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USE OF CORN COB WASTE AS BIO-COKE BRIQUETTE ON COMBUSTION RATE BASED ON TEMPERATURE AND MOLD SIZE

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ABSTRACT

Biomass waste is one of the wastes that is abundant and underutilized, especially corn cob biomass waste from agricultural residues. Corn cob waste can be used as bio-coke briquette fuel, which has a high calorific value and is environmentally friendly. Corn cob waste contains cellulose, hemicellulose, and lignin, which act as a natural adhesive and help form dense and sturdy briquettes when heated. This research intends to test the utilization of corn cob waste as material for making bio-coke briquettes and analyze the effect of temperature and mold size on the burning rate of bio-coke briquettes.
This type of research is quasi-experimental with a post-test-only control group design, using 15 kg samples of corn cobs in each of 3 treatments, 1 control with 3 repetitions with variations in mold temperature (170°C, 180°C, 190°C), and mold size (diameter 12mm, 20mm, 30mm). This research uses a Hydraulic Press and Thermocontroller to regulate the pressure and temperature for making bio-coke briquettes, then observations are made by calculating the burning rate of the bio-coke briquettes. Then the data was analyzed using a one-way ANOVA test.
The research findings indicate that the optimal combination for the longest burning rate of bio-coke briquettes is a mold size diameter of 30 mm and a mold temperature of 190°C, resulting in a burning time of 50 minutes. The one-way ANOVA test results demonstrated that variations in mold size have a significant impact on the burning rate of *bio-coke* briquettes ($p \leq 0.05$), while variations in mold temperature do not affect the burning rate of bio-coke briquettes.
This study highlights the potential of bio-coke briquettes from corn cob waste as an environmentally friendly alternative to reduce greenhouse gas emissions and improve

environmental health. It is hoped that it can become an alternative fuel to reduce the use of firewood for the community with simpler technology.
Keywords: *Corn Cob Waste, Bio-Coke Briquettes, Combustion Rate, Temperature, Mold Size*

INTRODUCTION

KLHK (Ministry of Environment and Forestry) in 2022 showed that waste that is not managed properly contributes to causing negative impacts on the environment and health. According to Law Number 18 of 2008, waste and garbage disposal can be done simply, reduce, reuse, and recycle. This article requires changes in community behavior related to how to reduce waste, reuse, and recycle waste to create regulations that improve public health, environmental quality and quality and waste can be utilized. (Firdani et al., 2021)

The negative impact of agricultural waste naturally does not affect the environment or living organisms, but if disposed of improperly, it can gradually become one of the main causes of climate change and global warming (Saputra & Renata, 2023). Although this law focuses more on the aspects of protecting and empowering farmers, its implementation also covers environmental issues, including the management of agricultural waste. The Agriculture Law provides a legal basis for the government to develop policies that support the management of agricultural waste sustainably, research in 2022, improper disposal and management of agricultural waste will hurt the environment and impact environmental health. We need to implement policies and laws that can encourage waste reduction, reuse, recycling, and recovery, and ultimately move the manufacturing sector towards zero waste. If optimally managed and utilized, agricultural waste can become a sustainable value-added resource and make an important contribution to energy security and environmental sustainability. Proper conversion and utilization of agricultural waste can lead to economic development and resource conservation, contribute to a circular economy, and improve human health (Masrurroh et al., 2023).

Agricultural waste includes crop residues such as straw crop residues, and other organic wastes such as corn cob biomass waste can become piles of garbage. Agricultural waste can also be a potential source for increasing disease vector populations. Accumulation of agricultural waste can cause environmental pollution, land degradation, and public health problems. Agricultural waste has the potential to harm human health through various pathways, both directly and indirectly (Wulandari et al., 2023). In addition, agricultural waste containing organic materials can be a major source of water pollution. This waste, if not managed properly, can pollute water sources and produce excess nutrients such as nitrogen and phosphorus. Not only that, agricultural waste can also have an indirect impact on human health through the spread of disease (Rentina et al., 2022).

