

Implementation of the Superior Waste Concept for Rice Husk: Managing Rice Husk Waste Into Biochar and Charcoal Briquettes as Economic Products

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ABSTRACT

This research aims to apply the principles of Superior Waste Management by processing rice husks into products that are economically valuable and environmentally friendly, such as charcoal briquettes and biochar. This research was conducted in Senaning Village, Jambi, with an approach that involved community participation through training. The research results show that briquettes made from rice husks have high calorific value and low water content, making them very suitable for use as an alternative fuel source. Apart from that, the biochar produced is also able to improve soil quality and store carbon, which provides important benefits for the agricultural sector and reduces the impact of climate change. This program not only helps reduce pollution, but also opens up additional economic opportunities for the community

INTRODUCTION

Senaning Village is one of the villages located in Pemayung District, Batanghari Regency, Jambi. The geographical location of the village is on the banks of the Batanghari river. The typology of the land is lowland and passed by the Batanghari river. Senaning Village is located between Lubuk Ruso Village and Kuap Village. Senaning Village has three hamlets, Hamlet I, Hamlet II, and Hamlet III. The village consists of 5 RTs and 257 households. Senaning Village is an area where the majority of the population work as wet-rice farmers and catfish farmers. Others open shops and stalls, and raise chickens, goats, and cows. The village's main crop is paddy rice, which contributes significantly to the community's economy. However, the increase in rice yield has led to an increase in the amount of rice husk waste available. Most of this waste is simply piled up without optimal management, and some is even given away for free.

The lack of knowledge and information about rice husk waste management is a challenge for the Senaning Village community. This waste actually has great potential to be utilized as raw material for making charcoal briquettes and biochar. Briquette charcoal from rice husks has various advantages, such as high energy efficiency, environmentally friendly, and can be an alternative to fossil fuels. In addition, the utilization of this waste contributes to reducing pollution due to direct burning of waste, while biochar has a significant ability to improve soil quality, store carbon, and improve agricultural yields. (Ilyasa et al., 2023). According to Yahya (2017), rice husk is one of the most beneficial agricultural wastes. However, farmers often consider that the husk is agricultural waste that can only be used as fertilizer, scouring ash, or animal feed.

Seeing this problem, the Pro Ide Miseta team held a socialization activity for the Senaning Village community. This activity aims to provide an understanding of how to process rice husk waste into briquette charcoal. This socialization is also expected to increase public awareness of the potential of waste as a source of additional income, as well as encourage environmental sustainability through the use of waste more wisely. Unfortunately, the lack of community knowledge about this processing technology is a major obstacle. For this reason, the Pro Ide Miseta team held socialization and training activities to increase the understanding of the Senaning Village community regarding rice husk waste management.

IMPLEMENTATION AND METHODS

PRO IDE (Village Innovation Program) activities in the form of community service in Senaning Village, Pemayung District, Batanghari Regency, took place from September to November. The target group involved in this activity consisted of 25 people. The participants included 5 members of the Payo Dadap farmer group, 5 members of the farmer's wisdom group, 10 people from the youth, and 5 administrators of the Senaning Village PKK. The stages of implementing community service activities in the PRO IDE Miseta Program of the Faculty of Agriculture, Jambi University used the PRA (Participatory Rural Appraisal) approach method. This approach involves all participants actively in the service process. The active involvement of participants aims to ensure that

the results of community service provide optimal benefits according to community needs (Putri et al., 2022).

The implementation of community service in the PRO IDE Program involves several important stages. Each stage is designed to ensure that activities run effectively, provide real benefits, and encourage the sustainability of service results. The following are the stages of the activities carried out:

1. Identification of Target Group Needs

The activity began with identifying the needs of farmer groups, youth, and PKK administrators in Senaning Village. This process was carried out through discussions and surveys to understand the problems faced by the community related to rice husk waste. This stage aims to develop programs that suit local needs and create relevant solutions.

