BIS ENERGY AND ENGINEERING

Volume 2 2025 | DOI: 10.31603/biseeng.369
6th Borobudur International Symposium on Science and Technology (BIS-STE) 2024

UNIMMA PRESS
Universitas Muhammadiyah Magelang

Utilization of vehicle exhaust gas through generator engineering to generate voltage for vehicle batteries

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Abstract

The research aims to discusses the experiment of the potential of optimizing the winding on the generator to obtain additional voltage using motorcycle exhaust gas. The voltage obtained in this experiment is used as an additional voltage needed to electrolyze water into HHO gas which can be used as an alternative to fuel oil on a motorcycle. This studi used an experimental method which modifies the winding on the generator and adds several circuits mounted on the motorcycle exhaust. Several experiments were carried out by changing the winding from the standard state of 104 turns to 99 turns, 114 turns, 124 turns and 129 turns. The result is that the voltage increases if the standard winding is compared with the 114, 124, and 129 windings by 6.7%, 8.5%, 17%. And decreased in winding 99 with a result of 1.21% of the standard. Based on the data generated, it can be concluded that if the winding on the generator coil is added, it will produce a large voltage as well. However, if the winding on the generator coil is reduced, the resulting voltage will also.

Keywords

Winding, Exhaust gas, Generator

Introduction

There are many types of vehicles that are used to support the implementation of daily activities. One example is a motorcycle. Motorcycles themselves move using chemical energy obtained from petroleum derived from fossils that have been buried for thousands of years. The chemical energy is converted into mechanical energy that can move the motorcycle. But over time, its availability is running low and the pollution it causes also greatly impacts human life and the environment (Dewi, Dini, Magfiroh, & Mauli, 2022). Therefore, alternative energy is needed to replace fossil fuels. One of the alternative energies is the use of HHO fuel produced from the water electrolysis process (Mawarti, 2017). With the additional of an electrolizer, it has an effect on reducing motorcycle fuel consumption (Wahyudi, Purwanto, Maksum, Setiawan, & Sampurno,

Published:
May 31, 2025

Selection and Peer-review under the responsibility of the 6th BIS-STE 2024 Committee

2023). However, the process of electrolyzing water needs a high enough voltage o warrant additional voltage (Setiawan & Salam, 2018). Therefore, researchers designed an idea by utilizing vehicle exhaust gas and adding several circuits to generate additional voltage. The circuit is composed of an additional body, turbines, generator and motorcycle exhaust. The researcher focuses on the generator winding which, if modified, can obtain a large voltage than the standard generator state without modification (Sauky, Al Farisi, Liliana, & Wenda, 2021).

Method

In this research, using an experimental research method where this research begins with designing a circuit, preparing the required measuring instruments and tools and materials to make a circuit and conducting experiments to obtain the necessary data. (Sugiyono, 2012). The series of tools and materials used are presented in Figure 1.