Proper management of agricultural waste, implementation of sustainable agriculture, and use of environmentally friendly agricultural practices are key to reducing the risk of negative impacts of agricultural waste on human health, maintaining the balance of the ecosystem, to identifying sustainable solutions, such as reusing waste as an energy source or industrial raw material, and to developing environmentally friendly management methods with the environment to minimize its negative impacts. Corn harvests are abundant in Indonesia, as is the corn cob waste

produced. The remainder of the corn processing industry will produce waste in the form of corn cobs, the amount of which will continue to increase along with the increase in production capacity(Dewi, 2014).

Therefore, an innovative idea to reduce the volume of corn cob waste and increase added value is to utilize corn cob waste to be converted into a renewable energy source. Corn cob waste is one type of agricultural waste that is often seen in many countries, especially in areas with high corn production. Corn cobs are one of the plants that are often forgotten and thrown away after being harvested, which can cause environmental and economic problems (Gani, Erdiwansyah, et al., 2023).

METHODS

This study uses a type of quantitative research quasi-experimental, quasi-experimental is a research method that involves giving treatment or manipulation of independent variables to observe their impact on dependent variables to measure and analyze statistically with the post-test only control group design technique, namely the control group and the experimental group are compared after treatment is given to see the effects of a treatment after being treated. Quasi-experiments are studies that approach the original experiment. Generally called O_1 for pre-test while O_2 post-test. O_2 namely providing the expected results or changes after the intervention is carried out and allows to emit the impact of the independent variable by recording the duration of the bio-coke briquette fire. In this study, only the final post-test test was carried out, namely the effect of the treatment given on variations in mold temperature differences and mold size, to test the effect of temperature and mold size of bio-coke briquettes from the utilization of corn cob agricultural waste on the rate of fire combustion.

RESULTS AND DISCUSSION

The analysis of the flame burning rate data based on the mold size and mold temperature is presented in the form of a total value of the duration of the flame burning on the bio-coke briquettes after the combustion test was carried out, the effect of variations in mold size and mold temperature of the bio-coke briquettes succeeded in providing significant results on the duration of the flame burning rate.

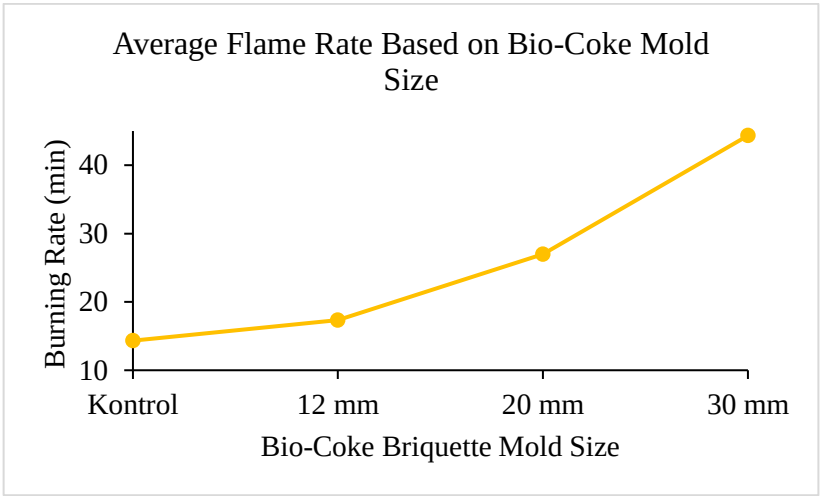

Chart 1. Average Percentage of Flame Rate Based on Mold Size

Based on the graph, it can be seen that the larger the size of the briquette, the longer the fire burns. This can be seen from the increasing average value of the duration of the fire burning along with the increasing size of the bio-coke briquette.

