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Socialization and Making Briquettes from Rice Husk Waste and Tapioca Flour in Braja Indah Village, Braja Selebah Subdistrict, East Lampung Regency

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ABSTRACT

Briquettes are solid fuels made from waste materials. Rice husks serve as the primary raw material for briquette production. This article provides an overview of a training program aimed at introducing the production of briquettes from rice husks and tapioca flour in Braja Indah Village. The program was carried out in three stages: the survey process, product preparation, and training activities. This article adopts a qualitative approach with a descriptive-explanatory model. The outcome of the program was the production of briquettes capable of igniting successfully. Through this training, the community gained new insights and information on managing rice husk waste into more beneficial products, thereby reducing rice husk waste that could otherwise contribute to environmental pollution. This initiative was a collaborative effort between university students participating in community service (KKN) and the local government of Braja Indah Village to promote the program.

1. Introduction

Braja Indah Village is one of the villages in the Braja Selebah sub-district, East Lampung Regency, Lampung Province, Indonesia. This village is predominantly characterized by rice fields, with the majority of its population engaged in farming. Farmers in this village harvest rice approximately every four months, depending on water availability. To support rice processing, there are numerous milling facilities, which, after the harvest season, generate significant amounts of rice husk waste (Sugiharto & Firdaus, 2021). Improperly managed rice husk waste can negatively impact the environment and pose health risks to nearby communities. To mitigate environmental pollution caused by unmanaged husks, rice husks can be utilized as an alternative fuel source, replacing kerosene, gas, or wood charcoal, and can also be processed into eco-friendly organic fertilizer (Sutisna et al., 2021).

One of the potential uses of rice husk waste is converting it into briquettes (Ruing & Sulaiman, 2022). Briquettes are processed biomass products that are compacted (densified) to increase their calorific value compared to the raw materials. Compared to firewood, briquettes offer several advantages: higher heat intensity, cleaner and more convenient usage, and reduced storage space requirements. The quality of briquettes is determined by their physical, chemical, and mechanical properties. Physical properties include density, particle size, and optimal moisture content (5-8%). Chemical properties focus on fixed carbon content (≥ 60%), ash content (≤ 10%), and calorific value (> 5000 kcal/kg). Mechanical properties emphasize compressive strength (10-15 kg/cm²) to ensure the briquettes remain intact. These factors make briquettes efficient, eco-friendly, and easy to use (Mustain et al., 2021).

Briquettes are typically made from organic materials that undergo combustion in the absence of oxygen (pyrolysis) and are mixed with specific binders (Mangalla et al., 2019). The briquetting process aims to achieve a higher calorific value compared to direct combustion and minimizes smoke production. The quality of briquettes is further evaluated based on the physical, chemical, and mechanical characteristics mentioned above.

Besides raw materials, the type of binder used significantly influences briquette quality (Saputra et al., 2021). Binders enhance calorific value during combustion by strengthening the bonds between particles, ensuring a compact texture, and enabling better water retention within the briquette's pores (Rumiyanti et al., 2019). Binders improve particle arrangement, making the briquettes denser and enhancing their compressive strength during the pressing process (Jannah et al., 2022). Binders are categorized into two types: organic binders (e.g., starch, sago flour, and adhesive paste) and inorganic binders (e.g., sodium silicate, cement, and bentonite) (Rahardja et al., 2022). In this training program, organic binders, specifically tapioca flour, were used.

Therefore, community service activities are essential to achieve the following objectives: Utilize existing organic waste, particularly rice husk waste, for briquette production as an alternative to conventional fuels. Strengthen and enhance community knowledge, enabling them to independently produce briquettes.

2. Methods

2.1 Time and Place

This community service activity was carried out on July 12, 2024 in Braja Indah Village, Braja Selebah Sub-District, East Lampung Regency. This activity was carried out by a community service team consisting of 7 people. Participants in this activity were 30 people from Braja Indah Village, consisting of 5 people from the community, 10 people from farmer groups, 8 people from village officials, and 7 PKK mothers.

2.2 Tools and Materials

The tools used in the briquette-making process include a combustion can, wooden pestle, metal drum, PVC mold, stove, water container, pressing iron, and the following materials: 2 kg of rice husks, 200 g of tapioca flour, and 500 mL of water.

2.3 Methods

This article is written using a qualitative method with a descriptive-explanatory model, which aims to provide a detailed description of the implementation of the socialization program for making briquettes from rice husk waste in Braja Indah Village, as well as to describe the results and impacts of the program. Qualitative research does not produce data in the form of numbers, but rather in-depth descriptions in the form of words that explain the process and results of the activity (Malahati et al., 2023). This method is generally applied to provide an in-depth description of human interaction, program implementation, behavioral changes, and the effects that arise from an activity, such as the socialization of making briquettes from rice husk waste. The data used in writing this article includes primary data from the direct experiences of socialization participants, as well as secondary data obtained through a literature review on the use of agricultural waste, especially rice husks, to produce renewable energy.

3. Results and Discussion

The briquette-making process was carried out in one day from 08:00 to 10:00 WIB as part of a socialization and final briquette production practice. Before the scheduled time, all necessary tools and materials were prepared by the community service team. The briquette-making process includes the following steps:

1. *Drying Rice Husks*
   The rice husks were dried for approximately ±2 days from 08:00 to 15:00 WIB each day, totaling 48 hours. The drying process aimed to reduce moisture content to facilitate grinding (Sofyana et al., 2021).

2. *Burning Rice Husks*
   A container for burning the rice husks was prepared, and 2 kg of rice husks were burned together with 2 kg of charcoal. This process reduced the moisture content from 80% to 20%, resulting in deep black husks. Briquettes with high moisture content tend to crumble easily, are prone to mold, and produce excessive smoke during combustion (Rahmiati et al., 2019).

