THE IGNITION OF MOTORCYCLE LIGHTS DURING THE DAY WILL AFFECT FUEL USE

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Abstract

Police stakeholders called on motorcyclists to turn on the lights during the day. The ignition of the lights will require electrical energy, where the energy needed is taken from a machine that uses fuel.Therefore, motorbikes will use more fuel if the lighting is done. This study aims to determine what percentage of the increase in fuel use is due to the lighting of the lights, especially during the day to obtain information about the effects of lighting the lights.Testing is done by turning on a motorcycle by setting a fuel use of 50 milliliters and the length of time spent using fuel is measured with and without the ignition of the lights.Then the rate of use of fuel volume is calculated with and without the ignition of the lights.By comparing these two quantities, the percentage and amount of increased use of fuel with and without ignition of the lights is obtained.After testing and calculation is done, the percentage of increase in fuel use due to lighting is obtained at 1.3% to 1.8% and an average of 1.6%. Meanwhile, the percentage of fuel use for lighting is 1.3% to 1.8% and an average of 1.575%.Indeed, this percentage is very small for one motorbike, but if there are 10 million motorbikes that consume 1 liter per day with lighting, then in one month it will use as much as 4.725 million liters or 21.2 billion rupiah for lighting.This large amount is certainly not wasted and there is no increase in air pollution due to smoke and global warming if there is no lighting on the lights during the day.

Keywords*: type and condition of motorcycle, percentage, fuel, cost*

A. Introduction

Police stakeholders of Medan City have long instructed motorcyclists to turn on the lights during the day, with the aim of reducing the level of traffic accidents.From a technical standpoint, this ignition of the lights will require energy, where the energy needed is consumed from the engine by burning fuel.Therefore, if the lighting is done then the motorbike will use more fuel. Meanwhile the government echoed saving energy to the public and also saving on the use of fossil fuels.This is a contradiction with the policy that requires motorcyclists to turn on the lights during the day. More importantly, the use of fuel will be more numerous and, therefore, more costs or money spent, and at the same time, this will accelerate the depletion of petroleum reserves.In addition there will also be more severe air pollution which, among other things, is carbon monoxide, carbon dioxide, and thermal pollution which can increase global warming.Carbon monoxide can deplete the ozone layer.Based on the above problems, it can be stated that the ignition of motorcycle lights during the day will increase the use of more or more fuel, so that greater costs will be spent and pollution from the smoke of motorized vehicles increases which can increase global warming, pollution environment, and depletion of the ozone layer as a protector and filter for sunlight that strikes the earth.The general objective of this research is to develop and apply science and to conduct a study of energy conservation and the environment.The specific goal is to determine the extent to which increased use of motorcycle fuel as a result of lighting up the lights during the day.The target to be achieved in this study is to provide information and enlightenment to motorbike users and the government about the large percentage of increased fuel use and the costs or money spent due to ignition of motorcycle lights during the day.The contribution of this research is in the form of efforts made to develop knowledge and automotive technology and to find solutions to problems that often occur in the community as well as to increase benefits for humans and to obtain a better life.This research contributed several important things, among others, namely:

1. To improve the experience and knowledge of researchers as lecturers;
2. To add to the contents of the library of AMI Medan and ATI Immanuel Medan;
3. To provide input to the Automotive Industry in the form of a fuel saving strategy;
4. To provide information to the public and the government about the percentage of increased use of fuel or money due to the ignition of motorcycle lights during the day.

Transportation is a primary need for the community as well as the need for food. Motorcycle is one of the means of transportation that is widely used by the community, perhaps because the price is affordable and can pass agile on narrow roads.According to recent observations by authors in the city of Medan, and also in other big cities such as Yogyakarta, Jakarta, Bandung, including Pematang Siantar, there are so many motorbikes passing on the highway. This happened maybe because of the small installments and down payment for the purchase of it, so that motorcycle enthusiasts had no trouble getting it.

As a means of transportation, motorbikes need power to be able to drive and carry loads such as people, goods, and so on.The power obtained comes from the motorbike engine with the combustion process of fuel inside the engine which will produce heat and pressurized energy, which is mechanical energy, and then this pushes the piston to move back and forth from the upper dead point to the lower dead point.This translation motion is converted into a rotary motion on the crankshaft and is continued to move the wheel and also to drive a dynamo or generator to produce an electric current that turns on the light.

