

Introduction to Waste Processing Technology to Address Organic Waste Issues in the Baru Beach Tourism Area

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ABSTRACT

The community service activities aimed to enhance knowledge and awareness of organic waste management in the Baru Beach Tourism Area. An innovative approach was taken to achieve this goal by providing lectures on various waste processing technologies, focusing on pyrolysis technology. Participants included the Urban Village-Owned Enterprise (BUMKAL) Mukti Lestari, Poncosari Urban Village, and residents. Pre- and post-event questionnaires were used to evaluate the effectiveness of the activity. The analysis showed a significant increase in participants' understanding, although the peak understanding only reached 53%. Developing better materials, extending the duration, and using more interactive methods are recommended to improve future actions. The conclusion of the community service activity significantly increased public understanding of organic waste management in the Baru Beach Tourism Area.

INTRODUCTION

Community service has become the main focus in responding to severe challenges related to waste management and environmental conservation (Kalra, 2020). One of the efforts in waste management carried out by community groups is creating a waste bank (Wartama & Nandari, 2020). Poncosari Urban Village, Sandakan District, Bantul Regency has an Urban Village-Owned Enterprise or BUMKAL Mukti Lestari, which consists of a group of people in the Poncosari Urban Village actively plays a role in waste management efforts. BUMKAL Mukti Lestari has succeeded in sorting waste based on type, producing recycled products, and creating additional sources of income for its members. Despite its strenuous efforts, BUMKAL Mukti Lestari still faces various obstacles, including a lack of understanding of alternative waste processing technologies, limited waste disposal facilities, and minimal understanding of comprehensive waste management (Sari et al., 2023).

One critical aspect that requires serious attention is managing organic waste in the Baru Beach Tourism Area, which is one of the operational focuses of BUMKAL Mukti Lestari (Figure 1). Efforts to date have not been entirely successful in overcoming the problem of organic waste in the area (Sudjono, 2023). To overcome the problem of organic waste in the Baru Beach Tourism Area, it is important to increase active community participation (Kalra, 2020). One way to achieve this is through community service activities related to waste management. Community service activities in Indonesia are integral to sustainable development, especially in rural community development, waste processing, and sanitation (Mangindaan, 2021).



a) Baru Beach tourist area

b) Piles of rubbish at Baru Beach

Figure 1. Condition of rubbish in the Baru Beach Tourism Area

Therefore, collaborating between BUMKAL Mukti Lestari, Poncosari Urban Village, and Universitas Sarjanawiyata Tamansiswa (UST) is important to overcome this problem. Several UST students, accompanied by lecturers with experience in pyrolysis technology to produce energy from waste, took the initiative to carry out community service activities to manage organic waste in Baru Beach. This community service activity aims to introduce various waste processing technologies. Some technologies for processing waste include pyrolysis (Mandala et al., 2016), gasification (Aridito & Ma'arif, 2019; Ma'arif, 2019; Ma'arif et al., 2016, 2019), biogas and incineration. This emphasis on

understanding technology can provide innovative solutions to the problem of organic waste in the Baru Beach Tourism Area.

The innovation of this activity lies in introducing several waste processing technologies to convert organic waste in Baru Beach into charcoal with added value. Although there have previously been activities related to waste processing in Poncosari Urban Village, this activity provides a more specific approach, namely focusing on introducing various waste processing technologies, especially pyrolysis technology. Therefore, through this community service activity, it is hoped that all parties involved can understand various types of waste processing technology, especially pyrolysis technology, so that it becomes a new insight into managing waste, especially organic waste, in the Baru Beach Tourism Area.

IMPLEMENTATION AND METHODS

The community service method has a clear and structured aim, namely, to improve organic waste management in the Baru Beach Tourism Area. This section describes the steps that have been planned, including activity design and success parameters, activity implementation, and data collection and analysis.

Activity Design and Success Parameters

Community service activities are designed as interactive lectures that aim to introduce innovative and effective waste-processing technologies to participants. The activity participants included all BUMKal Mukti Lestari administrators, several officials of Poncosari Urban Village, and the community around Baru Beach, which have a significant role in waste management. The activity design provides comprehensive and interactive information, allowing participants to discuss and ask questions about the topics. The parameters for the success of this activity include two main aspects: the level of participant attendance and increasing participant understanding regarding the material presented. The level of participant attendance is an important indicator to assess the extent to which this activity can reach and involve related parties. A total of 20 participants were invited to attend this activity, including the management of BUMKal Mukti Lestari, several officials of Poncosari Urban Village, and several representatives of the community around Baru Beach. High levels of attendance reflect active interest and involvement from stakeholders.

