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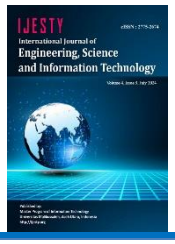

Effect of Changes in Air Temperature on Fuel Consumption and HC and Co Exhaust Gas Emissions

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Abstract

Motorized vehicles are generally equipped with a driving engine which functions as a driver for the car. Motorized vehicles have engines consisting of one cylinder, two cylinders, three cylinders, and so on, and all of them require air as a medium for burning fuel in the combustion chamber to produce power to drive the vehicle. Motorized vehicles, both at sea and on land, operate at different air temperatures in all corners of the earth. This research was carried out by varying the air temperature entering the combustion chamber. The intended temperatures are 20oC, 25oC, 30oC, 35oC, and 40oC, and what will be examined is fuel consumption, HC, and CO exhaust emissions. The research results show that air temperatures from 20 to 40 degrees do not significantly affect fuel consumption or HC and CO exhaust emissions.

Keywords: *Air Temperature, Exhaust Emissions, Fuel, Gas Emissions.*

1. Introduction

The increase in motorized vehicles in Indonesia is swift; the increasing traffic jams in every big city in Indonesia prove this. The increase in the number of cars impacts increasing air pollution, fuel consumption is also growing, while fuel supplies are becoming increasingly scarce. On the other hand, fuel as energy is an essential ingredient for human life today; all human activities depend on energy, or it could be said that human life depends on energy availability [1] [2]. Fossil fuel energy produces emissions that pollute the air when converted into mechanical energy and threaten human life. Therefore, a possible solution is to reduce the production of vehicle exhaust emissions, especially CO and HC, by conducting research, and the same goes for the presence of fossil fuels, which are increasingly depleting daily to find what is called renewable energy or reduce its use. Fuel or increase the efficiency of fuel use [3] [4] [5].
From the background description above, the researcher conveys several problem identification:
1. To what extent do changes in air temperature affect fuel consumption
2. To what extent is the effect of changes in air temperature on exhaust gas emissions, especially CO and HC?

Is there an effect of changes in air temperature on vehicle fuel consumption and exhaust emissions? The research object is a 4-stroke 135cc single-cylinder motorbike. The exhaust gas emissions studied are HC (Hydro Carbon) and CO (Carbon Monoxide) exhaust gas emissions. The air temperature variations are 200C, 250C, 300C, 350C, and 400C. Engine speed is 1500 rpm. The fuel used is premium 88.
The aim of this research is as follows: to determine the effect of changes in air temperature on fuel consumption and HC and CO exhaust emissions [6] [7] [8].

2. Research Methods

This research was carried out using experimental methods and observational data collection [9] [10] [11]. The media and tools used in this research to support the progress of this research are [12] [13]:

Table 1. Tools and Materials

No	Name Material	Merk	Specifications	Quantity
1	Motorcycle	Yamaha Jupiter Mx	135 cc	1 Unit
2	Engine Gas Analyzer	ISO 3930		1 Unit
3	Tacho Meter			1 Unit
4	Measuring cup			1 Unit
5	Tool Set			1 Set
6	Stopwatch			1 Unit
7	Heater			1 Unit
8	Cooler			1 Unit
9	Hose			1 Unit
10	Thermometer	Krisbow		1 Unit

2.1. Writing System

This research begins with preliminary observation; the activities include literature study, preparation of tools and materials, machine settings, experiments, data processing, data analysis, discussion, and conclusion [14] [15] [16]. The systematics of this research can be presented in the form of a flow diagram as follows:

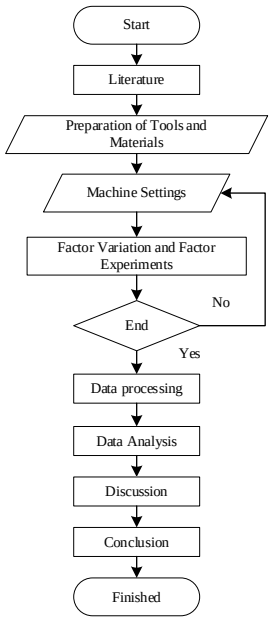

Fig 1. Research Flow Diagram

3. Results and Discussion

3.1. Research Results

Fuel consumption was tested 3 times at each specified temperature, and the average was taken from all three, as shown in Table 2 below [17] [18] [19] [20].

Table 2. Fuel Consumption Test Result Data (ml/t)

No	Air Temperature	Rotation (Rpm) (t = 2 mnt)	Fuel Consumption			
			Lv 1 (ml)	Lv 2 (ml)	Lv 3 (ml)	Average (ml)
1.	20^0C	1500	20,12	20,11	20,12	20.110
2.	25^0C	1500	20.10	20.09	20.11	20.108
3.	30^0C	1500	20.09	20.09	20.10	20.099
4.	35^0C	1500	20.10	20.08	20.09	20.098
5.	40^0C	1500	20.08	20.09	20.07	20.107

In the graph, it can be displayed as follows.

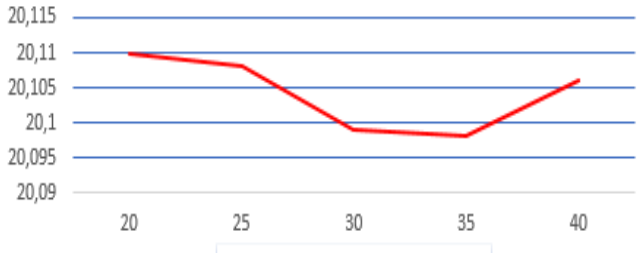

Fig 2. Graph Fuel Consumption

Likewise, with hydrocarbon (HC) exhaust emissions, each test temperature was carried out 3 times; from the three test results, the average was taken and can be tabulated as in Table 3 below.