The distribution of power produced by the engine shaft besides being used to drive a motorcycle through wheels, some is used to rotate the generator.Some of the power used by the generator will be converted into electricity. Electric power produced by the generator is used to charge the battery (when the battery is in full capacity) and supply current to motorcycle equipment such as headlights, taillights, indicator lights, and others.Power stored in batteries is also used to supply the flow of other equipment such as indicator lights, measuring instrument lights, turn signal lights, and horns and so on.

As the equipment that is activated on the vehicle increases, an increase in current is needed for the equipment, so that the power used by the dynamo or generator becomes increased and the energy used to move the vehicle becomes reduced.In order for the power used to drive the vehicle not to decrease due to the increase in the activated equipment, improvement in power and engine of the vehicle is needed.To get improvement in power and engine, the use of fuel must be increased. When the headlights are turned on, the rear lights, indicator lights also come on, so that all three add to the burden on the motorcycle engine and consequently the use of fuel increases.

Use of fuel

The use of fuel is the amount of fuel consumed by the vehicle engine and denoted by V (volume) and M (mass) in units of m^3lt / ml and kg, respectively.In addition, theuseoffuel per unit of time called the Rate is formulated as follows:

$$M = \frac{\textit{Mass of fuel used}}{\textit{Time of fuel use}} = \left|\frac{kg}{s}\right|$$

$$V = \frac{\textit{Volume of fuel used}}{\textit{Time of fuel use}} = \left|\frac{M^3}{s};\frac{Ml}{s}\right|$$

Percentage of increased fuel use

If the rate of fuel use with ignition of lights is denoted by V_{PL} and the rate of fuel use without ignition of lights is denoted by V_{TL}, then the percentage of increase in fuel use due to lighting can be calculated by the following formula:

where:

$$P = \frac{V_{PL} - V_{TL}}{V_{TL}} \times 100\%$$

P : Percentage of increased fuel use (%)

V_{PL} : Rate of fuel use with ignition of lights (ml / s)

V_{TL} : Rate of fuel use without ignition of lights (ml / s)

Increased use of fuel and financial costs

Based on the percentage of fuel increase, the increase in fuel use due to ignition of the lights can be determined as follows:

$$P_{bb} = P.V_{TL}$$

where:

P_{bb} : Increased use of fuel (liters / motorcycle)
P : Percentage of increased fuel use (%)
V_{TL} : Volume of fuel use without ignition of lights (liters / motorcycle)

The result of an increase in fuel use is an increase in costs or money that must be spent, and this can be calculated by the following formula:

$$P_{rp}= P.V_{TL}.H=P_{bb}.H$$

where:

P_{rp} : Increase in money spent due to lighting (rupiah / motorcycle)
P_{bb} : Increased use of fuel (liters / motorcycle)
H : Fuel cost per liter (rupiah / liter)

Percentage of fuel use for ignition of lights

When the motorcycle lights are turned on, part of the use of fuel is intended for ignition of the lights. The percentage of the amount of fuel used for ignition of lights can be determined as follows:

$$P = \frac{V_{PL}-V_{TL}}{V_{PL}} \text{ x } 100\%$$

where:

P_l : Percentage of fuel use for lightning (%)
V_{PL} : Rate of fuel use with ignition of lights (ml / s)
V_{TL} : Rate of fuel use without ignition of lights (ml / s)

Use of fuel and money spent on lighting

Based on the percentage of fuel use for ignition of the lights, the amount (volume) of fuel used for the lamp can be determined by the following formula:

$$V_l = P_l.V_{PL}$$

where:

V_l : The amount (volume) of fuel used for ignition of lights (liter/ motorbike)

P_l : Percentage of fuel use for lightning (%)

V_{PL} : Volume of fuel used with ignition lights per unit of motorbike (liter/motorcycle)

The amount of cost or money spent on lighting up lights can be calculated using the following formula:

$$B_{rp}=P_1.V_{PL}.H.= V_1.H$$

where:

B_{rp} : Amount of money spent on lighting up lights (Rp)

H : Fuel price per liter (rupiah / liter)

B. Method

This research was conducted at the Automotive Laboratory of ATI Immanuel Medan with a research period of 2 (two) months which included systematic research, procurement of materials and tools, data processing, and preparation of reports.The materials and equipment used in this study consist of:

1. Literature, office stationery, and Laptop;
2. Motorbikes with the Honda Beat brand produced in 2010 and 2011, total of 30 units;
3. Motorcycle fuel, pertalite is chosen, as much as 10 liters;
4. Measuring instrument of fuel consumption and its buffer;
5. Fuel line hose and hose fastener;
6. Stop watch.