Meanwhile, increasing participants' understanding of the material presented is a benchmark for the success of this activity. A questionnaire was distributed before and after the event to measure participants' understanding. This questionnaire evaluates participants' initial understanding before the lecture and identifies changes or improvements in understanding after the interactive lecture. The questions in the questionnaire cover various aspects, such as types of waste, waste processing technology, especially pyrolysis technology, and its practical application and potential in managing organic waste in the Baru Beach Tourism Area.

The questionnaire was created using a Likert scale of 1 to 5, in the order of not knowing, a little knowing, quite knowing, knowing, and very knowing. However, in discussing the questionnaire data, the level of participants' understanding regarding each question was divided into two, namely understanding and not understanding. Questionnaires were circulated by students with questions including:

1. Knowledge about types of waste (Q1)
2. Knowledge about types of everyday organic waste (Q2)
3. Knowledge of technology for processing waste (Q3)
4. Knowledge of pyrolysis technology (Q4)
5. Knowledge of procedures for using pyrolysis equipment (Q5)
6. Knowledge about types of waste that can be processed by pyrolysis (Q6)
7. Knowledge about pyrolysis products (Q7)

By paying attention to these two success parameters, the activity can significantly increase participants' understanding and awareness regarding waste processing technology, especially pyrolysis technology. Apart from that, this activity can also encourage the active participation of participants in sustainable waste management efforts (Ma'arif, Sari, et al., 2023; Ma'arif, Yunitasari, et al., 2023).

Implementation of Activities

This activity was held at one of the representative food stalls in the Baru Beach Tourism Area on Friday, 25 August 2023. The Head of Poncosari Urban Village officially opened the event to show strong support for this activity. Meanwhile, the activity presenter is an academic with expertise in waste management and practical experience in applying waste processing technologies. The speaker gave a lecture introducing several technologies, such as pyrolysis, gasification, and biogas, to give participants a more comprehensive insight into the various options available for processing organic waste. Atmosphere activity's devotion to the public can be seen in Figure 2.



a) Attended by several officials of Poncosari Urban Village

b) Delivery of material by the resource person

Figure 2. The atmosphere of implementing community service activities

The lecture method was chosen because it focuses on providing an in-depth understanding of technologies that can be used to solve organic waste management problems (Loughlin & Lindberg-Sand, 2023). In addition, this method provides opportunities for participants to gain practical knowledge and skills that can be applied directly in everyday life (Zakirman et al., 2019). The lecture method also includes case study examples of using pyrolysis technology in organic waste management. With this approach, participants can understand more profound theory and knowledge of practical skills to apply these technologies effectively and efficiently.

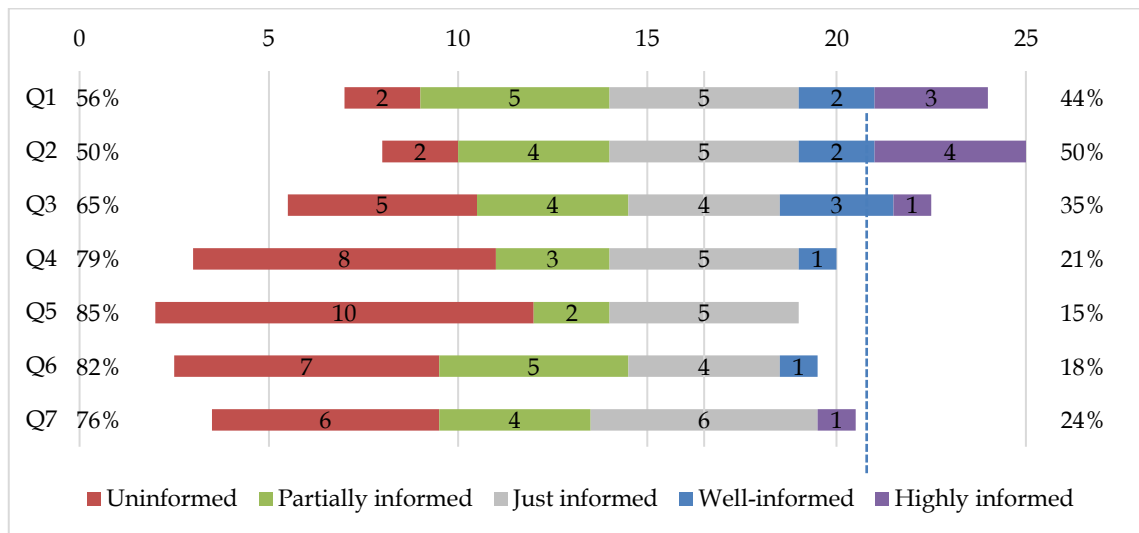
In community service activities using the lecture method, participants are introduced to waste processing technologies, including pyrolysis, gasification, and biogas. Next, the material focuses on pyrolysis technology, which can convert organic waste into charcoal. 20 UST students prepared this activity. Students are accompanied by 2 lecturers from UST and 1 lecturer from UP45. Meanwhile, 20 participants attended, including BUMKal Mukti Lestari administrators and several village officials. Poncosari Urban Village and several community representatives around Baru Beach, the service team, and participants took a photo to conclude the activity, as seen in Figure 3.