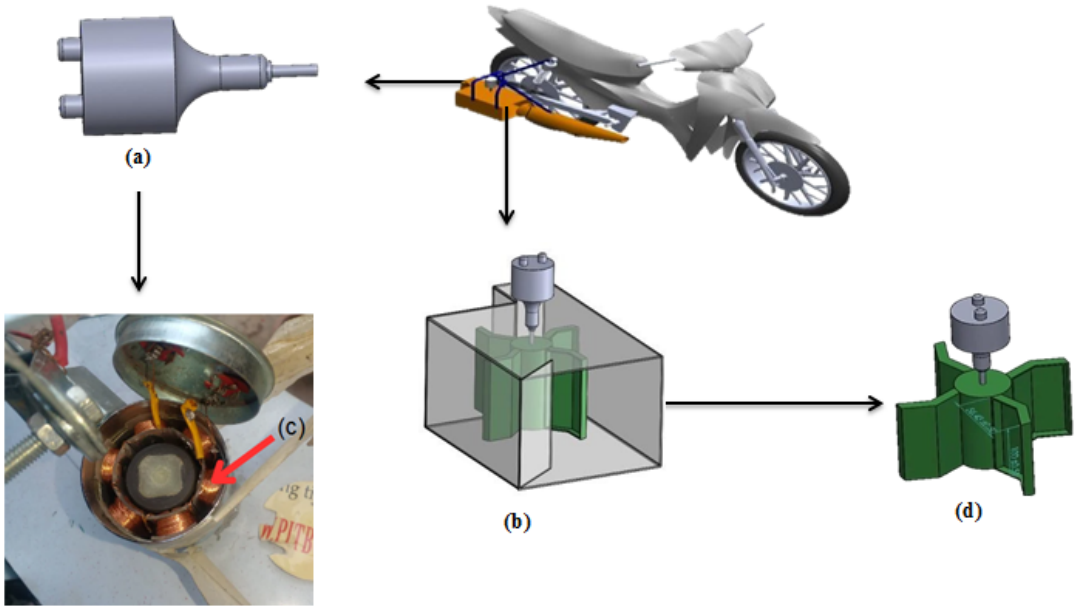

Figure 1. The series of tools and materials used (a) generator, (b) additional body, (c) coil, and (d) turbins

In Figure 1, a set of tools and materials will be used in the data collection process. There are a motorcycle, an additional body in which there is a propeller connected to the generator and in the generator there is a coil that will convert wind energy from motorcycle exhaust gas into voltage. The additional body that is installed on the motorcycle exhaust aims to maximize the exhaust gas produced by the combustion residue to rotate the turbines. The turbines serves to capture exhaust gas, which will convert wind energy that will be forwarded to the generator (Anggraini, Surtono, & Pauzi, 2016). This turbines has 2 forms, namely vertical axis and horizontal axis type turbines (Yani, 2021). In the experiments that will be carried out using a vertical-axis turbines because it has the advantage that the torque produced is high so that the rotor can rotate at slow wind speeds (Nurdin, Purwanto, Setiawan, & Sugiarto, 2023). The propeller will be connected to the generator, where the function of the generator is to

convert the kinetic energy produced by the propeller into electrical energy through the principle of Faraday's law (Sauky, Al Farisi, Liliana, & Wenda, 2021) (Rakhman, 2023).

Data analysis

To get a conclusion from the data generated from the voltage measurements with the treatment of varying the numbers of turns in the generator coil and without treatment with the following analysis :

a. The data obtained from the multimeter test equipment is taken as the average for each treatment with the formula:

$$M = \frac{\sum x}{n} \qquad (1)$$

b. From the average obtained, a comparison of each point is made by comparing percentages with the formula :

$$P = n - N / n \times 100\% \qquad (2)$$

Description: P as Percentage number to be obtained; n as Average tension in the treatment with the standard number of turns; N as Average stress in the treatment with a varied number of turns

Results and Discussion

Results

Table 1. Results

Winding	Velocity	Voltage (V)
99	30	1.9
	40	2,8
	50	2.9
	60	3.0
104	30	2.2
	40	3.0
	50	3.3
	60	3.6
114	30	2.2
	40	3.0
	50	3.4
	60	3.6
124	30	2.3
	40	3.1
	50	3.6
	60	4.2
129	30	3.0
	40	3.3
	50	3.8
	60	4.7

The results of the experiments carried out obtained voltage results with variations in the number of turns 114, 124, 129 turns which were compared with the number of

standard turns, namely 104 turns and the comparison of standard turns with turns that were reduced from the standard state of 99 turns. Table 1 shows the data from the experiments that were conducted.

To see the data from the experimental results of the variation in the number of turns on the generator more clearly. A graph of the experimental comparison result is presented in Figure 2 to Figure 5.