Implementation of Research

The implementation of the study begins with the calibration of the measuring instrument of fuel use and stop watch, which is to adjust them to standard measuring instruments. Then proceed with the implementation procedure as follows:

1. One Honda Beat motorcycle was chosen.

2. The motorcycle chosen is serviced in an automotive workshop in Laboratory.
3. Installation of a measuring instrument of fuel consumption is assisted by a buffer and then the installation of the fuel line hose from the fuel tank to the measuring instrument of fuel consumption continues to the carburetor then clamped with a fuel hose binder.
4. Filling fuel into the fuel tank to full capacity.
5. Adjust the fuel valve to half full on the carburetor.
6. Battery settings to full capacity, by turning on the engine, a few minutes later the battery capacity is measured, if it is not full the engine is turned on again.
7. Turn on the motorcycle engine without igniting the lights.
8. After the engine has been turned on for several minutes, the measuring instrument of fuel consumption is set to zero and the stop watch is turned on at the same time.
9. Once the measuring instrument of fuel consumption points to 50 ml, the stop watch is deactivated and the time indicated on the stop watch is recorded.
10. Repeat again from step 6 but step 7 with the lights on.

Furthermore, the parameters specified in the study are measured and analyzed into research variables.In this study the research variables used are as follows:

1. Measuring instrument of fuel consumption
2. Time of fuel use
3. The rate of fuel use
4. Percentage of increased fuel use
5. Percentage of fuel use with ignition of lights.

Data Analysis

Analysis of the data used in this study is comparative analysis, namely by comparing the use of fuel with and without ignition of lights. In addition, the percentage of increased fuel consumption, and the cost or money spent due to ignition of motorcycle lights is calculated.

C. Results And Discussion

Data on Research Results

After the testing is carried out where the volume of fuel used is set at 50 milliliters, the time for using fuel with and without ignition of the lights is obtained as follows:

Table 1. Data on Research Results

Motorcycle	Time for using fuel (s)	
	Without ignition of lights (t_{TL})	With ignition of lights (t_{PL})
1	537,88	530.66
2	533,71	526.57
3	536,84	527.23
4	537.82	528.52
5	536.44	527.97
6	534.57	525.24
7	535.62	526.78
8	532.22	524.72
9	537.31	528.32
10	535.43	526.49
11	537.84	530.31
12	538.32	530.333
13	536.54	527.23
14	532.23	525.11
15	532.87	523.49
16	535.44	526.17
17	533.26	525.32
18	532.84	525.21
19	530.36	522.29
20	530.64	522.84

21	538.78	530.64
22	537.42	529.63
23	535.26	525.67
24	538.84	529.51
25	523.51	528.49
26	537.18	527.36
27	538.29	530.36
28	533.16	523.81
29	535.65	527.37
30	531.86	523.29

Rate of Fuel Use

Based on the time of fuel use obtained from testing, the rate of use of fuel for motorcycle 1 can be calculated as follows:

$$V_{PL} = \frac{v}{t_{PL}} = \frac{50\,(ML)}{530.66\,[S]} = 0.09422\,\left|\frac{ML}{S}\right|$$

$$V_{PL} = \frac{v}{t_{PL}} = \frac{50\,(ML)}{357.88\,[S]} = 0.09296\,\left|\frac{ML}{S}\right|$$

Table 2. Rate of Fuel Use

Motorcycle	V_{PL} (ML/L)	V_{TL} (ML/S)
1	0.09296	0.09422
2	0.09368	0.09495
3	0.09314	0.09484
4	0.09297	0.0946
5	0.09321	0.0947
6	0.09353	0.09519
7	0.09335	0.09492
8	0.09395	0.09592
9	0.09306	0.09494
10	0.09338	0.09497
11	0.09296	0.09428
12	0.09288	0.09428
13	0.09319	0.09484
14	0.09394	0.09522

15	0.09383	0.09551
16	0.09338	0.09503
17	0.09367	0.09518
18	0.09384	0.0952
19	0.09423	0.09573
20	0.09423	0.09563
21	0.0928	0.09423
22	0.09304	0.09441
23	0.09341	0.09512
24	0.09279	0.09443
25	0.09337	0.09461
26	0.09308	0.09476
27	0.09286	0.09428
28	0.09378	0.09545
29	0.09334	0.09481
30	0.09401	0.09555