Table 3. HC Exhaust Emission Test Result Data (PPM)

No.	Air Temperature (°C)	Rotation (Rpm) t = 2 mnt	HC Exhaust Emission (PPM)			
			Lv 1 (ppm)	Lv 2 (ppm)	Lv 3 (ppm)	Average (ppm)
1.	20	1500	40,739	40,699	40,718	40,7186
2.	25	1500	40,718	40,709	40,709	40,6986
3.	30	1500	40.708	40.689	40.699	40.6986
4.	35	1500	40.708	40.708	40.708	40.7080
5.	40	1500	40.714	40.705	40.735	40.7180

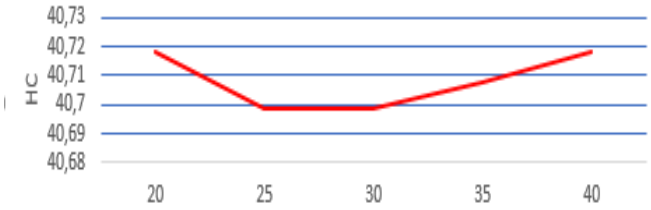

Fig 3. Graph Emmision HC

Like fuel consumption and HC, Carbon monoxide (CO) exhaust emissions were tested 3 times for the specified test temperature and can be displayed in Table 4 below.

Table 4. Data on Co Exhaust Emission Test Results (%)

No	Temp	Rotation (rpm), t = 2 mnt	Exhaust Gas Emission Content			
			Lv 1	Lv 2	Lv 3	Average
			CO(%)	CO(%)	CO(%)	CO(%)
1.	20^0C	1500	0.175	0.178	0.177	0.1766
2.	25^0C	1500	0.173	0.179	0.175	0.1756
3.	30^0C	1500	0,174	0,178	0.177	0.1763
4.	35^0C	1500	0,172	0.176	0.175	0.1743
5.	40^0C	1500	0.171	0.177	0.174	0.1740

Table 4 above can be displayed in graphic form as follows.

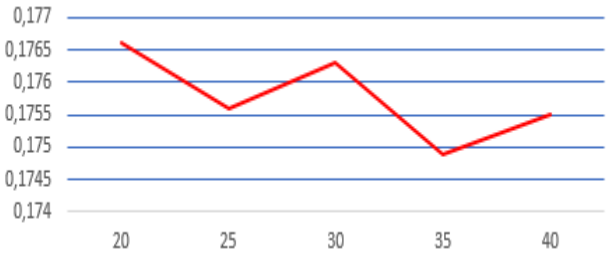

Fig 4. Graph Emmision Co

3.2. Discussion

3.2.1. Fuel Consumption

Table 4.1 above is a table of fuel consumption where, according to the research results table, there is a change in fuel consumption, but it is tiny and can even be ignored. The temperature change tested with an interval of 5 degrees starting from 20, 25, 30, 35, and 40 degrees only shows a difference in fuel consumption of 0.003 ml in 2 minutes. That number is minimal (ignored).

3.2.2. Hydro Carbon (HC) Exhaust Gas Emissions

Table 4.2 above shows that the HC gas emissions produced do not change much from the air temperature variation from 20 to 40 0C with an interval of 5 0C. This means that a variation in air temperature from 20 to 40 0C still meets the engine working temperature, which ranges from 90 - 105 degrees Celsius. According to Table 4.2 above, the change in HC gas emissions from 20 to 40 degrees with an interval of 5 degrees is only 0.001 ppm; this is also ignored.

3.2.3. Carbon Monoxide (CO) Exhaust Gas Emissions

From Table 4 above, we can read that the production of CO gas emissions does not change from the variation of an air temperature of 20 to 40 0C with an interval of 5 0C. This means that a variation of air temperature of 20 to 40 0C still meets the engine working temperature, which ranges from 90 - 105 degrees Celsius. According to Table 3 above, the change in CO gas emissions starts from 20 to 40 degrees with an interval of 5 degrees.

The effect of air temperature variations on fuel consumption and HC and CO exhaust emissions in a 135 cc 4-stroke two-wheeled vehicle can be shown as follows:

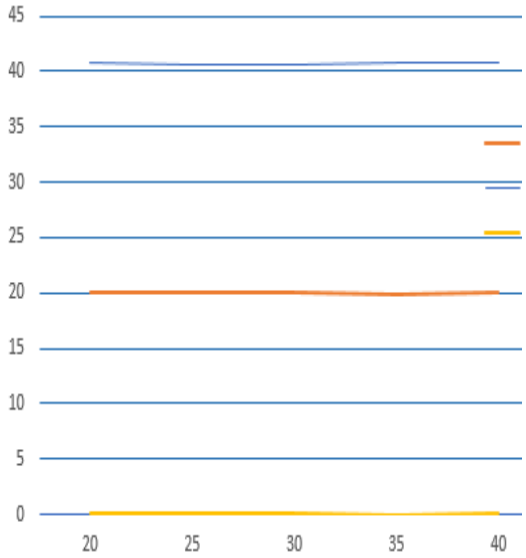

Fig 5. Fuel Consumption Graph HC Emissions and Co Emissions

4. Conclusion

1. Variations in air temperature from 20 degrees to 40 degrees with intervals of 5 degrees do not affect fuel consumption in combustion engines.
2. Variations in air temperature from 20 degrees to 40 degrees with intervals of 5 degrees also do not have much effect on HC exhaust emissions and fuel consumption in combustion engines.
3. Variations in air temperature from 20 to 40 degrees with intervals of 5 degrees also do not affect CO exhaust emissions and fuel consumption in combustion engines; in fact, there is no change.

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