7000 rpm and engine torque [11]. Similar research was also conducted by [12], which concluded that CO exhaust emissions were obtained in E20 fuel or a mixture of Pertamax and 20% Ethanol with a content of 1.33%.

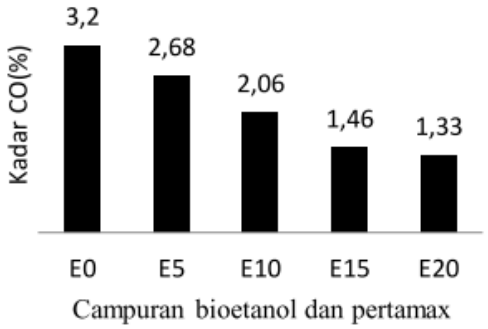

Figure 3. Effect of addition of bioethanol on CO levels (%) [12]

Research conducted [13] states that a significant increase in engine torque is a mixture of 10 and 15% ethanol with an increase of 0.89 Nm, while the best exhaust emissions are a mixture of 15% ethanol. Mixing Pertalite and Bioethanol from Sorghum seeds also increases engine performance and reduces exhaust emissions that produce air pollution [14]. Fuel quality is measured by RON (Research Octane Number), where the higher the octane value, the better the fuel quality. RON simply describes how much pressure can be given before the gasoline burns spontaneously in the combustion chamber of the vehicle. The highest RON values on the market are Pertamax Turbo RON 96 and Shell V Power 95 [15]

Table 1. Octane Value of Indonesian Gasoline [15]

No	Type	Octane Number (RON)
1	Premium	88
2	Pertamax	92
3	Shell Super	92
4	Shell V-Power	95
5	Petalite	90
6	LPG	112

However, on the other hand, fuel types with a high RON, such as Pertamax or Shell V-Power, cannot maintain the viscosity value of motor oil. In contrast to the type of Premium fuel, this happens because the calorific value of this type of fuel is the lowest; this has been researched [16], While the known motor mechanism system has two strokes (two strokes engine) and four strokes (four strokes engine). Engine) [17], while the most recent development is a six-stroke engine [1]

2. RESEARCH METHOD (10 PT)

The research method is a way for researchers to find the truth; it also describes the research design, which includes the research steps, time, sources used for research and data processing steps in the form of analysis [24]. This research was conducted with a quantitative method approach with the type of development research [24] and based on previous research that used ethanol as a substitute material and a mixture of motor fuels. The vehicle used as a test material was a Yamaha Scorpio motorcycle in 2010; the type of research was. Another method that supports this research is the Literature Review, which is used to prevent duplication of research and plagiarism; this is considered necessary because this method applies how to read, understand, examine, criticize and review specific sources [25]. For the rpm taken, namely 1000, 1500, 2000, and 2500, this research was carried out on the duration of December 2021 to January 2022 and presented in the research flowchart.

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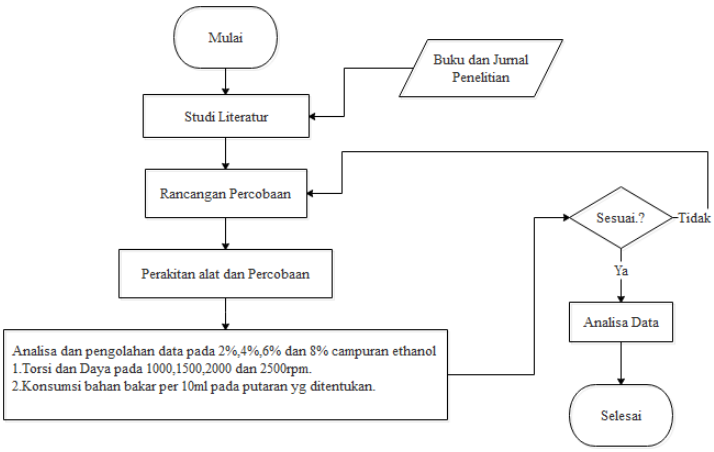


Figure 4. Research Flowchart

2.1 Research Tools and Materials

2.1.1 Tools

Tools are used to support research and research as expected

1. Brake Dynamometer

Brake Dynamometer measures torque and engine speed and displays engine performance results [26].