2. Counseling and Socialization

After identification, the team provided counseling on the management of rice husk waste into charcoal briquettes. The materials include benefits, economic potential, and positive impacts on the environment. This stage aims to increase community knowledge about the importance of environmentally friendly and economically valuable waste management.

3. Providing Equipment Assistance

Supporting equipment such as chaff burning tools, briquette molds, and ovens were handed over to the target group. This assistance aims to facilitate the community to practice the knowledge that has been given so that they can immediately apply it independently.

4. Training and Hands-on Practice

Training was conducted by guiding participants in the process of making charcoal briquettes starting from the preparation of materials, combustion process, to briquette molding. Participants are actively involved so that they have adequate skills to continue production independently. This stage aims to strengthen the technical capabilities of the community.

5. Monitoring and Evaluation

Evaluation was conducted to assess the success of the activity, both in terms of participants' understanding and the application of the skills obtained. Monitoring is conducted throughout the program to provide technical assistance and ensure that the equipment provided is used properly. Evaluation aims to identify shortcomings in the program as well as provide recommendations for improvement for similar activities in the future.

RESULTS AND DISCUSSION

The main activities in this village innovation program are socialization and hands-on practical methods. The theoretical material presented was related to how to process rice husk waste into briquette charcoal, including the process of burning, mixing, molding, and drying the briquettes. The materials also included the introduction of simple technologies such as combustion drums and manual molds. At the time of practice, each participant was given a guide module containing the steps of making briquettes and biochar as well as an explanation of the composition of the materials and tools used. Participants were directly trained to carry out all stages of the briquetting process with the guidance of the implementation team.

Briket

Materials required:

1. Dried rice husk (main ingredient).
2. Wood charcoal (for additional fuel power).
3. Sago starch (adhesive).
4. Water (adhesive solvent).

Material Comparison:

- a. Rice husk and wood charcoal: 2:1.
- b. Sago starch and water: 1:2.

Tools required:

1. Burning drum.
2. Strainer.
3. Lesung (manual grinder).
4. Stirring device.
5. Cauldron.
6. Oven dryer.
7. Briquette mold.

Manufacturing Steps:

1. Processing of Rice Husk and Wood Charcoal:
 - a. Burn the rice husk in a drum until it becomes charcoal on low heat to avoid excessive baking.
 - b. Do a similar process for wood to produce wood charcoal.
2. Milling:
 - a. Grind the rice husk charcoal and wood charcoal to a fine powder.
 - b. Sift the charcoal powder to ensure fineness and separate it.
3. Mixing with adhesive:
 - a. Dissolve sago starch with water (1:2 ratio) to form a thick solution.
 - b. Combine husk charcoal powder, wood charcoal powder, and adhesive solution (ratio 2:1:1).
 - c. Stir until the mixture is evenly distributed and easy to mold.

4. Molding:
 - a. Put the mixture into the mold and press firmly to make it solid.
 - b. Shape the briquettes as needed (cylinder or block).
5. Drying:
 - a. Dry the briquettes in the sun until they are completely dry.
 - b. Alternatively, use a drying oven at a low temperature to speed up the drying process.
6. Storage:
 - a. Store the dried briquettes in a dry place protected from moisture.



Figure 1. Briket



Figure 2. Socialization of the Utilization of Rice Husk Waste Into Briquettes

Moisture content affects the quality of the briquettes produced. The lower the moisture content, the higher the calorific value and combustion power. Conversely, high moisture content causes the calorific value produced to decrease, because much of the energy produced is absorbed to evaporate water (Sumangat, 2009: 21). Briquettes produced by burning rice husks have low air content (6-8%) and high calorific value, meeting national standards for alternative fuels. The production process includes the stages of burning the husk, mixing the charcoal with adhesive, molding, and drying using an oven. Rice husk briquettes can be used as a substitute fuel for fossil fuels such as oil, gas, or coal. These briquettes are effective enough to be used for cooking or even small energy generation. Rice husks are usually just burned or thrown away. However, by processing them into briquettes, this waste can become a valuable product and open up new business opportunities for farmers and communities. Rice husk briquettes are more environmentally friendly as they do not produce as much smoke or harmful pollution as burning the husks directly. This helps keep the air clean.

