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SFCE Analysis on 110 Cc Automatic Motorcycle with Roller Mass Variations on Continously Variable Transmission System

Made Mara[1], Made Wirawan[2]
[1,2]Mechanical Dept., Faculty of Engineering, Mataram University, Mataram, INDONESIA
[1]Corresponding Author

ABSTRACT: *Continuously variable transmission (CVT) system is one of the systems that plays an important role in the performance of the engine on automatic motorcycles. Roller is a component found in continuously variable transmission or CVT. In general, rollers have a mass of 8 grams to 18 grams. Rollers serve to put pressure on the primary pulley based on centrifugal force. The higher the engine speed, the more the roller will press the primary pulley so that the v-belt that is pressed on the primary pulley can transmit engine rotation to the secondary pulley. Roller mass affects the specific effective fuel consumption (SFCE) produced. The purpose of this study was to determine the effect of variations in roller mass on the CVT (Continuously Variable Transmission) system on the specific effective fuel consumption on a 110 cc motorcycle. Experimental methods were used in this study. This study used various variations of different roller masses, namely 8 gram, 10 gram, 12 gram (standard) and 14 gram rollers. The test was conducted to determine the comparison between fuel consumption by measuring the expiration time of 5 ml of fuel used during the testing process against the effective power produced, or better known as effective specific fuel consumption. The effective specific fuel consumption test was conducted using engine speeds of 2000 rpm, 4000 rpm, 6000 rpm, 8000 rpm and 9600 rpm. The results of the study showed that the lowest effective specific fuel consumption value was obtained using a roller mass of 14 grams with a value of 0.099 Kg/PS.hour at an engine speed of 6000 rpm. While the highest effective specific fuel consumption value was obtained at the same roller mass variation, namely 14 grams but at a different engine speed, namely at an engine speed of 9600 rpm, namely the value obtained was 1.165 kg/PS.hour.*

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I. INTRODUCTION

One type of vehicle that uses an internal combustion engine with gasoline as its fuel is a motorcycle. Gasoline fuel has many types from premium, pertalite, pertamax, pertamax plus, pertamax turbo and pertamax racing. Each type of fuel has a different octane value, where the higher the octane value, the more expensive it is. Nowadays, automatic motorcycles are more in demand because they are easier to use by the public, men or women, young or old. And the price is relatively cheaper compared to other types of motorcycles, making automatic motorcycles increasingly in demand [1]. What distinguishes automatic motorcycles from other types of motorcycles is the transmission system used. The transmission system in question is an automatic transmission system. This system can be defined as a vehicle transmission whose operation is carried out automatically by utilizing centrifugal force or often referred to as Continously Variable Transmission (CVT). CVT is a power transmission system from the engine to the rear wheels using a belt (V-belt) that utilizes friction on the belt (V-belt) that connects the drive pulley to the driven pulley [2]. The primary pulley and secondary pulley produce centrifugal force to press the double clutch lining to the clutch housing, thus producing power output to rotate the rear axle [3]. Another important component in the CVT system is the roller [4].

Continuously variable transmission (CVT) is one of the innovations in the automotive industry. Where this system has a practical advantage, namely that it has been designed automatically so that there is no need to operate the gear shift lever when increasing or decreasing speed, simply by playing the gas slop connected to the throttle. CVT makes it easier for riders to drive motorbikes because it is easier in the process of controlling the vehicle. This system makes it unnecessary for riders to change the transmission ratio through a special lever because this system changes it automatically. However, automatic motorbikes with automatic transmissions also still have weaknesses in performance, this is evidenced by the decrease in speed. This decrease is caused by automatic motorbikes that use automatic gear shifts, where for the standard automatic transmission system, the maximum engine speed cannot be channeled to the transmission system to the maximum, so it cannot increase the speed of the vehicle. Unlike manual transmission motorbikes, speed can be optimized when shifting transmission [5].