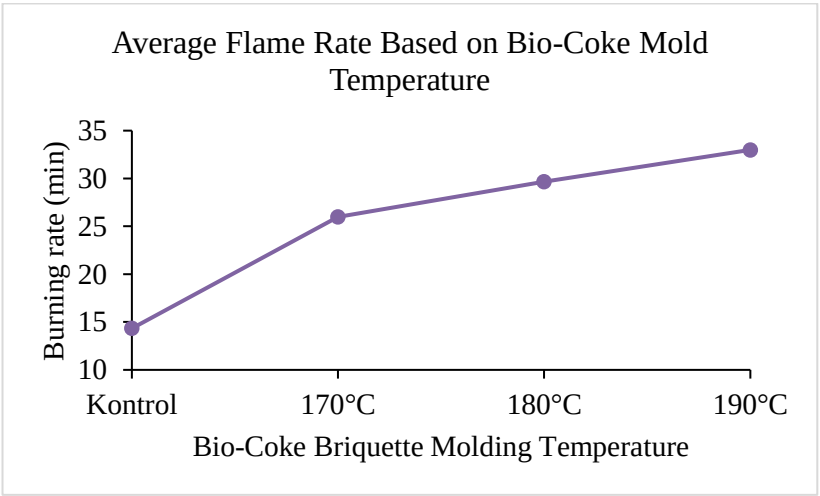

Chart 2. Average Percentage of Flame Rate Based on Mold Temperature

From the graph of the analysis results that have been carried out on the bio-coke fuel samples produced, it can be seen that the sample with a mold temperature of 190°C shows higher results, that the higher the combustion temperature, the longer the fire burns, this can be seen from the increasing average value of the duration of the fire burning along with the increasing combustion temperature.

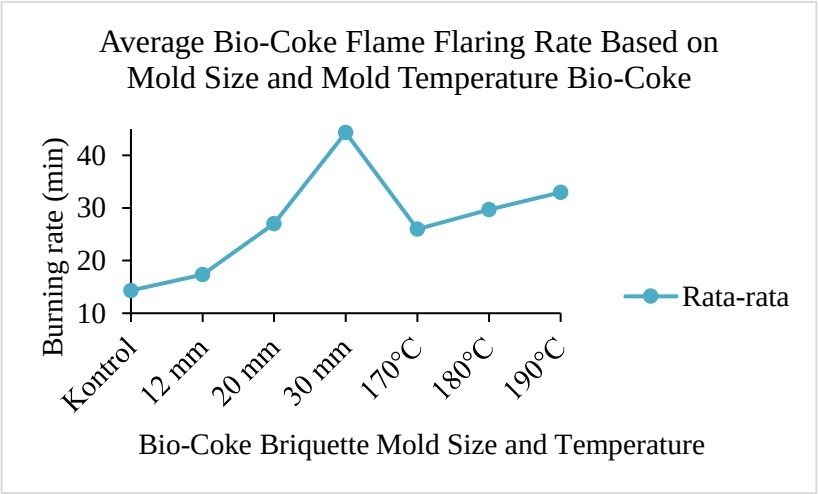

Chart 3. Average Bio-Coke Flame Flaring Rate Based on Mold Size and Mold Temperature Bio-Coke

Based on the observation results of the bio-coke briquette combustion test data, it can be seen in the graph that there is a significant variation in combustion time between various combinations of temperature and diameter of bio-coke briquettes. Generally, briquettes with larger diameters tend to have longer combustion times compared to smaller ones. In addition, combustion temperature also affects combustion time, with higher temperatures tending to produce shorter combustion times.

In the observation results of the bio-coke briquette combustion test data with variations in diameter (12 mm, 20 mm, 30 mm) and temperature (170°C, 180°C, 190°C), several patterns can be identified to evaluate the effectiveness of the briquette's flame duration under different conditions.

This can be seen from the data showing that briquettes with a diameter of 30 mm tend to have a longer burning time than those with a diameter of 20 mm and 12 mm at the same temperature. This is due to the larger volume of fuel available in briquettes with a larger diameter, so it takes longer to burn out completely. In addition, there is a significant difference in burning time between variations in the size of the combustion mold.

