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SOCIALIZATION OF WOOD CHARCOAL GASIFICATION USING DOWNDRAFT GASIFIER

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Abstract

The reduction in fossil energy requires alternative energy that can be renewed. Wood charcoal is one of the alternative sources that can be renewed. Wood charcoal is used to produce energy through direct combustion until now, such as in Pulau Semambu Village, Ogan Ilir, and South Sumatra. The Gasification Method is one technique for converting wood charcoal into gas fuel. This method is not widely known by the community, especially the Pulau Semambu Village, Ogan Ilir people. This Community Service aims to socialize wood charcoal gasification to produce gas fuel in the Pulau Semambu Village Community, South Sumatra. Community service is carried out through Presentations, Q&As, discussions, and demonstrations. The demonstration results showed that the Pulau Semambu Community was very interested in the material provided and the demonstration of making gas fuel from wood charcoal with a gasification process. The demonstration shows that 3 kg of fuel can produce gas for about 50 minutes. The gas fuel formed is identified by the combustion of the resulting gas, which makes the flame.

Keywords: Socialization, Gasification, Wood Charcoal, Fuel Gas, Pulau Semambu

INTRODUCTION

Wood charcoal is a source of biomass and renewable energy, and it is abundant in Indonesia. (Nurhafika, 2021). Wood charcoal is generally widely available throughout Indonesia. However, a lack of information on how to properly utilize wood charcoal to produce energy has resulted in it not being used optimally.

There are many technologies for utilizing wood charcoal as energy, one of which is

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through a thermochemical process, namely through the gasification process. The gasification process converts solid fuel into combustible gas (gas fuel) (Faizan.et al., 2023; Vidian, 2008]. Compared to others, one of the advantages of this technology is that its conversion efficiency is high, and the pollution produced is low (Zhang. et al 2019).

Those who know about this technology are generally limited; only sure scientists and practitioners are involved in utilizing biomass for energy. For this reason, a process of conveying information and applying wood charcoal conversion technology to gas fuel (gasification) to the general public is essential about this technology. The population in rural areas is one of the agents of national development that has great potential to utilize media for subsequent socialization so that this gasification technology can be applied in the field and socialized to all levels of society.

Pulau Semambu Village in Ogan Ilir Utara District is located on the edge of the East Sumatra highway and is 8 km from the Sriwijaya University campus. The area of Pulau Semambu Village is approximately 1200 Ha (Syafutri, et al, 2022). The villagers meet their needs by farming and working in home industries such as making or artisans' wooden house-building equipment. Wood plants can be produced from wood charcoal, whereas Inderalaya Utara District, based on data, has 1000 Ha of rubber tree plantation land (Kabupaten Ogan Ilir Dalam Angka, 2021), which has the potential to produce wood charcoal. Several businesses carried out on Pulau Semambu, such as fried tahu and fried kemplang businesses, have the potential to be replaced by wood charcoal gasification.

The author has carried out several community services regarding gasification: assistance in the gasification of sawdust and rice husks using an updraft gasifier (Vidian, et.al. 2023) and Demonstration of coconut shell gasification using an updraft gasifier (Vidian, et.al. 2024). In the community service currently being carried out, the fuel used is wood charcoal, the type of gasifier is downdraft, and the location is Pulau Semambu Village. This community service aims to provide information and knowledge about wood charcoal gasification technology to the people of Pulau Semambu.

IMPLEMENTATION METHOD

Gasification is a combustion process, but the air is limited to 20 to 40% of the air for stoichiometric combustion. The process takes place in a reactor called a gasifier. In this community service, a downdraft gasifier reactor is used. In this type of gasifier, the fuel enters from the top. Gasification air enters from the middle of the gasifier or the combustion zone, and the gasification gas exits from the bottom of the reactor, as in Figure 1. CO, CH_4, H_2, CO_2, N_2, and O_2 are the gas fuel produced. This gas fuel could be applied to drive internal combustion engines (gasoline and diesel) and gas and steam turbines. In addition, The drying process can also apply gas fuel produced. If used for applications in gasoline, diesel, and gas turbine engines, the gas fuel requires a gas cleaning process first, especially to remove tar content. However, the gas cleaning process is not necessary to apply the drying process and steam turbines (heating the boiler).

