



Original Article

Eco-Enzyme Production from Household Organic Waste for Natural Cleaning Solutions

Wiranda Intan Suri^{1✉}, Beata Ratnawati², Andini Tribuana Tunggadewi³, Luvy Dellarosa⁴, Miesriany Hidiya⁵, Dimas Ardi Prasetya⁶, Yudith Vega Paramitadevi⁷, Emil Wahdi⁸, Septian Fauzi Dwi Saputra⁹, Nurul Jannah¹⁰, Sylvi Aprilia Kartini¹¹, Nando Afigi¹²

^{1,2,3,4,5,6,7,8,9,10,11,12}Vocational School, IPB University, Bogor, Indonesia

Correspondence Author: wirandaintan@apps.ipb.ac.id[✉]

Abstract:

Household activities generate large amounts of organic waste. Improper waste management can negatively impact the environment. Several areas, including Mulyaharja in Bogor, still face difficulties in managing organic waste. This is because the practice of sorting and processing organic waste has not yet been widely introduced and implemented. An alternative solution to reduce the negative impact of poor organic waste management on the environment is to process it into eco-enzymes. In addition to reducing the amount of waste disposed of in landfills, eco-enzymes can also function as a natural cleaning solution for daily household use. To introduce this processing method, a sustainable waste processing program was carried out in Mulyaharja through two activities. The first activity was the socialization of the definition and processing of organic waste, as well as the types of organic waste that can be used to produce eco-enzymes. The second activity was hands-on training in processing organic waste into eco-enzymes, so that the community could fully understand the tools, materials, and stages of its production. The main ingredients in making eco-enzymes are fruit and vegetable peel waste, molasses, and water. After the eco-enzyme solution was ready, this solution could be used to clean toilets, bathrooms, floors, and kitchen surfaces. The results of the program showed an increase in community knowledge and skills in processing organic waste, as well as increased adoption of environmentally friendly cleaning products as alternatives to chemical cleaners.

Keywords: eco-enzyme, household, natural cleaning solution, organic waste



<https://jurnal.usk.ac.id/riwayat>

Introduction

The world's population is predicted to continue increasing, and by 2030, it is estimated to reach 8.5 billion people. In 2022, Indonesia was the fourth most populous

country in the world, with a population of 275 million people ([UN Department of Economic and Social Affairs 2022](#)). Environmental problems often occur along with population growth ([Wagianto, W., et al., 2022](#)). One of the environmental problems related to population growth is waste generation ([Nurrobi et al., 2022](#); [Utami et al., 2024](#)). Population growth and waste generation have a positive correlation ([Supangkat and Herdiansyah, 2020](#); [Toure, Maiga, and Ouattara, 2022](#); [Mapunda, Joseph, and Kasuwi, 2023](#)). This condition creates a major challenge for both waste management systems and environmental sustainability.

Indonesia generates a high quantity of municipal waste, and organic waste contributes half of the total ([Jain et al., 2017](#)). According to [Marodiyah et al. \(2023\)](#), poor organic waste management can cause environmental problems, including a degradation in the quality of soil, water, and air. [Benny et al. \(2023\)](#) also found that there are health risks to living things originating from organic waste if disposed of in landfills. Many communities still face difficulties in having the awareness, skills, and resources needed to manage organic waste properly ([Sholihah et al., 2025](#)).

Problems in organic waste management still occur in various areas in Indonesia, and this is also the case in Mulyaharja, Bogor, which still faces difficulties in managing organic waste due to the limited implementation of waste sorting and processing by the community. The lack of knowledge in organic waste processing can be seen in the majority of people simply throwing away fruit and vegetable peels, even though this waste can be used to produce eco-enzymes. Eco-enzymes can be used as a natural cleaning solution. Community involvement in waste management, especially organic waste, is very important because increasing the management of organic waste in each household will help reduce the amount of waste disposed of in landfills.

