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Utilization of Organic Waste in the Manufacture of Briquettes for a Sustainable and Environmentally Friendly Future

RR. Siti Muslikhah[1*], Dhimas Qamariel Nabilla Hafidz[2], Abdu Chairuroziqin[3]
[1,3]Fakultas Bisnis dan Ekonomika, Universitas Islam Indonesia
[2]Fakultas Teknologi Industri, Universitas Islam Indonesia
Corresponding Author: RR. Siti Muslikhah siti.muslikhah@uii.ac.id

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ABSTRACT

This community service initiative aims to address these issues by utilizing organic waste, such as food scraps, dry leaves, and wood, into briquettes as an alternative, sustainable, and environmentally friendly energy source. The program involved a series of stages, including observation, socialization, trials, training, and evaluation. The briquette-making process encompasses material collection, drying, crushing, mixing with adhesive, molding, and drying. The results show that community members are capable of producing usable briquettes, thus reducing waste volume and offering a potential source of income. This initiative not only mitigates environmental pollution but also empowers the local community economically. The project demonstrates that transforming organic waste into briquettes can be a practical and replicable model for sustainable waste management and rural energy solutions.

INTRODUCTION

The world faces a triple planetary crisis, namely climate change, pollution, and accelerating biodiversity loss. The Government of Indonesia, through the Ministry of Environment and Forestry (KLHK), in the agenda item 'Environment and Sustainable Development', explains the efforts in maintaining the Environment and Sustainable Development that have been carried out by the Government of Indonesia (www.menlhk.go.id). In this regard, environmental issues are increasingly becoming a major concern. One of the problems that continues to emerge is the increasing volume of organic waste generated by human activities. Organic waste, such as food scraps, leaves, and twigs, has the potential to cause environmental problems if not managed properly. One way to overcome this problem is to utilize organic waste to create a product with more value. Resource utilization and organic waste management an effective ways to control environmental pollution, improve environmental quality, develop a circular economy, and achieve sustainable development (Kharola et al., 2022; Peng et al., 2022; Indra Maulana et al., 2024)

Organic waste is used as biomass (Alao et al., 2024; Ćurčić et al., 2025; Joshua Abioye et al., 2025; McGookin et al., 2025), which is due to the increasing demand for energy, while resources are limited (Yang et al., 2015). Several previous studies have explained in the context of the use of organic waste for a sustainable and environmentally friendly future, including Fikri & Sartika (2018), namely, the use of organic waste to make briquettes, as well as research conducted by Mulyana & Suryaningsih (2019) and Donald et al. (2022). One of the large amounts of organic waste can be used to reduce waste that is a problem in Indonesia, as well as in Madyogondo Village. Madyoondo Village, located in Ngablak, Magelang, Central Java, is one of the areas that also faces challenges related to organic waste. Puntingan Hamlet, as part of Madyogondo Village, is the location of KKN (Real Work Lecture) in the context of community service aimed at overcoming local environmental problems. One of the initiatives taken is the manufacture of briquettes from organic waste.

Briquettes are solid fuels made from materials such as wood powder, charcoal powder, and in this context, organic waste (Nasution & Simbolon, 2022). Making briquettes from organic waste has the potential for dual benefits, namely, reducing the volume of organic waste disposed of and providing an environmentally friendly fuel alternative. By converting organic waste into briquettes, Hamlets can reduce the negative impact resulting from the disposal of organic waste to inappropriate landfills. In addition to environmental benefits, making briquettes from organic waste can also contribute to the community's economic empowerment. With the production of briquettes, people can utilize organic waste that was previously considered a burden as a source of income. This can help improve the welfare of the local community. Therefore, the service providers carry out socialization and training activities in utilizing organic waste into briquettes which are part of the KKN program in Puntingan Hamlet, Madyogondo Village, Ngablak, Magelang, Central Java. This article will also review the technical steps in the manufacture of briquettes, the potential environmental and economic benefits of this initiative, as well as the challenges

that may be faced during its implementation process. It is hoped that this article can provide better insight into how the use of organic waste into briquettes can be a sustainable solution to environmental and local economic problems.

IMPLEMENTATION AND METHODS

Solving the problems faced by the residents of Puntingan Hamlet, Madyogondo Village, is the main focus of this service. To carry out the service for its purpose, the initiation stage is carried out by conducting observation and socialization to the head of the hamlet and representatives of residents. The results of observation and socialization show that residents need training and guidance in the use of organic waste, which has been one of the waste problems in Puntingan Hamlet, one of which is the manufacture of briquettes. The use of organic waste by making briquettes is expected to be one of the solutions to waste problems and also a substitute for energy that can be used in daily life. Structurally, the flow of devotion is illustrated in Figure 1.

