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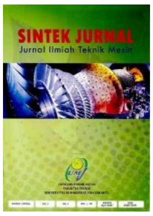

EFFECT OF IGNITION SYSTEM IN MOTORCYCLE TO PERFORMANCE AND EXHAUST GAS EMISSIONS WITH FUEL RON 88, RON 90, AND RON 92

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ABSTRACT

In the automotive field, the development of motorcycle ignition systems has been able to improve engine performance more fuel efficient. TCI has the advantage of transferring high voltage to the spark plug, the results issued from TCI are greater than the CDI system. To find out the results of motorcycle performance, namely the TCI ignition system and spark plugs on performance and exhaust emissions from motorcycles that use fuels such as Premium Ron 80, Pertalite Ron 90, and Pertamax Ron 92. Fuels that have octane that matches the bicycle motorcycles, in addition to the better performance of motorcycle engines, the fuel consumption is also more economical. In this study there are three variables, namely variations in rpm, performance and exhaust emissions. The results of the study of motorcycles that use the Ron 92 Pertamax fuel have far more torque and power than those that use the Ron 80 premium fuel and the pertalite Ron 90, while the HC levels produced by Ron 80 and 90 fuels tend to increase more than Ron fuel 92 which is between 65 - 228 ppm. CO2 levels were 12.53% while Pertamax was 10.74%, and pertalite was 11.17%, while the CO content produced was small at 3750 rpm resulting CO levels of 0.08 ppm. It can be concluded that the ignition produced is more stable which uses Pertamax fuel compared to using premium and pertalite fuel.

Keywords: *TCI; CDI; HC; CO^2; CO.*

1. INTRODUCTION

The development of science and technology from time to time encourages humans to create innovative work. Human needs are increasing and diverse as well as a trigger for the development of technology, including technology in the automotive field. One example in the field of transportation, especially in the automotive field experienced encouraging developments such as the ignition system on a motorcycle that is more practical and able to improve engine performance and fuel economy. Namely the TCI ignition system which is considered better than the CDI ignition system.

The difference in emissions is adjusted when the hydro ethanol mixture is used instead of the anhydrous ethanol mixture. The use of a mixture of E85 and E75 (gasoline containing 85% and 75% ethanol, respectively) results in a reduction in NOx emissions (30-55%) but increases carbon monoxide, methane, carbonyl and ethanol emissions compared to a mixture of E5, E10 and E15 (gasoline containing ethanol 5%, 10% and 15%, respectively [1]. Six linear equations for the mixture of BG1-ethanol and BG2-ethanol at the rotational speed developed. The fuel consumption value of the first gasoline-ethanol mixture is lower than that of the second set. This may be due to differences in the chemical composition of the BG1 gasoline base [2].

The results show that this system is able to effectively increase engine power (up to 1.4 kW at 9500 rpm WOT) without recalibration of the ECU [3]. AVL Boost is used as a simulation tool to analyze performance and emission characteristics for different ethanol, methanol and gasoline mixtures (by volume). When the percentage of the fuel mixture increases, CO and HC concentrations decrease and there is a significant increase in NOx emissions when the percentage of the fuel mixture increases up to 30% E30 (M30) [4].

This study considers the impact of modernization of injection ignition control and steering precision on vehicle driving dynamics [5]. This system changes the drop in pressure and temperature of the flue gas and, therefore, asks for a different composition of catalyst [6]. In addition to using an appropriate ignition system configuration, combustion characteristics similar to diesel fuel autoignition can be achieved for high gasoline replacement rates [7]. The evaporative cooling effect of methanol seems to play a major role in the ignition characteristics automatically sent fuel. The ignition site appears correctly at the end of the injection when the cooling effect of the evaporation is drawn or at the oscillation of the liquid length where the effect is temporarily withdrawn [8]. the composition effect on the fuel economy of the automotive fleet and the effect of utilization on how many people drive [9].

Port fuel injection and fueled with a mixture of gasoline bioethanol with 25% bioethanol based on volume (E25). Tests are carried out at various speeds and loads for stoichiometric and lean mixtures [10]. Ethanol is considered as a clean and renewable alternative fuel for SI engines when used in a mixture with gasoline in different fractions to increase oxygen content, thereby reducing exhaust gas emissions of incomplete combustion products and dependence on fossil fuels [11].

Characteristics and mechanical component parts piston piston engine (piston), is possible to modify, especially in the piston (piston) on the piston motor cycle [12].