Roller is one of the important components in the automatic transmission system or CVT. Variation of roller mass will greatly affect the performance of the automatic transmission system, so it can reduce weaknesses in automatic motorcycles. The heavier the roller, the more optimal the ability to move to push the movable drive face on the drive pulley so that it can press the belt maximally. This means that the heavier the roller, the more it will increase the middle and upper power to be more maximal, and vice versa if the roller is too light, it cannot press the belt maximally, the effect is that the middle and upper power will be reduced [6]. The average highest speed is 128.2 km / h on a roller weighing 11 grams, while the lowest average speed value is 125 km / h on a roller weighing 13 grams. And for the highest average rpm is 9100 rpm on a roller weighing 12 grams, while the lowest average rpm value is 8942.67 on a roller weighing 13 grams. Meanwhile, the highest average power is 11.37 HP on a roller weighing 11 grams and the lowest average power value is 11.02 HP on a roller weighing 13 grams [7]. Research using v-belt variation 1 obtained the highest power and torque by the 8 gram roller of 9.93 HP, for the 10 gram roller of 9.16 HP, while the 12 gram roller was 8.36 HP at 3500 rpm. The highest torque by the 8 gram roller reached 25.05 Nm, for the 10 gram roller it reached 27.67 Nm, while the 12 gram roller reached 26.19 Nm at 1500 rpm. The highest power and torque using v-belt variation 2 was produced by the 8 gram roller of 9.7 HP, for the 10 gram roller of 9.23 HP, while the 12 gram roller was 9 HP at 5500 rpm. The highest torque of the 8 gram roller reaches 25.9 Nm, for the 10 gram roller it reaches 23.41 Nm, while the 12 gram roller reaches 24.31 Nm [8].

The use of the automatic transmission type (CVT) concludes that the torque and power of the motorbike engine increase the most when using a 13 gram roller. The highest engine speed is 7000 rpm, torque 3.2 Nm and Power 2.34 kW. Meanwhile, fuel savings and efficiency are higher when using lighter rollers, namely 10.5 gram and 7 gram rollers [9]. The weight of the roller has an effect on changes in the performance of the 150 cc Vario motorbike engine. The use of a 13 gram roller, gets the best power results of 10.23 HP at 5000 rpm and the best torque of 10.49 Nm at 4000 rpm and produces the best speed of 119.68 km / h. When using roller weights of 15 grams and 18 grams, there is a decrease in power obtained, namely 9.45 HP and 9.57 HP at 4000 and 6000 rpm. The best torque is obtained at 4000 rpm with a roller weight of 18 grams of 10.65 Nm, and the 15 gram roller gets a decreased torque result of 10.59 Nm at 4000 rpm, while the use of roller weights of 15 grams and 18 grams for maximum speed results is 122.87 km / h at 4000 rpm, while the 18 gram roller has a decrease in speed so that the maximum speed is 120.34 km / h [10]. The lighter the mass of the roller, the faster the roller will move to push the primary moving pulley, so that it can press the v-belt and accelerate the change in the diameter of the primary pulley and secondary pulley. However, the pushing force of the roller on the primary moving pulley is getting smaller. On the other hand, if the roller is heavier, the slower it will move to push the primary moving pulley, but the greater the pushing force of the roller on the primary moving pulley, so the larger the diameter of the primary moving pulley [11].

II. RESEARCH METHODS

This study uses an experimental method, namely conducting research and testing directly on the research object.

Research Variables

The variables in this study are:

1. Independent variables
   The independent variables are variables that are freely determined by the researcher and will affect the dependent variables. The independent variables in this study are the effect of variations in roller mass of 8 grams, 10 grams, 12 grams (factory standard) and 14 grams on the CVT system on the performance of a 110 cc motorcycle.
2. Dependent variables
   The dependent variables are variables that are the main focus in carrying out the research. The dependent variables in this study are the effect of variations in roller mass on the CVT system on fuel consumption of a 110 cc motorcycle.

Testing Procedure

The steps taken during testing are as follows:

a. Trying the engine to operate for 4-5 minutes before testing. This is done to achieve the ideal working temperature of the engine after changing or before changing the roller.
b. Preparing the tools and materials that will be needed during testing.
c. Conducting fuel consumption testing by measuring the expiration time of 5 ml of fuel used during the testing process and effective power using variations of roller masses of 8 grams, 10 grams, 12 grams (factory standard) and 14 grams.
d. Fuel consumption and effective power testing is carried out using engine speeds of 2000 rpm, 4000 rpm, 6000 rpm, 8000 rpm and 9600 rpm (±100 rpm). Each rotation variation is tested 3 times.

e. After the test is complete using the first roller mass, let the engine stand for 4-5 minutes. This is done to cool the engine and make it easier to dismantle it to continue testing with the second roller mass.
f. Repeating steps b to e with different roller masses.
g. Next, analyze the comparison of fuel consumption to effective power, hereinafter known as the term specific fuel consumption effective (SFCE).

