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The Effect Of Roller Mass Variation On Fuel Consumption On A Motorcycle 110 Cc With Automatic Transmission

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Abstract— One of the systems that plays an important role in the performance of the engine on an automatic motorbike is the CVT (Continuously Variable Transmission) system. A roller is a component found in an automatic transmission or CVT. In general, rollers have a mass of 8 grams to 18 grams. The roller plays a role in putting 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 the engine rotation to the secondary pulley. The mass of the roller affects the performance of the resulting engine. The purpose of this study was to determine the effect of variations in roller mass on the CVT (Continuously Variable Transmission) system on fuel consumption on a 110 cc motorbike. 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. Testing was carried out to determine fuel consumption by measuring the expiration time of 5 ml of fuel used during the testing process. Fuel consumption testing was carried out using engine speeds of 2000 rpm, 4000 rpm, 6000 rpm, 8000 rpm and 9600 rpm. The results showed that the lowest fuel consumption value was obtained using a roller mass of 8 grams with a value of 1,026 Kg/hour at an engine speed of 8000 rpm.

Keywords—component; Roller, CVT, fuel consumption, Transmission System

I. INTRODUCTION

Motorcycles are one type of vehicle that uses an internal combustion engine with gasoline as its fuel. 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 with the driven pulley [2]. The primary pulley and secondary pulley produce centrifugal force to press the double 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].

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CVT is one of the innovations in the automotive industry. Where the CVT system has a practical advantage, namely 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 to control the vehicle. This system makes it unnecessary for riders to change the transmission ratio through a special lever because this system changes it automatically. But 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 standard automatic transmission systems, the maximum engine speed cannot be channeled to the transmission system to the maximum, so it cannot increase vehicle speed. 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

The research method used an experimental method, namely conducting research and testing directly on the research object.

Research Variables

The variables in this study are:

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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 using variations in roller mass of 8 grams, 10 grams, 12 grams (factory standard) and 14 grams.
d. Fuel consumption 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 rest 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. Repeat steps b to e with different roller masses.

III. RESULTS AND DISCUSSION

Fuel consumption is a measure of fuel consumption used to run the engine in a certain period of time, and is usually measured in units of fuel weight per unit of time [13]. The results of this test can be seen that the fuel consumption value for using roller mass variations of 10 grams (fig 2), 12 grams (fig 3) and 14 grams (fig 4) is almost the same at the same engine speed, while for a roller with a mass of 8 grams (fig 1) has the lowest fuel consumption value among the other variations.

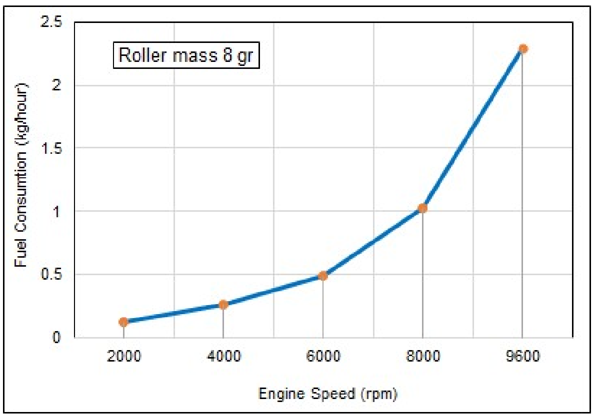

Figure 1. Graph of the relationship between engine speed and fuel consumption for a roller mass of 8 gr.

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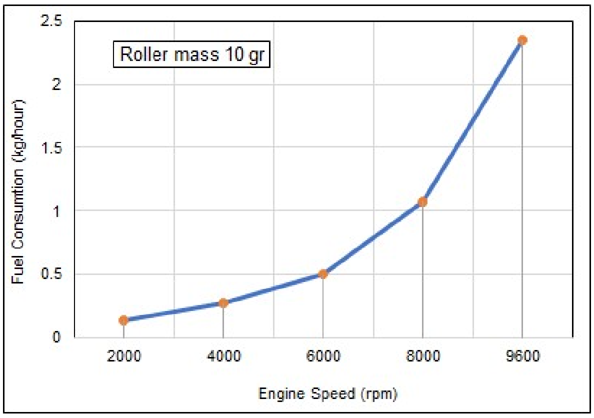

Figure 2. Graph of the relationship between engine speed and fuel consumption for a roller mass of 10 gr.