In general, briquettes heated at higher temperatures have shorter burning times. This can be caused by the higher heat intensity at higher temperatures, which accelerates the fuel combustion process (Gani, Adisalamun, et al., 2023). Therefore, based on the data analysis conducted, it can be concluded that descriptively the size of the bio-coke briquette mold and the mold temperature affect the duration of the fire, where the larger the size of the bio-coke briquette mold, the longer the fire lasts, and the higher the temperature of the combustion mold, the longer the fire lasts.

In the context of evaluating the effectiveness of the duration of the bio-coke briquette, these factors need to be considered together.

Although bio-coke briquettes with larger diameters tend to have longer burning times, increasing the combustion temperature can also accelerate the overall combustion process. Therefore, in determining the most effective combination of size and

temperature, it is important to consider the balance between briquette diameter and combustion temperature that can provide optimal combustion time.

In addition, it should also be noted that the effectiveness of the duration of the bio-coke briquette is not only determined by the combustion time, but also by other factors such as flame stability, smoke production, and fuel sustainability. Therefore, a comprehensive evaluation of the results of these data observations should also consider these additional factors to gain a more complete understanding of the effectiveness of bio-coke briquettes in practical applications.

This is due to factors such as differences in fuel preparation or natural fluctuations in firing conditions as well as longer mold temperature intervals will produce more visible differences.

CONCLUSION

Corn cob waste can be utilized as bio-coke briquettes as an alternative environmentally friendly fuel substitute. The effect of mold temperature variation is that higher mold temperatures, such as 190°C, tend to increase the longer burning rate of bio-coke briquettes. The effect of mold size variation is that larger mold sizes, such as 30 mm, produce briquettes with a slower burning rate compared to smaller sizes. The combination of mold temperature and mold diameter on the longest flame rate is that the mold diameter size is 30 mm and the mold temperature is 190°C resulting in a burning time of 50 minutes. The impact on environmental health of using corn cob waste as a bio-coke briquette material has the potential to reduce dependence on firewood, and fossil fuels and reduce carbon emissions to the environment.

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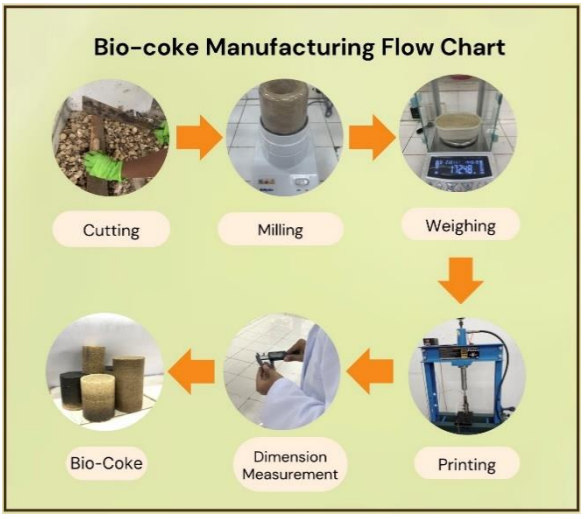
APPENDIX



Stored in a desiccator to keep the bio-coke from getting damp.

Bio-coke briquettes from the utilization of agricultural waste from corn cobs

Prepare 12 mm briquettes at a temperature of 170ºC, make sure the test room is free from wind and there is not much interference.

Record the start time of burning using a stopwatch, wait until the bio-coke briquettes are completely burned, and record the last time they burn.

Carry out the same treatment on a 20 mm size burnt and note the length of time the last flame burns

Also, the 30 mm size bio-coke briquettes were burned and the burning time of the last flame was recorded.

Prepare the control and perform a combustion test with the same treatment burned and record the duration of the last flame burning.

Record the start time of burning using a stopwatch, wait until the bio-coke briquettes are completely burned, and record the last time they burn.