This downdraft gasifier gasification system has been tested on a laboratory scale, starting from initial testing (Vidian et al, 2017) and application to gasoline and diesel engines

(Vidian et al, 2019). Before carrying out community service, we tested the gasification system first at the Gasification Laboratory of Mechanical Engineering, Sriwijaya University, using wood charcoal fuel, as in Figure 2. The main components of this gasification system are shown in Figure 3. The gas fuel produced from wood charcoal gasification is then burned, producing flame as in Figure 4. This community service was implemented at the Pulau Semambu Village, North Indralaya District, Ogan Ilir Regency. Implementation Time: September 21, 2024. with presentation, demonstration, and discussion methods. The presentation was made to explain through PowerPoint, including gasification theory, wood charcoal, how the gasifier works, how to make the gasifier, and how to turn on the gasifier. Next, an explanation of the gasification equipment system brought directly to the presentation location is given, as shown in Figure 5. Discussion includes presentation material on PowerPoint and gasifier systems that have been seen directly. The demonstration involves directly operating the wood charcoal gasification process in the downdraft gasifier to produce gas fuel.

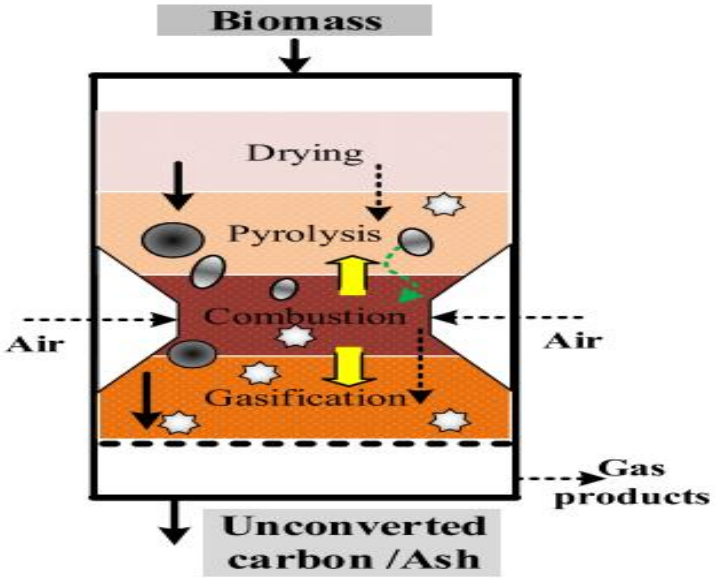

Figure 1. ***Downdraft Gasifier*** **(Zhang, 2020)**

Figure 2. Wood Charcoal Used

Figure 3. Downdraft Gasification System and its components

Figure 4. Laboratory Testing before Community Service Implementation

Figure 5. Downdraft Gasifier Gasification System Down to Community Service Location

RESULTS

Persentation

The presentation lasted approximately 50 minutes and included an introduction, a description of the theory of gasification, Materials that can be converted into gas fuel, equipment parts, how to manufacture equipment, materials used for manufacturing, and how to turn on the equipment. The presentation activities are shown in Figures 6 and 7.

Figure 6. Presentation Activities

Figure 7. Presentation Activities

DISCUSSIONS

During this discussion, participants were given time to ask questions about the presentation material with the presenter, as in Figure 8, and to see the downdraft gasifier reactor directly, which was accompanied by a question-and-answer process, as in Figure 9. During this question-and-answer time, many questions were asked by the participants, which shows their seriousness.

Figure 8. Discussion Activities

Figure 9. Discussion Activities

Demonstration

The implementation team turned on the gasification equipment to demonstrate the gasification process to approximately 40 community participants, as shown in Figure 10. The fuel used was wood charcoal. We tested for one maintained gasifier, and each gasifier contained approximately 3.5 kg. The test results show it can produce approximately 80 minutes of existing gas fuel. The time needed to obtain gas fuel is approximately 20 minutes. As indicated by the burning of gas fuel and then turning it into a red flame, as in Figure 11, gas fuel has successfully formed. The shape of the resulting gas fuel combustion flame is shown in Figure 12.

Figure 10. Demonstration Activities

Figure 11. The ignition process of the formed gas fuel

Figure 12. Burned gas fuel forms a continues flame or flare

CONCLUSION

From the implementation of community service in Pulau Semambu village, we can draw several conclusions can be drawn including:

a. The community of Pulau Semambu Village does not yet know gasification technology
b. The community of Pulau Semambu Village does not yet know how to convert wood charcoal into gas fuel through gasification technology
c. The community of Pulau Semambu Village does not yet know how to convert wood charcoal into gas fuel through gasification technology
d. There are several potential applications in Pulau Semambu Village for the application of wood charcoal gasification using downdraft gasifier.

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