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Literature study: potential of additional technology on conventional motorcycles on reducing the impact of exhaust gas emissions on the environment

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Abstract

Motorbikes in Indonesia reached 125,305,332 units or 84.5% of total motorized vehicles. Indonesia ranks 26th in the country with the highest level of air pollution in the world. Motor vehicles produce 70-80% air pollution and industry 20-30%. The CO and HC produced are not good for the environment. Reducing exhaust emissions becomes very important by identifying effective additional technologies. The research method used in this research is the literature review method by collecting information and data using various library materials. The results of the literature review show that the addition of technology can reduce exhaust gas emissions in the form of CO and HC. By adding additional technology to motorbikes, of which there are 125,305,332 units or 84.5%, it can reduce the level of air pollution in Indonesia. The use of additional technology on conventional motorbikes has great potential to reduce exhaust emissions which have a negative impact on the environment, but further research is needed to identify effective and economical technology.

1. INTRODUCTION

Motorcycles are the most widely used means of transportation in Indonesia. This is evidenced by data from the Central Statistics Agency in 2022, namely the number of motorcycles reaching 125,305,332 units or 84.5% of the total number of motorized vehicles in Indonesia (Wibowo & Nugroho, 2024). IQAir (2002) noted that Indonesia ranks 26th as the country with the highest level of air pollution in the world. In the same year, it was also reported that Jakarta was the city with the highest pollution in Indonesia (Winni & Mataram, 2024). Motor vehicle exhaust produces 70-80% of air pollution while industry only produces 20-30% of pollution (Pranata et al, 2021). With this data, the large number of motorcycles also affects environmental conditions, especially the air environment. Motorcycles produce emissions such as CO and HC gases which are harmful substances. Carbon monoxide (CO), Hydrocarbon (HC), are two of the exhaust gases

produced by motorcycles and have a negative impact on the environment (Iskandar et al., 2020).

A literature study on the potential use of additional technology on conventional motorcycles to reduce exhaust emissions is very important in this context. By identifying additional technologies that are effective in reducing exhaust emissions, we can develop more environmentally friendly and sustainable solutions in the transportation sector.

Until now, there has been a lot of research on the addition of additional technology applied to conventional motorcycles. These studies were carried out by experimental methods that took data directly from the results of the experiments carried out. The findings of these studies provide valuable insights into how additional technologies can affect exhaust emissions in conventional motorcycles in Indonesia. These studies can also be used as material to produce further research on exhaust emissions in motorcycles by making variations on the experiments to be carried out.

In this article, the author will present a comprehensive review of the literature on the potential use of additional technologies in conventional motorcycles to reduce exhaust emissions that negatively impact the environment. It is hoped that the results of this study can make a significant contribution in efforts to reduce the negative impact of motor transportation on the environment.

2. RESEARCH METHODS

The research method used in this study is *the literature review method*. Literature review or literature study is a research method that is carried out by collecting information and data sources from various sources such as books, journal articles, previous research, and other sources that are still related to the problem to be solved (Iskandar et al., 2023; Marsyaelina et al., 2022).

The source of the data taken is secondary data or literature taken from previous studies. The technique used is to analyze the results of research from scientific articles and other literature that have been published in online journals through google schoolar which has the purpose of determining the effect of the use of additional technologies on motorcycles on exhaust emissions. The results of the analysis of the study will be presented in a descriptive manner to provide a clear overview of the potential use of additional technologies on motorcycles against exhaust emissions.