Figure 3. Group photo after the activity between participants and the community service team

RESULTS AND DISCUSSION

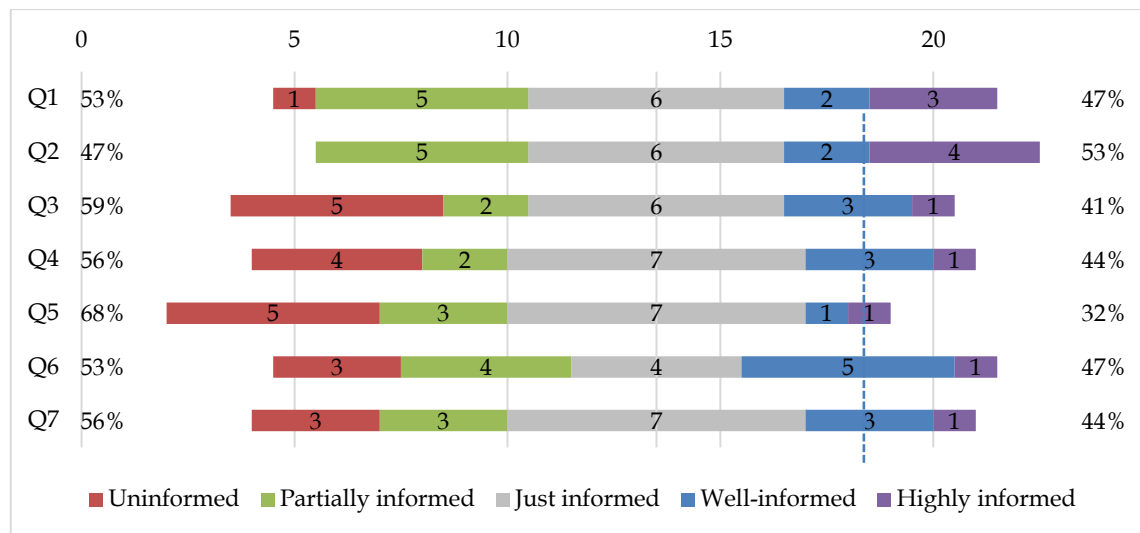
This section will present the results obtained from implementing community service activities related to waste management in the Baru Beach Tourism Area. These results were processed based on data obtained from questionnaires distributed to participants before and after the interactive lecture event. This data collection and analysis is used to evaluate the impact of activities on participants' knowledge regarding waste processing technology, especially pyrolysis technology, and to measure the effectiveness level in conveying information to participants. The data processing results from the questionnaire distributed before the activity can be seen in Figure 4.



Picture 4. Knowledge before activity

Based on the graph in Figure 4, the level of knowledge of 17 participants before the training activity on introducing waste processing technology in the Baru Beach Tourism Area questionnaire data analysis results show distribution patterns of participants' knowledge on seven aspects related to waste management and pyrolysis technology. In Q1, 56 % of participants stated that they did not understand the types of waste, while 44% stated that they understood. This shows the participants' limited knowledge regarding the classification of waste types. Meanwhile, in Q2, an equal comparison occurred in knowledge about types of everyday organic waste, with 50% of participants understanding and 50% not understanding, so it needs to be improved. On questions related to technology, the majority of participants, 65 %, expressed a lack of understanding regarding waste processing technology in general (Q3). A higher level of lack of understanding was seen in knowledge about pyrolysis technology (Q4); namely, 79% of participants did not understand. The same thing happened in understanding the procedures for using pyrolysis equipment (Q5), 85% did not understand, 82% did not understand the types of waste that can be processed using pyrolysis (Q6), and 76% did not understand the products resulting from pyrolysis (Q7). This illustrates that participants had limited knowledge of waste processing technology, especially pyrolysis, before this community service activity. Therefore, this community service activity needs to

highlight the previous understanding of the community, especially communities in coastal areas (Herdiansyah et al., 2021), so that this activity can increase participants' understanding and help in dealing with the problem of organic waste in the Baru Beach Tourism Area with the various technological alternatives that have been presented. Furthermore, after a lecture on introducing waste processing technology, questionnaires were distributed again to see the increase in participants' understanding. The data processing results from the questionnaire distributed after the activity can be seen in Figure 5.