3. *Grinding Burned Rice Husks*
   The burned rice husks, weighing 2 kg, were ground into fine powder, yielding 500 grams of powdered rice husks. The grinding process was intended to ease the briquette molding process using pipes (Ully et al., 2021).

4. *Mixing with Tapioca Flour*
   Tapioca flour was added to 500 grams of ground rice husk powder in a 10:1 ratio (rice husk powder to tapioca flour) and mixed thoroughly. Hot water at a temperature of 60°C was then added to the mixture while stirring evenly.

5. *Molding and Pressing*
   The mixture was placed into cylindrical molds resembling PVC pipes with a diameter of 1.27 cm and a height of 5 cm. The molds were pressed using a simple tool made of aluminum boxes and stones. Pressing ensured the briquettes compacted and the adhesive thoroughly penetrated the briquette pores, preventing cracks or fractures in the final product.

6. *Drying the Briquettes*
   The molded briquettes were removed from the molds and dried under sunlight for approximately 8 hours, from 08:00 to 16:00 WIB, to ensure the adhesive firmly bonded with the rice husks.

Briquettes formed through the molding and drying processes can be used as an alternative fuel to replace oil or charcoal. They offer a practical solution for communities, especially as a substitute for traditional fuels like oil or wood charcoal (Masriatini et al., 2021).

Briquettes have several advantages over regular charcoal. For instance, they provide longer-lasting embers, burning for about 4–5 hours with stable heat. Additionally, if air circulation is sufficient, they produce minimal smoke and leave less ash residue after combustion (Ardiansyah & Fatihah, 2023). Utilizing waste materials as an alternative fuel offers three direct benefits:

1. *Enhanced Energy Quality*
   The overall energy quality increases significantly, ranging from 20,920 to 27,240 kJ/kg. This improvement is due to the high energy content in the waste, which can be effectively reused.
2. *Environmental Benefits*
   Repurposing waste reduces the costs associated with disposal, which can be expensive depending on the type and amount of waste compared to its potential reuse.
3. *Reduction in Waste Accumulation*
   The reuse of waste materials helps mitigate landfill overflow as disposal sites are becoming increasingly scarce (Cholis et al., 2021).

Figure 1. Initial stage of burning rice husks

Figure 2. The second stage of burning and crushing rice husks

Figure 3. Final result of briquettes from rice husks

The result of utilizing rice husks is briquettes that are blackish in color and odorless, making them a very practical and efficient fuel. The process of making these briquettes involves processing rice husks, which were previously considered agricultural waste, turning them into useful alternative fuels (Adhani et al., 2020). The briquettes that have been produced from this process not only have a uniform appearance, but also good combustion quality, with a durability of up to 4-5 hours. In addition, the application of briquettes from rice husks also helps reduce the amount of agricultural waste that is thrown away, having a positive impact on the environment (Setiawan et al., 2019). With briquettes as an alternative fuel, the people of Braja Indah village not only obtain an efficient and environmentally friendly energy source, but also contribute to efforts to conserve natural resources and

better waste management (Ilyasa, 2020). We then socialize the making of these briquettes to the people of Braja Indah village so that the community can imitate and participate in utilizing agricultural waste from rice husks that are not utilized properly. The socialization activity of making briquettes from rice husk waste was carried out in three stages, namely material presentation, practice, and discussion (question and answer). The presentation of the material explained what briquettes are, their benefits, and how to make and use them. Furthermore, the practice of making them involved 30 people who wanted to try, consisting of 5 people from the community, 10 people from farmer groups, 8 people from village officials, and 7 PKK mothers. At this stage, high participation was seen from the mothers. Finally, in the discussion session, where the mothers still asked more questions, the most common question was whether the tapioca flour would also burn because the fire would easily burn the tapioca because of the low water content in the tapioca and the molding tool used for pressing.

Figure 4. Presentation of material about briquettes

The implementation of this program involves socialization and direct practice followed by various elements of society, including farmers, village officials, and PKK mothers' groups. To measure community knowledge in the socialization program of rice husk briquettes, several main parameters can be used. First, the level of community understanding of the benefits and uses of rice husk briquettes as an alternative energy source. Second, their ability to understand the process of making briquettes, from collecting rice husks to the burning process. Third, the level of community awareness of the environmental impact of using conventional fuels compared to rice husk briquettes. Finally, their knowledge of the sustainability and economic potential of using briquettes as environmentally friendly energy (Soolany, 2019). High participation, especially from the PKK mothers' group, shows great interest in this briquette making technology. During the discussion session, many questions were asked about the process of making and using briquettes, which shows the curiosity and readiness of the community to apply this technology in everyday life.

4. Conclusions

Agricultural waste in the form of rice husks with a low water content can be allocated in making briquettes to replace kerosene fuel with the chemical formula $C_{12}H_{20}$. which is used by the community and reduces rice husk waste. Activities in the form of material presentation as well as simple briquette making practices can strengthen and increase community knowledge, so that they can independently

make briquettes for ±48 hours each. The results of measuring the level of community knowledge related to the briquette making socialization program carried out by the community service team using several parameters, such as through interviews and direct surveys to participants, resulted in very high participant participation. During this community service program, participants even took part in making it and were able to understand how the process of making briquettes from rice husks is carried out. With the encouragement from these participants, it is hoped that participants who are members of the Braja Indah village community can continue to utilize this rice husk. This is expected to result in sustainable changes, as well as provide inspiration for innovation and sustainable efforts in waste and environmental management in the future.

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