3. RESULTS AND DISCUSSION

The articles used in the literature review of this study are as many as 10 articles. The results of the review are written in a table format by including the title of the article and the results of the research

Table 1. Article Review Results

No	Article Title	Research Results
1	Pengaruh Penggunaan Tabung Induksi YEIS (yamaha energy induction system) Terhadap Emisi Gas Buang Pada Sepeda Motor Yamaha Scorpio Z 225 (Randa et al., 2015)	From the use of YEIS induction tubes, there is an effect of reducing exhaust emissions in vehicles. This is because air and fuel are mixed more evenly when entering the YEIS induction tube. The use of YEIS induction tubes can reduce CO emissions by 28.96% and HC by 15.22%. The use of YEIS induction tubes on Yamaha Scorpio Z 225 motorcycles has a significant impact on reducing CO and HC emissions.
2	Pengaruh Pemasangan Exhaust Gas Recirculation Terhadap Emisi Gas Buang Honda Supra X 100 (Sugita et al., 2021)	From the installation of EGR that is automatically controlled on the Supra X 100 motorcycle, it has an effect on exhaust emissions, namely a decrease in HC and AFR values, an increase in CO emissions and an increase or decrease in CO2 emissions.

3	Pengaruh Penerapan Idle Stop Pada Kendaraan Roda 2 Terhadap Konsumsi Bahan Bakar dan Emisi di Kota Tanggerang Selatan (Wahid et al., 2024)	From the implementation of idle stops, it can reduce fuel consumption of 2-wheeled vehicles by 11% or more economically by 0.0015 liters/km and reduce greenhouse gas emissions, namely C02 by 13.3%, CH4 by 11.8%, and N2O by 12.3% in South Tangerang.
4	Pengaruh Super Kips Terhadap Emisi Gas Buang Sepeda Motor 2 Tak Kawasaki Ninja R150 Tahun 2013 (Pujiono, 2019)	The use of super KIPS on the Kawasaki 150 R motorcycle has an effect on improving the quality of HC and CO in exhaust emissions. When testing using super KIPS, the lowest HC level was 3227 ppm and the highest was 6551 ppm without using super KIPS. Meanwhile, the lowest CO level when using super KIPS is 1.60% and the highest is 9.54% without using super KIPS.
5	Pengaruh Penggunaan Catalytic Converter Dari Bahan Tembaga Terhadap Emisi Gas Buang Kendaraan Pada Motor Yamaha 2 Tak FIZR. (Pujiono et al., 2020)	The installation of a catalytic converter with copper material on Yamaha FIZR motorcycles has an effect on exhaust gas emissions, namely CO gas emission levels of 4.81% with HC levels of 9,999 ppm at 1500 rpm and CO gas emission levels of 3.96% and HC levels of 9,998 ppm at 1500 rpm without using catalytic converters. The use of catalytic converters with copper materials experienced the most emission reduction at 3000 rpm, namely the CO value of 5.23% and at 4000 rpm engine rotation the HC value increased by 79 ppm from 9920 to 9999 ppm.
6	Pengaruh AIS dan Pipa Gas Buang Berbahan Tembaga dan Alumunium Terhadap Mesin 200cc (Franzleon et al., 2021)	From the installation of AIS and Exhaust Gas Pipes with non-ferrous metal materials on Powerace 200cc Brand 3-Wheel Motorcycles can affect the decrease in HC and CO gas at certain revs. However, at certain rounds, CO2 gas has a high value. Exhaust manifolds with an angle of 60° have a good impact on the emissions produced and in the future it is still necessary to research what angle is the most effective to support engine performance.
7	Pengaruh Metallic Catalytic Converter Tembaga Berlapis Chrome Dalam Menurunkan Emisi Gas Buang Mesin Sepeda Motor Empat Langkah (Ariyanto & Wulandari, 2022)	The installation of a Chrome-Plated Copper Metallic Catalytic Converter or MCC CuCr on the Supra Fit Motorcycle has a reduced impact on the exhaust gas emissions produced with an average reduction of 24% for CO emissions and 30% for HC emissions. This study concludes that MCC CuCr passed the emission test in accordance with the Regulation of the Minister of the State for the Environment number 5 years old motor vehicles category L (4-stroke motorcycles).