Percentage of Increase in Fuel Use

Based on the rate of fuel use with and without the ignition of lights, the percentage increase in fuel use for motorcycle 1 is calculated as follows:

$$P = \frac{V_{PL} - V_{TL}}{V_{TL}} \times 100\% = 1.355\%$$

Calculations for motorcycles number 2 to 30 are done in the same way and the results are shown in the following table:

Table 3. Percentage of increase in fuel usage

Motorcycle	P	Motorcycle	P	Motorcycle	P
1	1.355	11	1.42	21	1.541
2	1.356	12	1.507	22	1.472
3	1.825	13	1.771	23	1.831
4	1.753	14	1.363	24	1.767
5	1.599	15	1.79	25	1.328
6	1.775	16	1.767	26	1.805

7	1.682	17	1.515	27	1.496
8	1.426	18	1.449	28	1.781
9	1.698	19	1.538	29	1.575
10	1.703	20	1.486	30	1.638

Of the total motorcycles tested, the average percentage of increase in fuel use is obtained at P = 1.6004%.

Percentage of fuel use for ignition of lights

Based on the rate of use of fuel with and without ignition of lights, the percentage of increase in fuel use can be calculated as follows. For motorcycle number 1 is:

$$P_1 = \frac{V_{PL} - V_{TL}}{V_{TL}} \times 100\% = 1.337\%$$

as shown in Table 2 and this means that there is an increase in fuel use due to the ignition of the lights.The magnitude of this percentage of increase is in the range of 1.3% to 1.8% with an average of P = 1.6%. It looks like this number isn't too large.

Meanwhile the percentage of fuel use for lighting of lights is shown in Table 4 and is in the range of 1.3% to 1.8% with an average of P1 = 1.575%. This number is also not too large.

Table 4. Percentage of fuel use for lighting of lights

Motorcycle	P_1	Motorcycle	P_1	Motorcycle	P_1
1	1.337	11	1.41	21	1.518
2	1.338	12	1.485	22	1.451
3	1.792	13	1.74	23	1.798
4	1.723	14	1.344	24	1.737
5	1.573	15	1.759	25	1.311
6	1.744	16	1.736	26	1.773
7	1.654	17	1.492	27	1.474
8	1.406	18	1.429	28	1.75
9	1.669	19	1.515	29	1.55
10	1.674	20	1.464	30	1.612

Increased use of fuel in rupiah

If the ignition of lights is done on each motorcycle, the increase in fuel use is:

$$P_{bb} = P.V_{TL} = 0.016 \text{ (liter/motorcycle)}$$

This increase is indeed very small and in one month only 0.48 liters per motorcycle. But if there are 10 million motorbikes, that means an increase of 4.8 million liters of fuel in one month. The impact is increasing air pollution and global warming.

As a result of the increase in fuel use, there is an additional rupiah that must be provided. The additional cost or rupiah for each motorcycle that uses 1 liter of pertalite every day is:

$$P_{rp} = P.V_{TL}\ H = 72 \text{ (Rupiah/motorcycle)}$$

This addition is probably not much and in one year is also only Rp. 2160 per motorcycle. But if there are 10 million motorbikes, the additional rupiah will be large, which is Rp 21.6 billion in one month. If the lighting of lights is not done then the Rp 21.6 billion is not wasted by useless and can be used to build several buildings every month.

Use of fuel and rupiah for lighting of lights

If each motorcycle uses 1 liter of pertalite with the ignition of the lamp then 0.01575 is used for ignition of the lights. This figure is indeed very small and in a month are only 0.4725 liters / motorcycle.But if there are 10 million motorbikes, this figure is quite large, which is 4.725 million liters in a month. If the ignition of lights is not done then 4.725 million liters is not wasted uselessly.Another impact is increasing air pollution and global warming. In terms of the rupiah, if every motorcycle uses 1 liter of gasoline every day for ignition of the lights, the rupiah spent on lighting up the lights can be calculated as follows:

$$B_{rp} = P_1.V_{PL}.H$$

The meaning is that if each motorcycle uses 1 liter of pertalite with the ignition of the lights then Rp. 70,875 is spent on lighting the lights.This figure is indeed very small and in one month is only Rp2126.25 per motorcycle. But if there are 10 million motorbikes, this figure is quite large, which is Rp. 21.2 billion a month is wasted by uselessly due to the ignition of the lights.