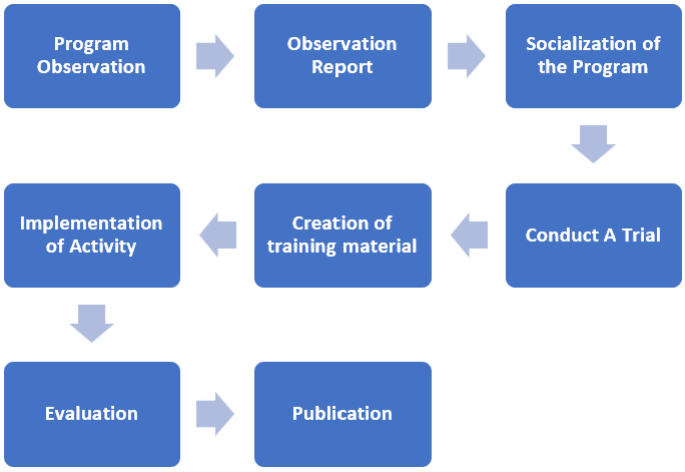

Figure 1. Flow of Service

In detail, the flow of service can be described as follows: 1) program observation. In this initial stage, the service makes observations related to the problems faced by Puntingan Hamlet. 2) Preparation of observation reports, which are used as input and consideration in the implementation of community service programs by utilizing organic waste. 3) Program socialization, socialization is carried out to explain the initiation of community service programs, through interviews and discussions with hamlet heads and residents' representatives. The problem obtained is that the residents are related to waste handling, so that solutions can be provided, especially the use of waste or organic waste into briquettes. 4) Conducting a trial of making briquettes, which is done to get maximum results. 5) The creation of training materials, carried out by searching for related literature. 6) Implementation of Socialization and Training, explanation of various advantages and aspects related to making briquettes from organic waste. 7) Evaluation of activities, and 8) Publication is the last stage.

RESULTS AND DISCUSSION

Community service is carried out with several series of activities. The activities carried out by the devotees are:

Program Observation

To carry out a program that aims to hold the production of briquettes from organic waste in Puntingan Hamlet, the service made observations by visiting the agricultural Land located in Puntingan Hamlet to identify the potential that exists in the area. After conducting interviews with residents, it can be concluded that in Puntingan Hamlet, many residents own agricultural land, and there is an abundance of organic waste such as food scraps, vegetables, dry leaves, wood, and others. This research provides deeper insight into the resources that can be utilized in the production of briquettes and ensures that the collection of organic waste raw materials can be carried out efficiently and sustainably.

Figure 2. Observation with one of the Residents

Preparation of Observation Results Report

After making observations, the service members prepared a report on the results of the observation. This report is used as input and consideration in the implementation of community service programs by utilizing organic waste.

Program Socialization

This stage is a follow-up activity carried out by the service provider to inform the training program that will be carried out. Socialization activities are activities carried out by service providers to start service program activities. The activity was carried out informally between the devotees and the head of the hamlet, and several residents. In this activity, the service members socialized the program to the head of the hamlet and representatives of the residents. The socialization process is carried out by discussion and dialogue methods to gain understanding related to the service program. Still related to this socialization

activity, identification of problems faced by residents is also carried out. The results of the need assessment training were agreed that the service program would be carried out training on the use of organic waste through the manufacture of briquettes. Activities in the form of training and assistance in making briquettes in an effort to utilize organic waste.

Conducting a Trial

After completing the observation stage and also socialization in Puntingan Hamlet, the next step is to conduct a trial stage with residents. In the manufacture of briquettes from organic waste, the following ingredients are used: charcoal powder as the main fuel, tapioca flour as an adhesive, and water to mix all the components. Next, here is a series of processes for making briquettes from organic waste.

a. Collection of Briquette raw materials
   The first step is to search for organic waste materials needed for this process, such as finding wood, collecting leaves, and picking up unused vegetable and fruit waste in Puntingan Hamlet.

Figure 3. Doing the Collection of Raw Materials for Briquettes

b. Burning or Drying Process
   Once all the necessary ingredients have been collected, the next step is to carry out the drying or burning process. The purpose of this stage is to reduce the water content that is still in the waste that is initially wet.

Figure 4. Combustion or Drying Process

c. Crushing or Refining Process

The next step is to carry out the crushing or refining process, in which the rough initial materials will be mechanically processed, so that they are transformed into charcoal powder particles of very small size and a smooth texture.

Figure 5. Crushing or Refining Process

d. Screening Process

To achieve a smooth result, the step taken is to carry out a filtration process with the aim of separating the coarser powder from the finer powder. In this process, the less fine powders are filtered and separated so that only the powders that have a smooth texture will be obtained as a final result.

Figure 6. Screening Process

e. Adhesive Mixing Process

The next step in this process is to mix tapioca flour with charcoal powder. The required composition is 85% charcoal powder and 15% tapioca flour, which serves as an adhesive. Once these two ingredients are mixed, the next step is to pour enough water as a solvent to achieve an even distribution of the mixture. In this stage, water is gradually added until it reaches the desired consistency in the mixture.

Figure 7. The Mixing Process Between Tapioca Flour and Charcoal Powder

Figure 8. After Mixing, Pour Water

f. Printing Process.
After the process of mixing tapioca flour and charcoal powder is complete, the next step is to proceed with the molding process so that the briquettes can be formed according to the needs. At this stage, the well-prepared mixture is placed in a suitable mold to form briquettes of the desired size and shape. This process allows the briquettes to be formed precisely according to the desired specifications.