Biochar

Biochar is a type of charcoal made from biomass waste, for example, rice husks and corn cobs (Di et al., 2024). The term biomass is used for all combustible organic matter in nature, especially plants and animals in soil and aquatic environments. Biomass includes agricultural and industrial crop processing products and residues such as straw, husks, cobs, stems, leaves and shells (Annisa, 2022). Biochar is commonly referred to as porous charcoal produced from the carbonization process (pyrolysis technique) and serves to improve soil quality and can be used as an alternative for soil management (Isnainiyah et al., 2023). Rice husk biochar is an organic medium that contains a lot of potassium and carbon which is useful for plant growth and development. Biochar is a product resulting from the incomplete combustion process of certain raw materials at a temperature of 300-600 °C with limited oxygen supply or no oxygen at all. Making biochar from rice husk waste is one of the effective ways to manage agricultural waste, improve soil quality, and reduce carbon emissions. The simple yet efficient pyrolysis process can provide great economic, environmental, and social benefits.

Materials required:

- a. Dry rice husk (main ingredient).
- b. Water (solvent).

Tools required: Combustion drum.

Manufacturing method:

1. Preparation of Rice Husk
 - a. Make sure the rice husk is free from dirt or foreign materials such as soil or stones.
 - b. Dry the rice husk in the sun or using an oven to reduce its moisture content, as too high moisture content can interfere with the pyrolysis process. Pembakaran
 - c. Put the dried rice husk into the burning drum.
 - d. Light a fire in the kiln. White smoke will come out of the chimney when the husk has burned.
 - e. The burning process usually lasts for 6 hours.
2. Watering and Drying
 - a. After the combustion process is complete, watering is carried out.
 - b. The burnt husk that has been watered is dried and dried in the sun.
 - c. Biochar is ready for use after drying.
 - d. Store biochar in an airtight container to prevent re-burning. Biochar should be stored in a dry and cool place.



Figure 3. Combustion Drum

Rice husk, which is produced from rice processing, is an ideal material for biochar manufacturing due to its high carbon content and easily degradable structure during pyrolysis. Rice husks are usually dried first before further processing.



Figure 4. Biochar



Figure 5. Biochar socialization

One of the main applications of biochar is to improve soil quality. Biochar can be used as an additive for soils that are arid or have low organic content. Biochar can be used in potted plants or home gardens to improve soil quality. Mix biochar with potting soil or garden soil to increase aeration, water holding capacity, and improve soil pH. This is beneficial for ornamental or vegetable plants that require fertile and moist soil. Due to biochar's ability to absorb moisture and odors, it can be used in household applications to reduce unpleasant odors, for example inside the refrigerator or in the bathroom. Biochar

can be used in moisture-absorbing bags or spread in specific places to keep the air and humidity clean.

The success or failure of this program can be seen from the resulting achievement targets. This is monitored through evaluation activities of the entire process that has been carried out by the MISETA Pro IDE Team with the Senaning Village community. This process is very important to measure the extent or percentage of program success after implementation. The results of this program evaluation will later be reported to relevant parties as a form of accountability for the grant funds provided for the implementation of activities. From the results of the evaluation of the activity of managing rice husk waste into briquettes, it was found that after the training on briquette making in the Senaning Village community, they were able to produce quality briquettes independently. The positive impact of this activity can be seen in the improvement of community skills, especially in processing waste into economically valuable products. In addition, the success of this program can also be seen from the increasing creative and innovative spirit of the community,

CONCLUSIONS AND RECOMMENDATIONS

Pro IDE Miseta's activities in Senaning Village, Pemayung District, Batanghari Regency, focused on socialization and training on processing rice husk waste into charcoal briquettes. This program aims to provide additional knowledge to the community on how to utilize waste into alternative fuels that are environmentally friendly and economically valuable. With this training, the community is expected to be able to produce and utilize briquettes independently, opening up opportunities for economic improvement while reducing the impact of environmental pollution.

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