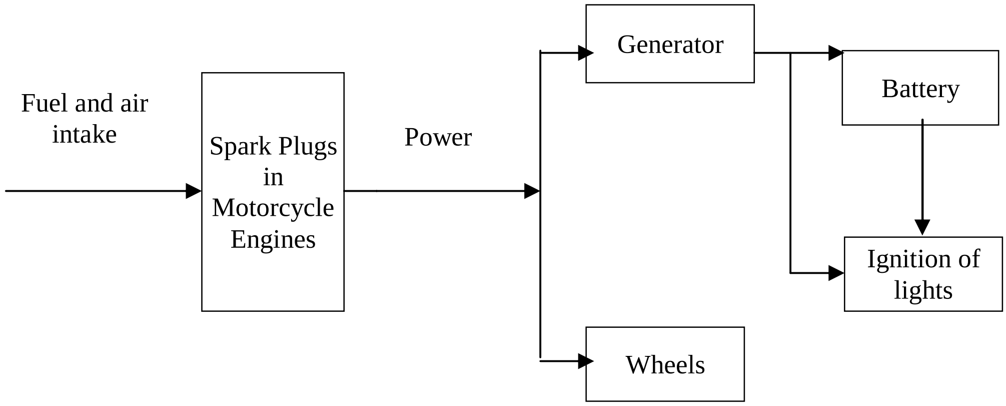

Figure 1. Power Distribution Scheme

Figure 3.1. Testing Instrument Setup

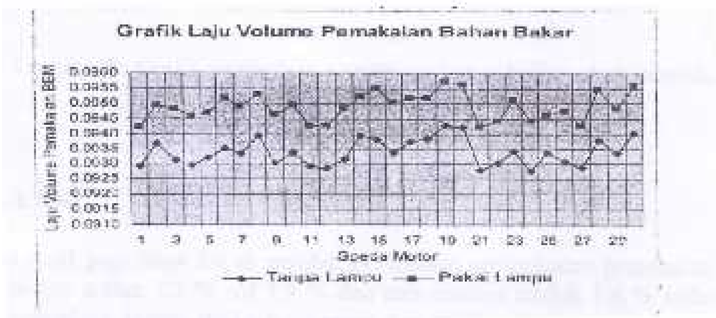

Figure 2. Graph of the rate of fuel use

Figure 3. Graph of percentage of increase in fuel usage

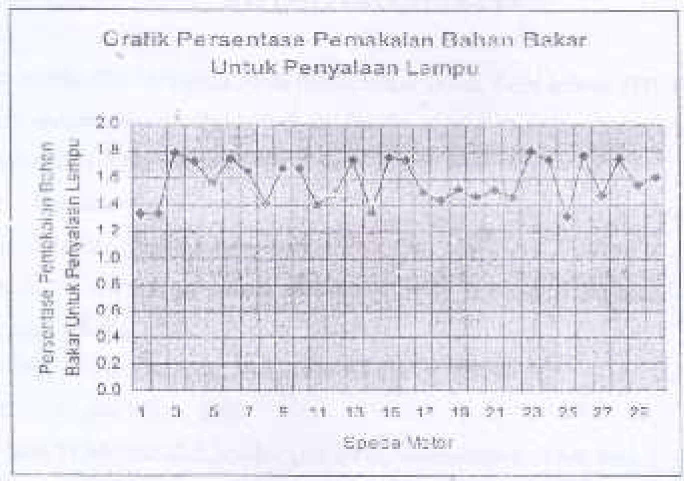

Figure 4. Graph of percentage of increase in use of fuel for ignition of lights

D. Conclusion And Suggestion

Conclusions

The results show that the percentage of increase in fuel use due to ignition of lights is in the range of 1.3% to 1.8% with an average of 1.6%, while without ignition of the lights the percentage of fuel use is in the range 1.3% to 1.8% with an average of 1.575%.

This percentage is indeed very small for every motorcycle, but if there are 10 million motorbikes that consume 1 liter of fuel every day without igniting the lights, then in a month there will be an increase of 4.8 million liters or Rp 21.6 billion due to the ignition of the lights.In other words, if there are 10 million motorbikes that consume 1 liter of fuel every day with the ignition of lights, then in one month 4.725 million liters or Rp 21.2 billion is spent on the lighting of the lights.

Suggestion

The researchers appealed to the government so that policies that require motorbike riders to turn on motorcycle lights during the day need to be revisited because the impact is very large on the environment and accelerates the depletion of petroleum reserves or fossil fuels and disposes for nothing tens of millions of rupiah every month.

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