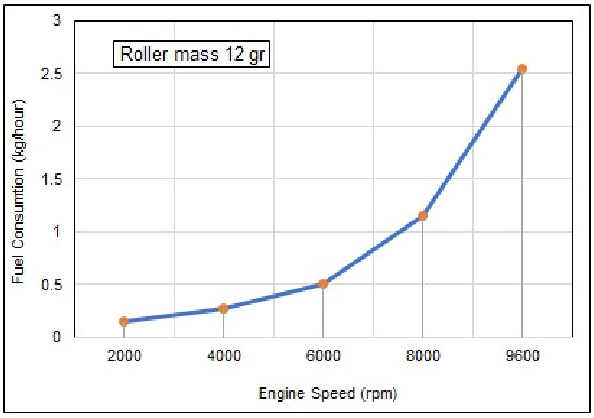

Figure 3. Graph of the relationship between engine speed and fuel consumption for a roller mass of 12 gr.

Based on Figures 1, 2, 3 and 4, it can be seen that the increase in fuel consumption increases with increasing engine speed and roller mass. The fuel consumption value from the test uses different roller variations. The increase in fuel consumption obtained is not too different, basically fuel consumption is influenced by the mass of the roller. Increasing the mass of the roller will increase the fuel consumption value with the same engine speed. While when the engine speed increases, fuel consumption tends to increase as well. This is because the engine requires more power to maintain high engine speed. At high speeds, the engine also tends to work with heavier loads, which requires more fuel to produce the required power (Figure 5).

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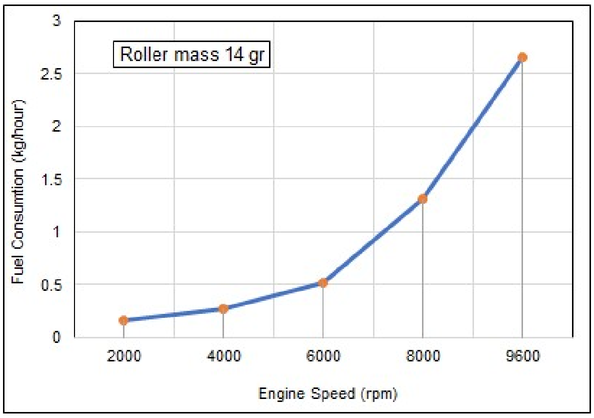

Figure 4. Graph of the relationship between engine speed and fuel consumption for a roller mass of 14 gr.