At 1750 rpm rotation, the highest torque is obtained, the highest power is rotated at 2000 rpm which is for power 4.6 kW (premium) and 4.7 kW (Pertamax), while torque is 16.5 Nm (premium) and 16.8 Nm [13].

In the use of premium with a mixture of 9 ml of addictive substances also obtained a reduction in CO emissions by 1,378%, HC by 35.2 ppm, CO2 by 0.02% and O2 experienced an increase of 1,314% from the levels of exhaust gases using a premium with a mixture of 5 ml and 7 ml of additives. From the results of testing the levels of exhaust emissions produced using premium without using additives include CO levels of 1,984%, HC levels of 137.4 ppm, CO2 levels of 6.1% and O2 levels of 9,748% [14].

2. METHODS

In this research, the treatment is carried out in the form of variations of motor rpm with premium fuel 80, pertalite 90, and Pertamax 92, to the exhaust gas emissions, then the results will be seen in the form of changes that occur in power, torque and exhaust gas emissions at each variation of rpm that uses (premium fuel , pertalite, and pertamax.a) Data Collection Method.

2.1. Object used

Machine type: 4 steps, SOHC with Air Cooling, eSP
Diameter x Step piston: 50 x 55.1 mm
Cylinder volume: 108.2 cc
Comparison of compression: 9.5: 1
Maximum Power: 6.38 kW / 7500 rpm
Maximum Torque: 9.01 Nm / 6500 rpm
Ignition system: TCI

2.2. Make a variation of RPM

The study will use 10 variations of rpm. At the beginning of the study using a low rpm rotation. The study was conducted with a variety of rotations so that the performance and emissions can be matched accordingly.

The test was carried out to find the performance and exhaust emissions of the Honda Beat eSP 108.2 cc motorcycle.

2.3. Comparative Method

This research was conducted by comparing 3 fuels, namely fuel premium 80, pertalite 90, and petamax 92. To see which fuel has better exhaust performance and emissions.

2.4. Motorcycle Performance

The parameters used in the calculation of motor performance include: Torque, Power, and Specific fuel consumption (SFC).

a) Torque

Torque is a measure of the machine's ability to do work. Torque magnitude is a derivative quantity commonly used to calculate the energy produced from objects that rotate on its axis. Torque units are usually expressed in N.m (Newton meters). The formulation is as follows:

$$T = F \times b \quad (1)$$

With:
T = torque (N.m)
F = force (N)
b = object distance to rotation center (m)

b) Power

Motor power is one of the parameters in determining motor performance. The understanding of power is the amount of motor work over a certain period of time.

To calculate the magnitude of a 4-step motor power the formula is used:

$$P = = \frac{2\pi . n . T}{60000} \ (kW) \quad (2)$$

With:
P = power (kW)
n = engine speed (rpm)
T = torque (Nm)

c) Specific Fuel Consumption

Specific fuel consumption or specific fuel consumption (SFC) is the amount of fuel per time to produce power of 1 HP. So SFC is an economic measure of fuel use.

$$SFC = M\, f\, 10^3 \ / \ P_B \quad (3)$$

$$M\, f = \frac{sg_f \, . \, V_f \, . \, 10^{-3}}{t_f} \quad (4)$$

Where:

SFC : specific fuel consumption(g/ kW.h)
M *f* : amount of fuel unit time (kg / hour)
V_f : volume of fuel used
sg_f : specific gravity of fuel(0.715gr/ ml)
t_f : time required for fuel consumption
P_B : power generated (KW)

3. RESULTS AND DISCUSSION

Data obtained from experiments in the form of torque data from motorcycle engines were tested using a torque meter and gas analizer, then further processed into power and exhaust emissions. The data obtained is still in the form of torque in Newton meters (Nm), engine speed in units of revolution per minute (rpm), and fuel gas emissions (ppm and %).

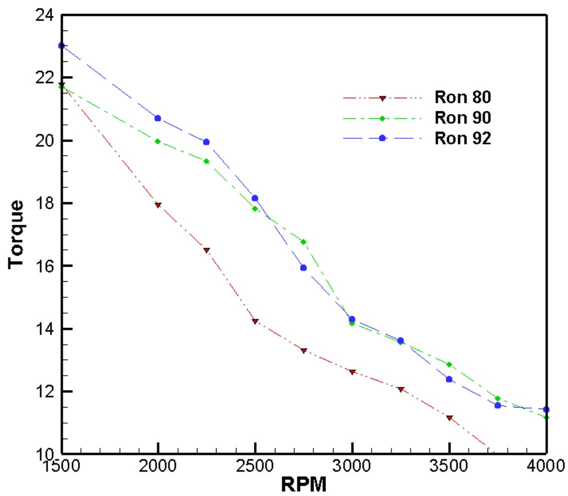

Figure 1. Torque graph of the RPM rotation

Based on the test results graph in Figure 1 shows that there is a difference between torque using premium fuel 80, pertalite 90 and Pertamax 92. The highest torque produced by premium fuel is 21.77 Nm at 1500 rpm, 21.69 Nm pertalite fuel at 1500 rpm, and pertamax is 23.00 Nm at 150 rpm.