III. RESULTS AND DISCUSSION

Based on Figure 1, Figure 2, Figure 3 and Figure 4, it can be seen that the increase in specific fuel consumption effective is influenced by the effective power value and fuel consumption value. If the fuel consumption remains the same and the effective power value produced increases, it will provide a low specific fuel consumption effective value. The lower the value produced, the better the specific fuel consumption effective value. While the effective power value remains the same and the fuel consumption increases, it will provide a high specific fuel consumption effective value. The higher the value produced, the less good the specific fuel consumption effective value. However, if the fuel consumption value decreases and the effective power remains the same, it will get a low specific fuel consumption effective value. In the test of varying the roller mass and different engine speeds, it can be seen that the specific fuel consumption effective value for using variations in roller mass of 8 grams, 10 grams, 12 grams and 14 grams gets different values.

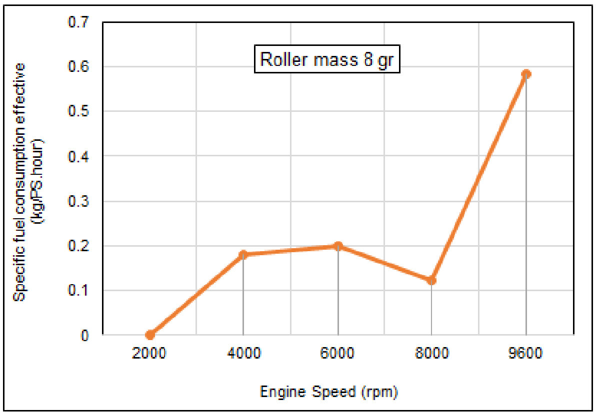

Figure 1. Graph of the relationship between engine speed and effective specific fuel consumption for a roller mass of 8 gr.

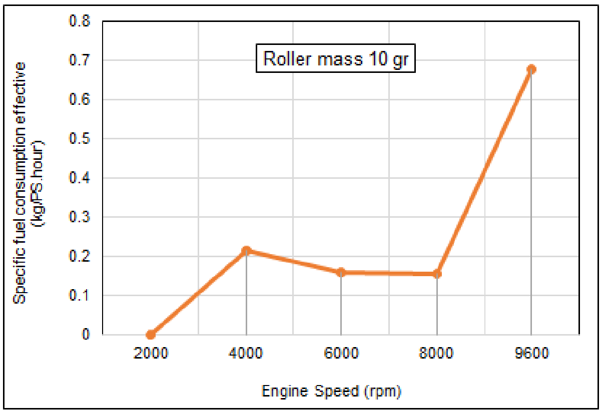

Figure 2. Graph of the relationship between engine speed and effective specific fuel consumption for a roller mass of 10 gr.

Testing with the four variations of roller mass at 2000 rpm engine speed has not been able to move the drum on the dynamometer so that it cannot display the power value, so the specific fuel consumption effective value cannot be calculated. While at 4000 rpm engine speed using an 8 gram roller gets a value of 0.181 kg / PS hour, 6000 rpm engine speed 0.200 kg / PS hour, 8000 rpm engine speed 0.122 kg / PS hour and at 9600 rpm engine speed 0.584 kg / PS hour. The use of a 10 gram roller mass at 4000 rpm gets a specific fuel consumption effective value of 0.213 kg / PS.hour, at 6000 rpm engine speed gets a specific fuel consumption effective value of 0.159 kg / PS.hour, and 8000 rpm engine speed gets a specific fuel consumption effective value of 0.156 kg / PS.hour while at 9600 rpm engine speed gets a specific fuel consumption effective value of 0.679 kg / PS.hour. The use of a 12 gram roller mass (factory standard) at 4000 rpm rotation gets a specific fuel consumption effective value of 0.171 kg/PS.hour, at 6000 rpm rotation gets a specific fuel consumption effective value of 0.102 kg/PS.hour, and at 8000 rpm rotation gets a specific fuel consumption effective value of 0.168 kg/PS.hour while at 9600 rpm gets a specific fuel consumption effective value of 0.669 kg/PS.hour. The use of a 14 gram roller mass at 4000 rpm rotation gets a specific fuel consumption effective value of 0.173 kg/PS.hour, at 6000 rpm rotation gets a specific fuel consumption effective value of 0.099 kg/PS.hour, and at 8000 rpm rotation gets a specific fuel consumption effective value of 0.194 kg/PS.hour while at 9600 rpm gets a specific fuel consumption effective value of 1.165 kg/PS.hour.