8	Penggunaan Catalytic Converter dari Bahan Kuningan Dengan Ketebalan 0,2 mm Terhadap Emisi Gas Buang Kendaraaan Pada Motor 2 Tak (Prasetyo & Fahrurrozi, 2020)	The installation of a Catalytic Converter made of Brass with a thickness of 0.2 mm on a 2 Stroke 110 cc Motorcycle has a reduced impact on exhaust emissions, namely with the lowest CO and HC gas emission levels occurring at 1,500 rpm, CO gas emission levels of 3.96%, and HC gas levels of 9,999 ppm, the highest in tests using standard exhausts. The emission level is at 4,000 rpm, the CO gas level is 5.01%, and the HC gas level is 9,920 ppm. Meanwhile, in exhaust gases with catalytic converters, the lowest CO and HC emission levels occurred at 1,500 rpm, CO gas levels of 2.14%, HC concentrations of 9,999 ppm, and the highest CO and HC emission levels at 3,000 rpm. If the CO gas content is 5.23% and the HC gas content is 9,999 ppm. With this data, the Catalytic Converter from Brass Material with a Thickness of 0.2 mm is effective in reducing exhaust gas emissions where when the engine is at 1500 rpm, the CO level drops by 1, from 3.96% to 82% from 2.14%, and the HC value drops from 9,999 ppm to 5,587 ppm, which is a decrease of 4,412 ppm.
9	Pengaruh Pipa Galvanis dan Catalytic Converter Tembaga Terhadap Emisi Gas Karbonmonoksida dan Hidrokarbon (Setiawan, 2024)	The installation of Galvanized Pipes and Copper Catalytic Converters on the Vario 110 Motorcycle has a significant impact on reducing exhaust emissions. With a decrease in the percentage of CO and HC levels. Where a decrease of 51% to the CO percentage and 36% to the HC percentage at 4000 rpm using 15 catalyst plates. A 43% reduction to the CO percentage and a 20% reduction to the HC percentage at 4000 rpm using 10 catalyst plates. Variations in engine rotation affect the reduction of CO and HC levels, as more air is available to the combustion chamber and the temperature of the combustion chamber increases, resulting in lower emission levels.
10	Alat Penurun Gas Buang Pada Motor, Mobil, Motor Tempel dan Mesin Pembakaran Tak Bergerak (Kusuma, 2002)	In this study, the use of Exhaust Gas Lowering Devices on Motorcycles, Cars, Outboard Motors, and Non-Mobile Combustion Engines was able to reduce CO exhaust gas emission levels by up to 50% from the original price, while CO2 was able to be reduced between 40% to 50%, and the O2 content increased by up to 10% as the data obtained in this study. It can be concluded that this tool can reduce CO and CO2 exhaust emissions and increase O2 levels

Based on data from the results of a literature review of 10 articles about sharing various types of additional technologies on motorcycles, the same result is that it can reduce exhaust gas emissions in the form of CO and HC. This can be seen in each article, namely by looking at the results of emission tests before and after the addition of additional technologies listed in the table whose results can reduce exhaust gas emissions on average. The addition of additional technology can also have other positive or negative impacts both in terms of combustion and engine components.

The addition of additional technology to motorcycles can also be combined between one technology and another. The combination between technologies can be done by conducting subsequent experiments. By implementing a combination, it is hoped that exhaust emissions can be reduced so that air pollution can be reduced (Iskandar et al., 2024).

Data from the Central Statistics Agency in 2022 is that the number of motorcycles reached 125,305,332 units or 84.5% of the total number of motorized vehicles in Indonesia. With the addition of additional technologies on motorcycles, which are as many as 125,305,332 units or 84.5%. It is hoped that it can reduce the level of air pollution in Indonesia. In this case, further research is still needed with experimental methods in the use of additional

technology on motorcycles in Indonesia, which is quite large.

4. CONCLUSION

Literature studies show that the use of additional technology in conventional motorcycles has great potential to reduce exhaust emissions that have a negative impact on the environment. However, more research is still needed to identify the most effective and economical technologies. In addition, the implementation of policies that encourage the adoption of clean technology in the automotive industry is also crucial to achieve the target of significantly reducing exhaust emissions.

5. DECLARATION/STATEMENT

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5.2. Author Contributions

All authors contributed to the process of conceptualization, methodology, data curation, writing, reviewing, and editing.

5.3. Conflict of Interest

The authors declare no conflicts of interest.

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