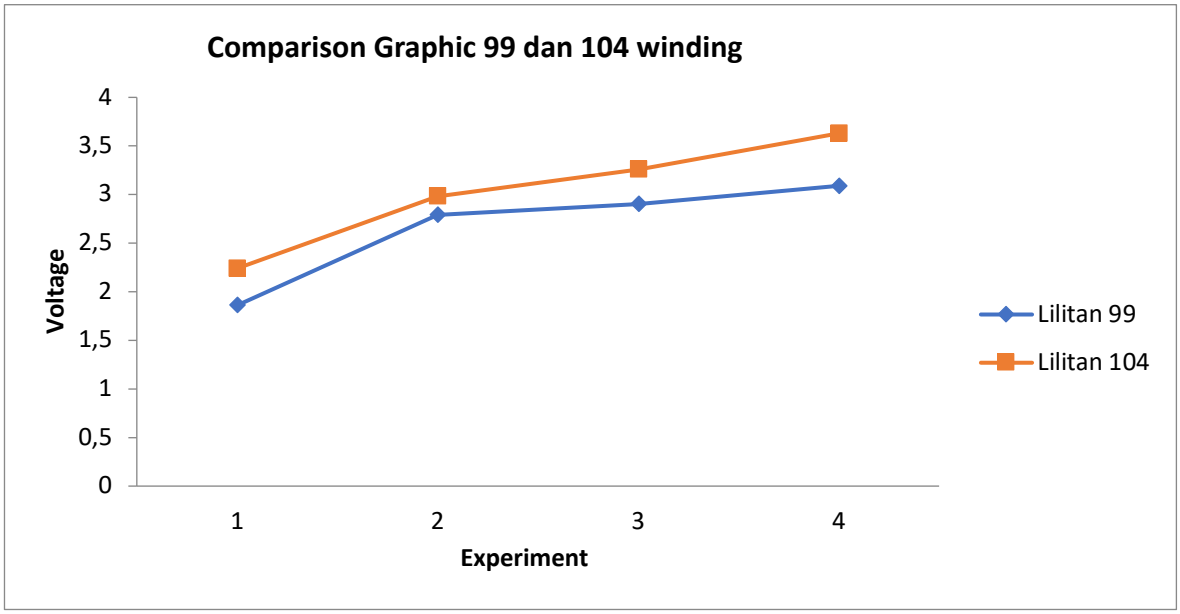

Figure 2. Comparison Graphic 99 and 104 winding

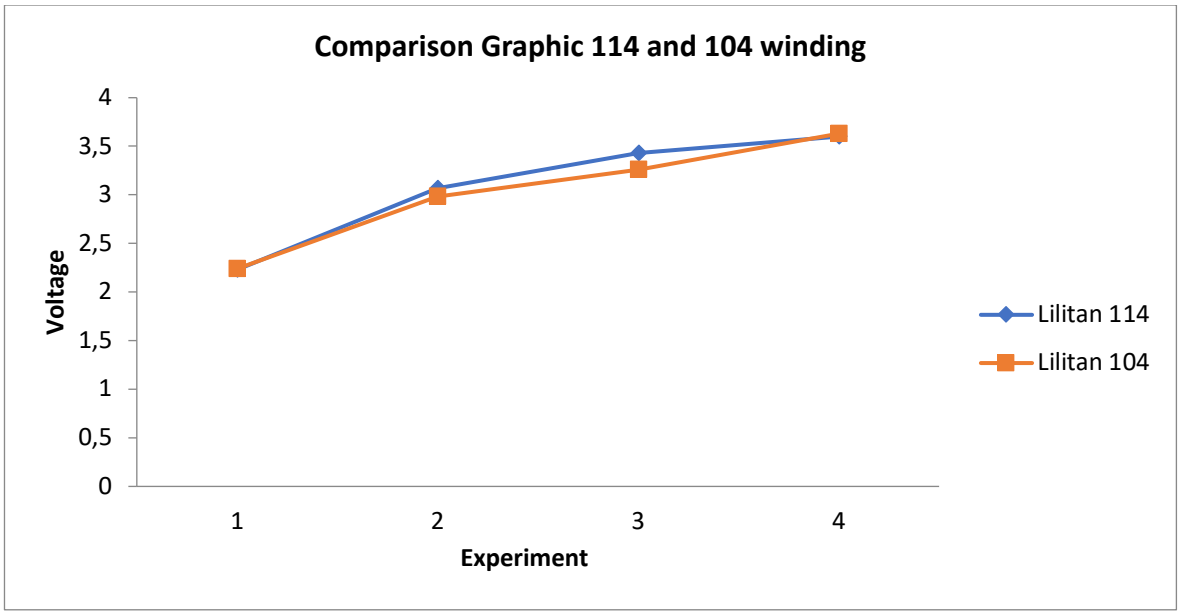

Figure 3. Comparison Graphic 114 and 104 winding

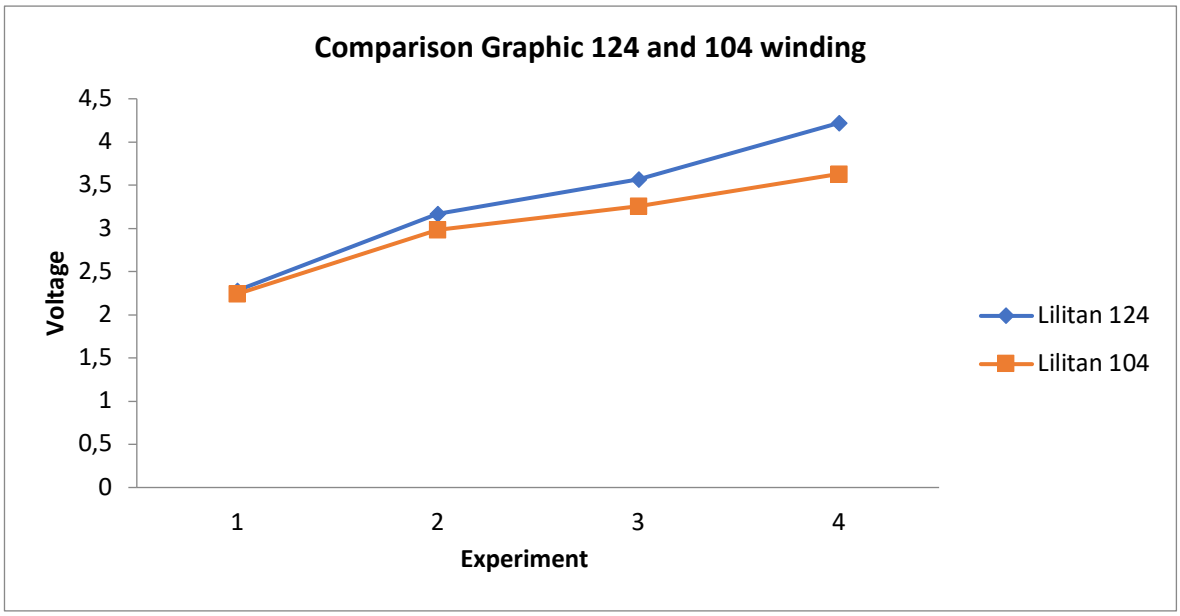

Figure 4. Comparison Graphic 124 and 104 winding

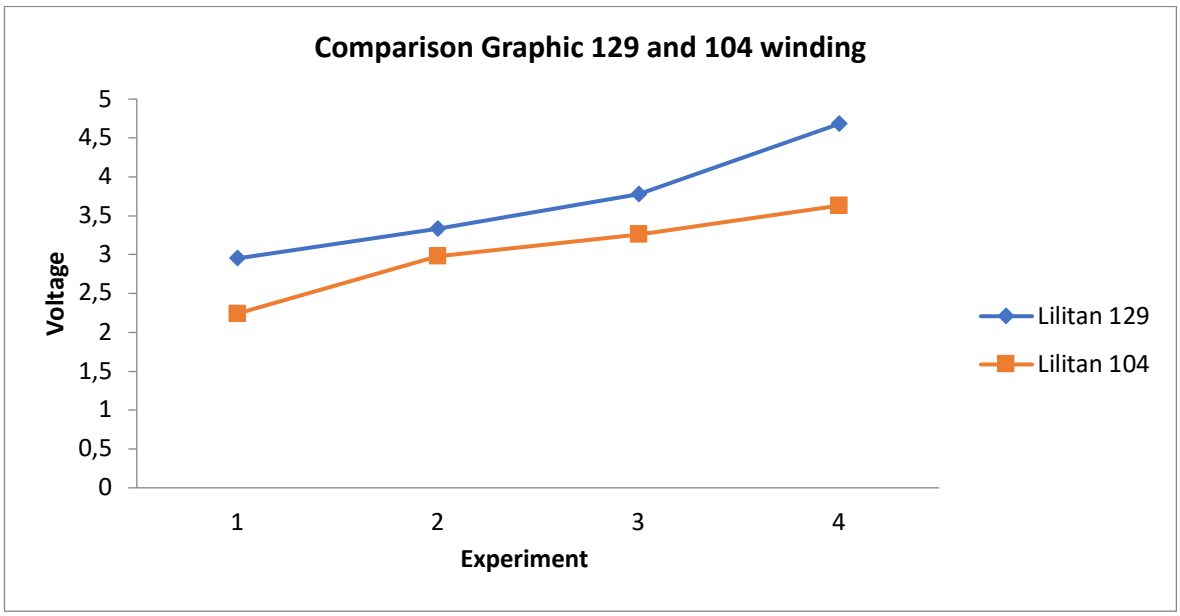

Figure 5. Comparison Graphic 129 and 104 winding

Figure 2 illustrates the decrease in voltage generated if the number of turns in the coil is reduced by a difference of 0.41 V. But in Figure 3 to Figure 5, the voltage generated from the number of turns on the coil varied by the number of turns 114, 124, and 129, increasing from the standard number of turns 114 with a voltage difference of 0.01 V, 0.48 V, and 0.60 V.

Discussion

From the experimental data that has been presented previously, in this section the research will provide a discussion. From the graph above, it can be seen that the increase in voltage obtained from the number of turns above the standard is 114 turns, 124 turns,