Picture 5. Knowledge after activity

The graph in Figure 5 shows a picture of the change in knowledge of 17 participants after taking part in a lecture activity introducing waste processing technology in the Baru Beach Tourism Area. This data reflects the participants' increased understanding regarding types of waste and pyrolysis technology after the activity. Overall, there was a positive increase in several aspects of knowledge measured. It can be seen that 47% of participants stated that they understood the types of waste (Q1), an increase from the previous 44%. Another positive increase was seen in understanding the types of daily organic waste (Q2), which was 53% from the previous 50%. In addition, the understanding of waste processing technology in general (Q3) increased to 41% from the previous 35%.

Regarding the understanding of pyrolysis technology (Q4), participants who stated they understood increased from 21% to 44%. This shows that the effectiveness of lectures that focus on specific themes has a significant influence (Barnhardt et al., 2021); in this case, the focus on pyrolysis technology compared to other technologies. The most significant improvement occurred in the procedures for using the pyrolysis tool (Q5), where participants' understanding increased from 15% to 32%. This shows that problem-based lectures are more effective than traditional lectures (Alaagib et al., 2019; Zheng et al., 2023), so these lectures can provide theoretical knowledge and practical understanding regarding the implementation of pyrolysis technology. There is also an increase in knowledge about the types of waste that can be processed by pyrolysis (Q6) by 47% from the previous 18%. Participants' understanding regarding pyrolysis

products (Q7) also experienced a significant increase, namely from 24% to 44%. These results illustrate that lecture activities do not just convey information but also succeed in increasing participants' overall understanding. In line with this, physical presence in lecture activities is also more effective than doing it online (Raes, 2022), so this method of community service activities is in line with this. With this increase, it is hoped that participants will be more able to contribute actively to supporting organic waste management efforts in the Baru Beach Tourism Area to achieve the overall goal of this community service activity.

Overall, the results of questionnaires before and after the activity illustrate the significant development of participants' knowledge regarding waste management and the use of pyrolysis technology to process organic waste in the Baru Beach Tourism Area. Before the activity, most participants had limited knowledge, with a significant lack of understanding in aspects such as waste types, waste processing technology, and, in particular, pyrolysis technology. However, after attending a lecture on introducing waste processing technology, a positive increase was seen in all aspects of the knowledge measured. There is a significant increase in understanding of the procedures for using pyrolysis equipment, the types of waste that can be processed using pyrolysis, and the products resulting from pyrolysis, reaching 32%, 47%, and 44%, respectively. This indicates that this activity not only provides theoretical understanding but also succeeds in providing practical and contextual knowledge regarding the application of pyrolysis technology.

Although there was a significant increase in participants' understanding after the activity, overall, it was still below 53%. This can be caused by several factors, including a low initial knowledge base, complexity of the material, limited time for lectures and discussions, differences in individual understanding, expansion of material topics, and methods of evaluating understanding. These factors create challenges in achieving higher levels of understanding, requiring adjustments to learning and evaluation strategies to achieve a deeper understanding of certain aspects (De Weger et al., 2018). Additional steps can be taken to increase the overall level of participant understanding by identifying areas that still require special attention.

CONCLUSIONS AND RECOMMENDATIONS

This community service activity achieved its goal of increasing participants' understanding regarding waste management and several waste processing technologies, especially pyrolysis technology, to overcome the problem of organic waste in the Baru Beach Tourism Area. Analysis of questionnaire data before and after the activity showed a significant increase in various aspects of knowledge. However, overall, the participants' level of understanding was still below 53%. This is caused by several factors, including a low initial knowledge base, the complexity of the material, and time constraints, which may be the main obstacles. However, the success of increasing understanding shows the positive potential of this activity in supporting waste management efforts in the region.

Several suggestions can be proposed to increase the effectiveness of community service activities. First, it is necessary to develop the material to suit the participants' initial level of understanding. This will ensure that the content is more structured and easy to understand. Additionally, it is important to consider using additional learning methods, such as practical demonstration tools. In the duration of the activity, extending the time needs to be considered so that participants have more time to interact, ask questions, and better assimilate knowledge. In order to achieve better results, it is recommended to encourage the active participation of participants through question-and-answer sessions that can deepen their understanding. These suggestions can be used to implement further community service activities to significantly increase participants' understanding of organic waste management in the Baru Beach Tourism Area.

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