Figure 5. Brake Dynamometer

2. Tachometer

A tachometer is a tool used to measure the speed at which the engine speed is being tested

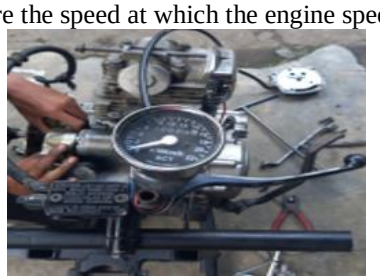


Figure 6. Tachometer

3. Burette

The burette in this study is used as a means of measuring the volume of fuel in a motorcycle carburettor

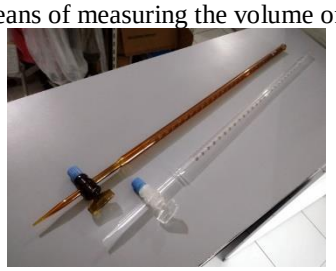


Figure 7. Burette

4. Measuring cup

To record and measure the amount of fuel being studied, a measuring cup is inserted into the burette. The measuring cup used is 500 ml

Figure 8. Burette

5. Stopwatch

To calculate the research time, a stopwatch is used, where this tool is used to calculate the time at a volume of 10 ml

Figure 9 Stopwatch

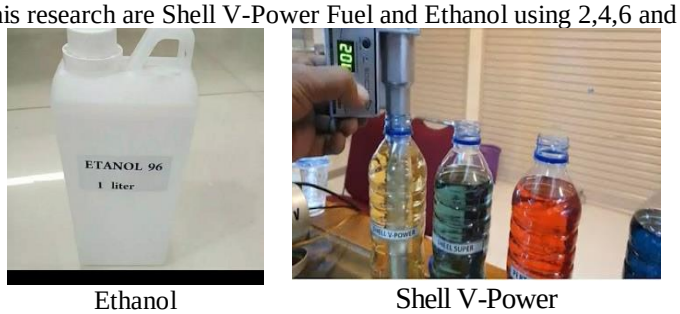
6. Yamaha Scorpio Engine

As research material, a Yamaha Scorpio z motorcycle engine was used with a maximum torque of 1.86 kgf.m/6,500 rpm, maximum power of 19 PS/8000 rpm, and a cylinder volume of 223 CC.

Figure 10 Yamaha Scorpio Engine

2.1.2 Material

The materials used in this research are Shell V-Power Fuel and Ethanol using 2,4,6 and 8% mixture variations



Ethanol Shell V-Power

Figure 11 Ethanol Fuel and Shell V-Power

3. RESULTS AND ANALYSIS

3.1 Results

From the discussion, the results of the test are obtained and calculations process the data

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1. Torque calculation (τ)
   Torque is defined as an instantaneous force with units (Nm lbf.ft or kgf.m.) with the torque equation (τ)

   $\tau = F.\ m\ (N.m)$ (1)

F is obtained from the force read by the loadcell (kgf.)

2. Power Calculation
   Power is the energy produced by the combustion engine per second. The power equation (P) of the equation

   $P = \frac{2\pi.\tau.n}{75.60}(hp)$ (2)

3. Calculation of fuel consumption (SFC)
   is defined as the amount of fuel used to produce power in one hour. The mass of fuel (mf) that enters the carburettor can be calculated by the equation

   $mf = {}_{vf}.\ \rho\_{}_{f}(\text{kg})$ (3)

   Specific fuel consumption (SFC) equation of equation

   $SFC = \frac{mf}{P.\Delta t}(\text{kg/hp.jam})$ (4)

The following is a data table on measuring fuel consumption per 10 ml.

Table 1. Shell V-Power Fuel Test at 1000 rpm

Fuel Shell V-Power	Time (Sec/ml)	Force on Loadcell (Kg.f)
+2% Metanol	108 Sec	0,435 kg.f
+4% Metanol	130 Sec	0,472 kg.f
+6% Metanol	152 Sec	0,505 kg.f
+8% Metanol	174 Sec	0,535 kg.f
Petalite	79 Sec	0,399 kg.f

Table 2. Testing Shell V-Power Fuel at 1500. rpm

Fuel Shell V-Power	Time (Sec/ml)	Force on Loadcell (Kg.f)
+2% Metanol	98 Sec	0,825 kg.f
+4% Metanol	100 Sec	0,842 kg.f
+6% Metanol	103 Sec	0,862 kg.f
+8% Metanol	105 Sec	0,875 kg.f
Petalite	63 Sec	0,787 kg.f

Table 3. Testing Shell V-Power Fuel at 2000. rpm

Fuel Shell V-Power	Time (Sec/ml)	Force on Loadcell (Kg.f)
+2% Metanol	65 Sec	0,947 kg.f
+4% Metanol	72 Sec	0,963 kg.f
+6% Metanol	79 Sec	1,025 kg.f
+8% Metanol	86 Sec	1,102 kg.f
Petalite	57 Sec	0,91 kg.f

Table 4. Testing Shell V-Power Fuel at 2500. rpm

Fuel Shell V-Power	Time (Sec/ml)	Force on Loadcell (Kg.f)
+2% Metanol	39 Sec	1,231 kg.f
+4% Metanol	43 Sec	1,350 kg.f
+6% Metanol	47 Sec	1,358 kg.f
+8% Metanol	51 Sec	1,421 kg.f
Petalite	38 Sec	1,195 kg.f

3.2 Analysis

3.2.1 Torque

Torque (T) is the torsional moment obtained by multiplying the force (F) by the radius (r) or the length of the brake dynamometer arm. The unit of torque is (kgf.m) and is expressed by the formula Force (F) is the frictional force acting on the dynamometer rotor and is measured by a load cell in units (kgf) obtained from the measurement of each test with changes in the speed of 1000 rpm, 1500 rpm, 2000 rpm and 2500 rpm. is reading. The value of F is the force that is read from the ethanol fuel load cell contained in the table, and the value (r) is the arm length of the armature (0.50 m). The following graph shows the results of the torque calculation analysis.