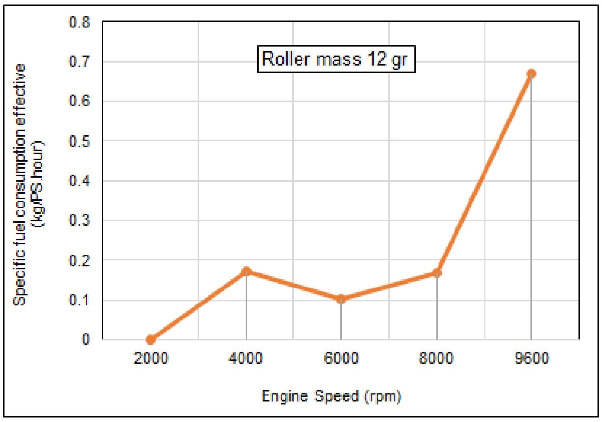

Figure 3. Graph of the relationship between engine speed and effective specific fuel consumption for a roller mass of 12 gr.

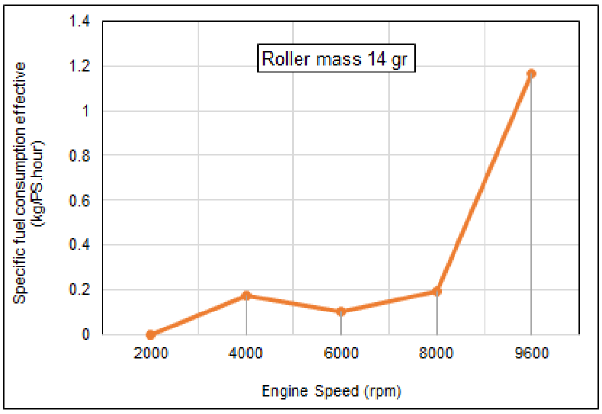

Figure 4. Graph of the relationship between engine speed and effective specific fuel consumption for a roller mass of 14 gr.

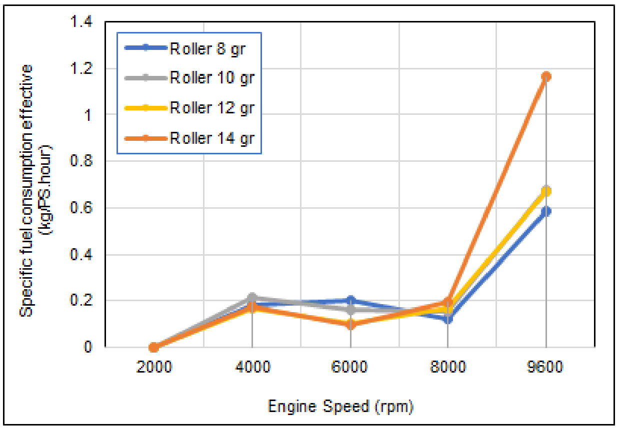

Figure 5. Graph of the relationship between engine speed and effective specific fuel consumption.

The lowest specific fuel consumption effective value was obtained at the variation of the roller mass of 14 grams at an engine speed of 6000 rpm, which is 0.099 kg/PS.hour (figure 5), which is caused by the effective power obtained being quite high compared to the effective power value obtained when using other roller masses. While the highest specific fuel consumption effective value was obtained at the same roller mass variation, which is 14 grams but at a different engine speed, which is at an engine speed of 9600 rpm, the value obtained was 1.165 kg/PS.hour, which is caused by the low effective power obtained compared to the effective power value obtained when using other roller masses.

IV. CONCLUSION

Based on the results of the analysis and discussion of the research on the effect of using variations in roller mass on the CVT (continuously variable transmission) system on the specific effective fuel consumption on a 110 CC motorcycle. In this study, tests have been carried out on variations in roller mass changes in the CVT system, namely sizes of 8 grams, 10 grams, 12 grams (factory standard), and 14 grams. The lowest specific effective fuel consumption value was obtained using a roller mass of 14 grams with a value of 0.099 Kg / PS.hour at an engine speed of 6000 rpm. While the highest specific effective fuel consumption value was obtained at the same roller mass variation, namely 14 grams but at a different engine speed, namely at an engine speed of 9600 rpm, namely the value obtained was 1.165 kg / PS.hour

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