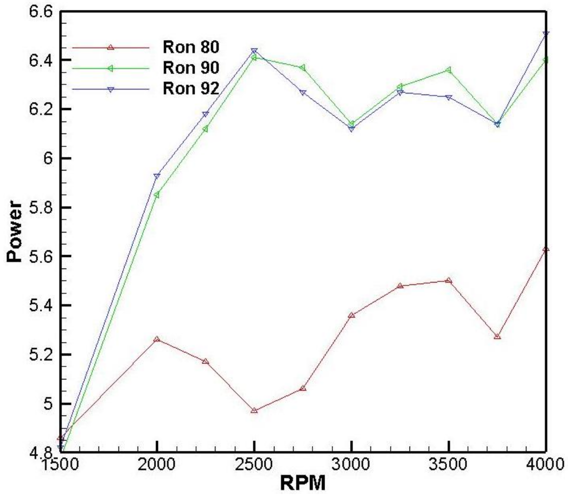

Figure 2. Power graph for the RPM

Based on Figure 2 that there is a difference between power using premium fuel 80, pertalite 90 and Pertamax 92. The highest power produced by premium fuel is 5.63 hp at 4000 rpm, 6.41 hp per pertalite fuel at 2500 rpm, and Pertamax fuel is 6.51 hp at 4000 rpm.

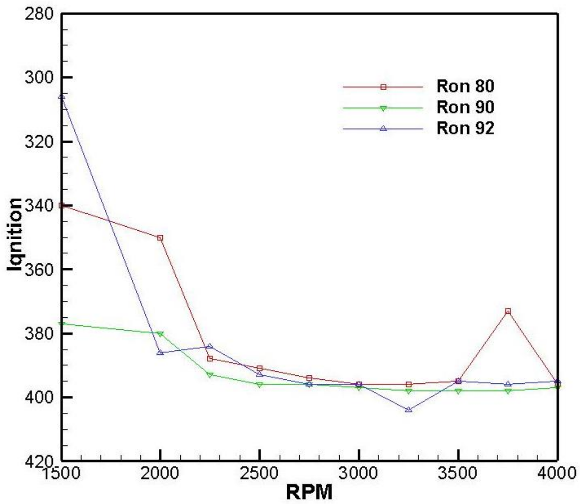

Figure 3. Ignition graphs for Rpm

Based on Figure 3 shows that there is a difference between ignition using premium fuel, pertalite and pertamax. The highest ignition produced by 396 V premium fuel at 3000, 3250 and 4000 rpm, 398 V pertalite fuel at 3250, 3500 and 3750 rpm, and 404 V first fuel at 3250 rpm.

Table 1. Research data on differences in levels of motor HC using premium 80, pertalite 90 and pertamax 92.

RPM	HC Ron 80	HC Ron 90	HC Ron 92
1500	228	130	270
2000	192	219	230
2250	288	122	383
2500	130	182	611
2750	156	207	128
3000	83	139	144
3250	54	59	400
3500	67	57	165
3750	43	79	179
4000	65	68	196

From the test results show that there are differences in levels of HC (hydro carbon) that uses premium fuel 80, Pertalite 90 and pertamax 92. Increasingly the rpm HC levels that use premium fuel 80 to decrease from 2500-3750 rpm. At 2500 rpm the resulting HC content was 130 ppm and 3750 rpm the HC content produced was 43 ppm. While the maximum HC levels that use premium fuel 80, are at 2000-2250 rpm. At 2000 rpm the HC level produced was 192 ppm and at 2250 rpm the HC level produced was 288 ppm. The minimum HC levels tend to be at 3750 rpm with HC levels of 43 ppm. Whereas those who used Pertamax fuel 92 at 2250-2750 rpm experienced an increase namely at 2250 rpm the resulting HC levels were 122 ppm and 2750 rpm the resulting HC levels were 207 ppm. Has decreased HC levels at 2750-3250 rpm. The highest maximum HC level produced at 2000 rpm is 219 ppm. Whereas the minimum HC level is at 3750 rpm at 43 ppm. While HC levels using pertalite fuel 90 in 2000-2500 have increased, namely at 2000 rpm the HC level produced was 230 ppm and at 2500 rpm the resulting HC level was 611 ppm. Has decreased HC levels at 3250-3500 rpm. The highest maximum HC level produced at 2500 rpm is 611 ppm. Whereas the minimum HC level is at 2750 rpm at 128 ppm. The conclusion from the graphic image 3 is the difference in the levels of RON 80 HC, RON 90 and RON 92, motorbikes that are tested using premium fuels 80 have lower HC levels than those who use pertalite 90 and Pertamax fuels 92. Increasing the rpm can get higher HC levels.