and 129 turns. And it can also be seen that the winding that is less than the standard winding with a total of 99 turns is lower than the standard situation.

In order to easily draw conclusions from the experimental data in the table, the following researchers made a percentage comparison table obtained by comparing the standard number of turns of 104 with the number of turns of 99, 114, 124, and 129. From the comparison of the standard number of turns of 104 with the number of turns added from the standard state of 114, 124 and 129 there was an increase of 6.7%, 8.5%, and 17%. However, in the comparison with the number of turns 99, there is a decrease in voltage of 1.21% from the standard state with the number of turns 104.

It can be concluded, in the experiment get the results that there is an effect if the winding on the generator is changed from the standard state. And in one of the references carried out (Putra, Purwanto, Setiawan, & Arif, 2023) also proves effective if the change in the winding on the generator can change the voltage produced.

Conclusion

From the experiments that have been carried out, researchers can conclude that by changing the number of turns on the generator can cause an increase in the voltage generated from the utilization of motorcycle exhaust gas. And also the winding that is added from the standard winding gets increased results. But inversely proportional to the number of windings that are reduced from the standard winding has decreased voltage. This is in accordance with the perspective of Ohm's law which says if the voltage and resistance are proportional, where if the winding in the generator is reduced (resistance) then the voltage will also be small and vice versa.

Acknowledgement

The researcher expresses gratitude to the UNP rector, Head of the Research and Community Service Institute and the Departement of Automotive Engineering for their financieal support and facilities throughout the completion of this research.

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