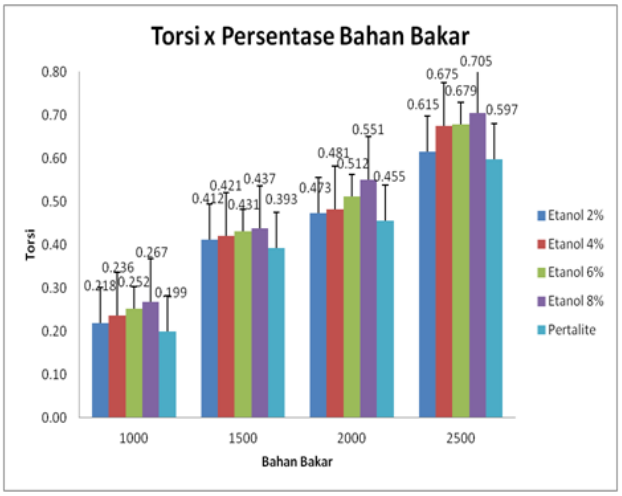

Figure 12 Ethanol Fuel and Shell V-Power

3.2.2 power

After calculating the torque, the amount of power released by the motor engine on its axis is known. Motor power is the amount of energy released. In an internal combustion engine, energy is generated from the compression process until combustion occurs in the cylinder and explodes. The detonation results apply to the piston moving back and forth in the engine cylinder. In the cylinder, the chemical energy of the fuel is converted into mechanical energy in the piston through the combustion process of Eq

$$P = \frac{(2\pi . T . n)}{(75.60)}$$

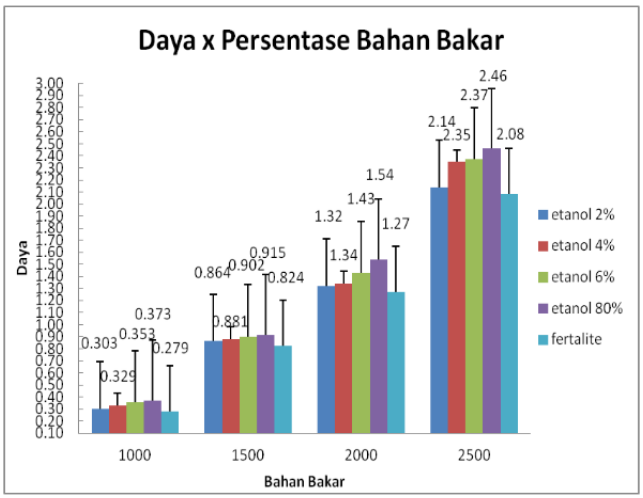

Figure 13 Power calculation result chart and fuel percentage

3.2.3 Fuel Consumption

After calculating the torque, the amount of power released by the engine on the crankshaft shaft. For combustion engines, power is generated from the compression process until combustion occurs in the cylinder,

which produces an explosion; in the engine cylinder, there is an explosion resulting from combustion, which causes the piston to work back and forth. While the changes that occur are chemical energy in the fuel, it becomes mechanical energy in the piston. The entry of fuel into the combustion chamber can be calculated by the equation

$$SFC = \frac{mf}{(P.\Delta t)}$$

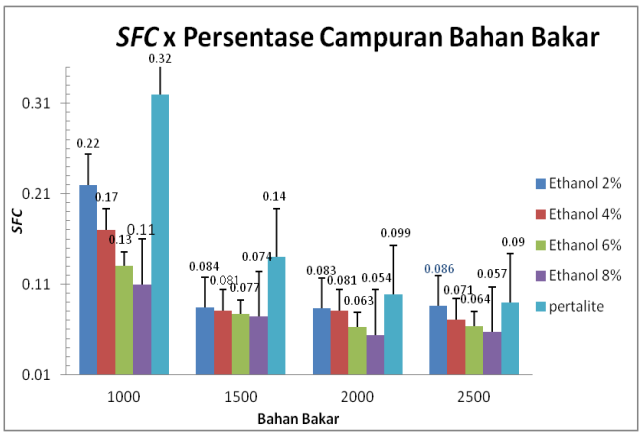

Figure 14 SFC calculation result chart x fuel percentage

4. CONCLUSION

After conducting intensive research, it can be concluded that using Shell V Power fuel when mixed with ethanol will result in better engine performance because if you refer to the results of the calculations discussed, the greater the percentage of methanol added to the fuel, the better. The resulting performance, both torque, power, and fuel consumption (SFC), but this is not recommended for general use because researchers have not considered and researched the aspects of what this mixing fuel can cause losses.

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