Eco-enzymes can be made by fermenting fruit and vegetable peels mixed with molasses and water, which are then stored in sealed plastic containers ([Ningsih et al., 2023](#)). Eco-enzymes are natural, biodegradable, and non-toxic solutions that can be used as an eco-friendly cleaning product. The production of eco-enzymes derived from the processing of household organic waste produced by the community is expected to be one of the factors that makes people aware of the benefits of waste processing which has an impact on them both from an economic perspective, because it can be used as a substitute for cleaning solutions and from an environmental perspective, because it can reduce the amount of waste produced.

The introduction of eco-enzyme production from organic waste, particularly for household waste, was conducted through socialization and hands-on training. These activities were intended to raise public awareness of the importance of processing the organic waste they produce by providing skills in a simple and inexpensive way, such as eco-enzyme production. By processing organic waste into eco-enzymes by the community, it is hoped that this will reduce the amount of waste directly disposed of, thus reducing the accumulation of waste in landfills.

Methods

The program of eco-enzyme production by using organic waste was introduced to the residents of Mulyaharja, Bogor, which consists of several activities: identification, socialization, and hands-on training. The identification was conducted in order to assess the management of organic waste and estimate the amount of it. Data was obtained through field observations and surveys with local residents and stakeholders. The main objective was to map existing problems and determine the most appropriate approach

for program implementation. By analyzing the survey findings, this process can assess community awareness and readiness for organic waste management, and can help in preparing a framework for socialization activities and hands-on training.

Socialization was conducted through presentations and interactive discussions with the community about organic waste management. The main objective was to increase understanding of the definition of organic waste, the negative impacts on the environment if it is simply disposed of without processing, and its potential if processed into useful products. The socialization also reinforced awareness raising about the importance of organic waste processing, starting at home. At this stage, making eco-enzymes as one of the organic waste processing methods was also introduced. The community was introduced to the types of organic waste that can be processed into eco-enzymes, and asked to start separating organic waste at home and bringing it to the hands-on training.

Hands-on training as the core activity involved all participants in making eco-enzymes from household organic waste (fruit and vegetable peels) mixed with molasses and water in a ratio of 3:1:10, and then the mixture was fermented in a closed plastic container for ±90 days. Besides making eco-enzymes, participants also learned how to use eco-enzymes as a natural cleaning solution, so the participants can apply environmentally friendly practices in their daily lives.

Results

Sub 1 Identification

To gather information on the community's initial conditions and knowledge of organic waste management, an initial assessment was conducted through field observations and surveys with residents and local stakeholders. The main objective of the initial identification was to assess the community's awareness and readiness for organic waste management. From the results of this activity, community behavior related to waste management and the availability of organic waste generated from daily household activities can be identified. These findings provide an overview of how household waste is currently managed and can also provide baseline data for analyzing existing challenges and opportunities.

Based on field observations of organic waste management conditions, it can be concluded that most households in Mulyaharja generated organic waste, which was mainly disposed of at temporary collection site, without any processing, mixed with other waste, and sent to landfills, potentially increasing waste volume and negatively impacting the environment, as illustrated in Figure 1. The results of field observations also provide information that the community really needs assistance related to organic waste management, because many residents still do not manage their organic waste properly.



Figure 1. Temporary Collection Site

After the field observations, a survey was carried out to find out whether residents were actually managing their organic waste or not. The results showed that 90% of residents stated that they had not processed their organic waste, as presented in Figure 2. Field conditions aligned with these results, as we can see in Figure 1, show how organic waste ended up at temporary collection site.

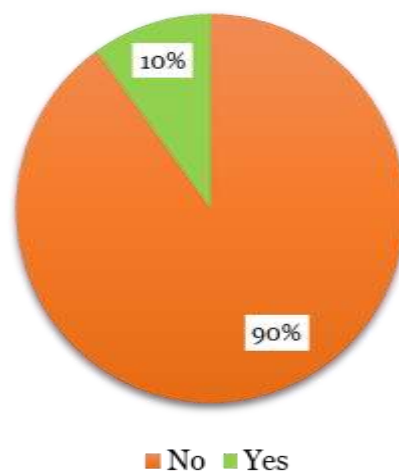


Figure 2. Proportion of Residents Processing Organic Waste

In Figure 3, we can see that 75% of the total respondents did not have any knowledge about the negative impacts of untreated waste disposal, thus, it is common for a lot of organic waste to be thrown away by the residents directly into the temporary collection site. According to a study conducted by [Sholihah et al. \(2025\)](#), the residents struggled to manage organic waste because they did not know the proper methods or did not possess the capacity to implement organic waste management. Based on the data obtained and the study above, we can conclude that people cannot manage waste effectively if they do not understand the importance of managing waste.