Table 2. Data on the results of studies of differences in CO2 levels of motorcycles using premium Ron 80, Pertamax Ron 92 and Pertalite Ron 90.

RPM	CO_2		
	(Premium) (%)	(Pertamax) (%)	(Pertalite) (%)
1500	12.53	10.74	11.17
2000	12.37	12.53	12.46
2250	9.52	13.86	11.56
2500	13.84	13.97	10.71
2750	14.05	12.43	11.14
3000	14.51	14.21	11.77
3250	14.45	14.01	8.42
3500	14.49	14.17	11.52
3750	14.52	14.32	13.94
4000	14.4	14.3	13.75

The premium fuel 80 at 2000-3250 rpm decreased CO levels. The maximum CO level that uses premium fuel 80 is at 2000 rpm at 0.57% and the minimum CO level is at 3750 rpm at 0.08%. The first fuel at 2750-3500 has decreased CO levels. The maximum CO level is at 2000 rpm at 0.74%, and the minimum CO level is at 2500 and 4000 rpm at 00.17%. While the pertalite fuel 90 produced CO levels decreased at 2250-2750 rpm. The maximum CO level is at 3250 rpm at 3.10%, and the minimum level is at 2750 rpm at 0.22%. The conclusion from Figure 4 the difference in the levels of CO premium, Pertamax and Pertalite, motors that use pertalite fuel have higher CO levels compared to motors that use premium and Pertamax fuels.

Ignition system affects the performance, and exhaust emissions on a motorcycle. Because, if the ignition used is not good, it will produce results that are not good.

The difference in motor torque that uses premium, Pertamax and Pertalite Torque or motor torque is the product of force (motor power) with the length of the piston arm. The more the rpm is increased the smaller the torque is produced. The effect of variations in engine speed and the use of fuel with different octane values will also affect the size of the torque produced. This is usually proven by the results of the study in Figure 1. At 1500 rpm the torque generated is 21.77 Nm and at 4000 rpm the torque produced tends to decrease by 9.83 Nm for motors that use premium fuel. While the motor that uses pertalite fuel at 1500 rpm the torque produced is 21.69 Nm and at 4000 rpm the torque produced tends to decrease by 11.17 Nm. And motors that use Pertamax fuel at 1500 rpm the torque produced is 23.00 Nm and at 4000 rpm the torque produced tends to decrease by 11.42 Nm. Power is the amount of effort done by the motor in a period of time or the results of the effort divided by a certain period of time. The amount of power produced is very influential on variations in engine speed and the effect of the fuel which has a different octane value. The higher octane value of the fuel will be difficult to burn which causes an increase in motor power. For low rpm at 1500 rpm at 4.86 hp for premium fuel. As for motorcycles that use pertalite fuel at 4.77 hp. And for motorcycles using Pertamax fuel 4.82 hp.

4. CONCLUSION

Research that has been done on 110 cc motorbikes with TCI ignition systems with standard spark plugs that use premium Ron 80 fuel, Ron 90 pertalite and Ron 92 Pertamax can be concluded that. The highest power produced is around 4000 rpm at 5.63 hp (Ron 80), 2500 rpm at 6.41 hp (Ron 90) and 4000 rpm at 6.51 hp (Ron 92), while the highest torque produced is around 1500 rpm of 21.77 Nm (Ron 80), 1500 rpm of 21.69 Nm (Ron 90), 1500 rpm of 23.00 Nm (Ron 92), for the highest levels of exhaust emissions and the lowest levels of exhaust emissions obtained at 2250 rpm for HC 288 ppm and 3500 rpm for HC 57 ppm. For CO levels of 0.57% 3.10% (Ron 90) and 0.17% (Ron 92). For CO2 levels of 14.52% (Ron 80), 9.52% and 10.74% (Ron 92). and the ignition produced is more stable which uses Pertamax fuel compared to using premium and pertalite fuel.

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