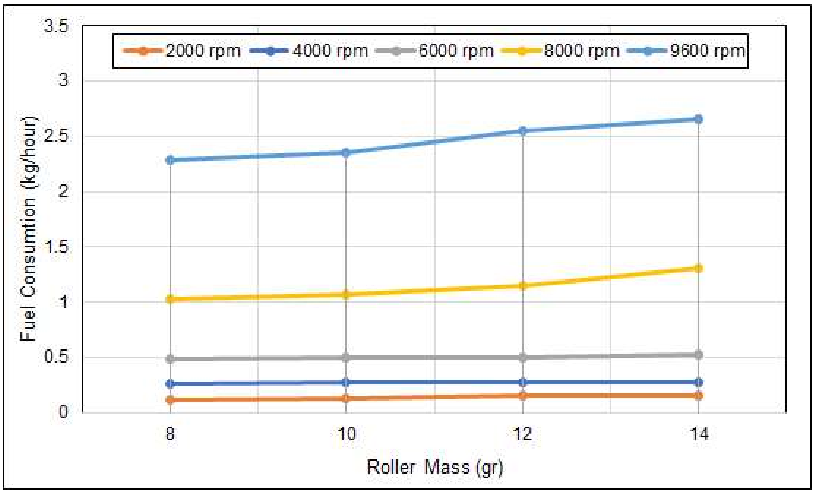

Figure 5. Graph of the relationship between roller mass and fuel consumption

In the use of 8 gram roller (figure 1) the fuel consumption value at 2000 rpm engine speed obtained a fuel consumption value of 0.122 Kg/hour. At 4000 rpm engine speed obtained a fuel consumption value of 0.260 Kg/hour with a percentage increase from 2000 rpm to 4000 rpm engine speed of 53%. At 6000 rpm engine speed obtained a fuel consumption value of 0.491 Kg/hour. At 8000 rpm engine speed obtained a fuel consumption value of 1,026 Kg/hour with a percentage increase from 6000 rpm to 8000 rpm engine speed of 52%. While at maximum engine speed the fuel consumption value obtained 2,291 Kg/hour with a percentage increase from 8000 rpm to 9600 rpm engine speed of 55%. In the use of 10 gram roller (figure 2) at 2000 rpm engine speed obtained a fuel consumption value of 0.135 Kg/hour. At 4000 rpm engine speed, the fuel consumption value is 0.270 Kg/hour with a percentage increase from 2000 rpm to 4000 rpm of 50%. At 6000 rpm engine speed, the fuel consumption value is 0.496 Kg/hour, at 8000 rpm engine speed, the fuel consumption value is 1069 Kg/hour with a percentage increase from 6000 rpm to 8000 rpm of 53%. While at maximum engine speed, the fuel consumption value is 2,354 Kg/hour with a percentage increase from 8000 rpm to 9600 rpm of 54%. In the use of a 12 gram roller (figure 3) the fuel consumption value at 2000 rpm engine speed is 0.152 Kg/hour. At 4000 rpm engine speed, the fuel consumption value is 0.275 Kg/hour with a percentage increase from 2000 rpm to 4000 rpm of 44%. At 6000 rpm engine speed, the fuel consumption value is 0.499 Kg/hour, at 8000 rpm engine speed, the fuel consumption value is 1.153 Kg/hour with a percentage increase from 6000 rpm to 8000 rpm of 56%. While at maximum engine speed, the fuel consumption value is 2.544 Kg/hour with a percentage increase from 8000 rpm to 9600 rpm of 54%. When using a 14 gram roller (figure 4), the fuel consumption value at 2000 rpm is 0.161 Kg/hour. At 4000 rpm engine speed, the fuel consumption value is 0.278 Kg/hour with a percentage increase from 2000 rpm to 4000 rpm of 42%. At 6000 rpm engine speed, the fuel consumption value is 0.525 Kg/hour. At 8000 rpm engine speed, the fuel consumption value is 1.308 Kg/hour with a percentage increase from 6000 rpm to 8000 rpm of 59%. While at maximum engine speed, the fuel consumption value is 2.658 Kg/hour with a percentage increase from 8000 rpm to 9600 rpm of 51%.

The fuel consumption value from 2000 rpm to 6000 rpm changes that occur are not too significant, while at 8000 rpm and above there is a significant change in the fuel consumption value which is influenced by each roller mass. The lowest fuel consumption value was obtained when using a roller mass of 8 grams at an engine speed of 8000 rpm with a value of 1,026 Kg/hour. This shows that the roller mass affects the fuel consumption value, when using a roller mass of 8 grams the engine requires a mixture of air and fuel that is not too much to move the roller with a mass of 8 grams. While the highest fuel consumption value was obtained when using a variation of a roller mass of 14 grams at an engine speed of 8000 rpm with a value of 1,308 Kg/hour, because the engine requires a mixture of air and fuel in large quantities to move the roller with a mass of 14 grams (figure 5).

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 torque of a 110 CC motorcycle. In this study, tests have been conducted on variations in changes in roller mass on the CVT system, namely sizes 8 grams, 10 grams, 12 grams (factory standard), and 14 grams. Varying the roller mass affects fuel consumption on motorcycles. The fuel consumption value at an engine speed of 8,000 rpm with the four variations of roller mass, the lowest fuel consumption value was obtained using a roller mass variation of 8 grams with a value of 1.026 Kg / hour and the highest fuel consumption value was obtained using a roller mass variation of 14 grams with a value of 1.308 Kg / hour.

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