Figure 9. Results After Printing

g. Drying Process.
To ensure that the resulting briquettes have the appropriate level of humidity for efficient combustion and to prevent damage to the briquettes, another important step is to carry out the drying process. The purpose of this drying process is to reduce the moisture content in the briquettes so that they can burn smoothly and without the risk of structural damage. By removing most of the moisture, the briquettes become denser, lighter, and ready to be used as an environmentally friendly energy source.

Figure 10. Drying Process

h. Ready-to-use Briquettes
After going through a drying process that takes three days, the briquettes will reach a dry level that allows them to be used.

Figure 11. Usable Briquettes

Creation of Training Materials

After undergoing a series of trials and facing various obstacles, the next step is to enter the stage of creating materials. The process of making this material begins by researching the purpose of making briquettes from organic waste that has been processed, followed by a SWOT analysis so that we know how sustainable the briquettes are, as well as an explanation of the manufacturing procedures.

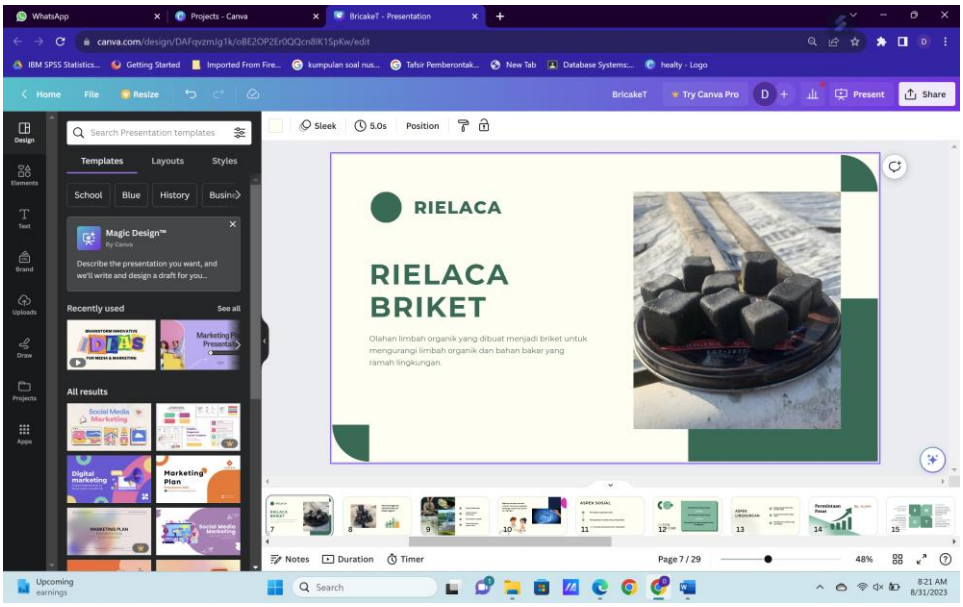

Figure 12. Material Creation

Implementation of socialization and training

After preparing the material, socialization and training on making briquettes from organic waste were carried out in Puntingan Village. During the socialization, various advantages and aspects related to making briquettes from organic waste were explained. After the series of socialization was completed, it was followed by a training session that discussed the steps of making briquettes comprehensively, starting from the initial stage to the end.

Figure 13. Socialization and the making of briquettes from organic waste

Evaluation and Follow-up Plan

Evaluation and follow-up plans are the last activities carried out in this training program. The first is the evaluation of the service trial of the four trials that have been carried out. The service has managed to identify several main problems that arise during the product manufacturing process. Thanks to efforts in identifying and overcoming these problems, it finally managed to achieve results that were in line with expectations in the last trial. This emphasizes the importance of conducting continuous evaluation and improvement of the production process to achieve the level of consistency required to produce high-quality products repeatedly. Continuous improvement efforts and meticulous

monitoring are required to achieve the desired level of quality in each production.

The second is the evaluation of the implementation of socialization and training. in the implementation of socialization and training, residents are seen as enthusiastic to participate in this activity. The results of the participant's evaluation can be concluded that, in general, the training technique is good, as well as in terms of material, it is considered to be by the training needs. After the evaluation, it was then continued with a discussion of the follow-up plan for the training results, where internally, the trainees discussed what kind of follow-up they wanted to follow up on in the future. The results of the discussion were agreed to implement the use of organic waste for the manufacture of briquettes.

CONCLUSIONS AND RECOMMENDATIONS

Puntingan Hamlet, located in Madyogondo Village, Ngablak District, Magelang Regency, Central Java, is one of the areas that also faces challenges related to waste handling, including organic waste. To overcome this problem, a community service program was carried out with socialization activities and training on the use of organic waste by making briquettes. As a result of the training, residents can make briquettes as one of the energy sources from the use of organic waste. This can also reduce the waste problem in the hamlet.

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