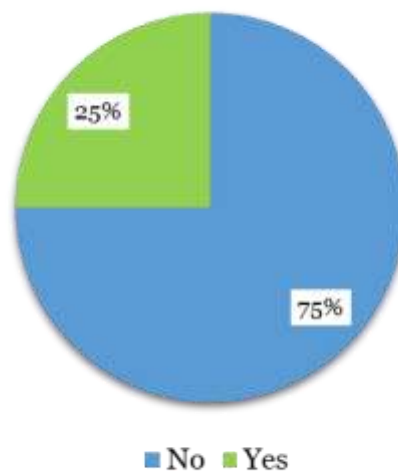


Figure 3. Proportion of Residents' Awareness of the Negative Impacts of Improper Organic Waste Management

The results of the survey, besides giving information about the ineffectiveness of the waste management system in the community, also showed that there were enough potential raw materials for converting organic waste into eco-enzymes. If we see from the perspective of the economy, this process can impact economic growth positively because the residents can convert waste into valuable materials. According to [Azwardi et al. \(2022\)](#), recycling municipal waste has a linear correlation with economic growth.

From the initial survey's result, the activities of socialization and hands-on training were designed in order to make the resident aware of waste management, especially for organic waste management. The step of socialization was conducted to educate the residents that managing the organic waste is important by introducing the concept, benefits, and environmental significance of eco-enzymes. The hands-on training step was conducted to train the residents on how to make eco-enzymes practical. According to [Sunarti et al. \(2023\)](#), combining dialogue-based learning with practical activities significantly improves waste management behavior.

Sub 2 Socialization of Waste Management

The socialization was conducted through presentations and interactive discussions. In general, the presentation was divided into three parts. The first part introduced the types of household waste commonly generated, the second explained the benefits of proper waste management, and the final part introduced the concept of eco-enzymes. Meanwhile, the interactive discussions allowed residents to ask questions and helped the facilitators understand their responses to the eco-enzyme program.



Figure 4. Socialization of Waste Management

During the initial part of the program, the residents were introduced to the classification of waste commonly generated in their homes, and were divided the waste into organic and inorganic waste. The organic and inorganic classification makes the resident easier to distinguish between materials that decompose naturally, which are organic waste, and those that do not, which are inorganic waste. Fruit and vegetable peels were classified as organic waste, while plastic packaging, glass bottles, and metal cans were classified as inorganic waste.

After the first activity, the program continued to the presentation about the benefits of good waste management to the residents. In this part, the residents were informed that organic waste can be used to produce products such as compost or eco-enzymes. By applying these practices at home, the residents not only reduce household waste but also help to minimize landfill waste accumulation. Through this understanding, the residents were encouraged to manage their household waste effectively.

Moreover, in the final part, residents were introduced to the idea of eco-enzymes as a practical and straightforward way to turn household organic waste into something useful. Eco-enzymes were explained as natural solutions made by fermenting fruit and vegetable peels. These solutions can be used as natural cleaners. During this session, participants were also informed that during the upcoming hands-on training, they would be asked to bring fruit and vegetable peels from their homes to practice making eco-enzymes.

Sub 3 Hands-on training of Eco-Enzyme Production

The main objective of hands-on training was to teach the community how to produce eco-enzymes from household organic waste. This activity served as the core of the program, allowing participants to apply what they had learned during the socialization. As previously informed during the socialization, residents brought fruit and vegetable peels from their homes to use in the hands-on training, where they practiced making eco-enzymes directly.

Each participant used the organic materials they had brought, such as fruit and vegetable peels, which were mixed with molasses and water in a 3:1:10 ratio, placed in the containers, and set to ferment for about 90 days. The residents were

informed of the importance of maintaining proper ratios while the process is running, keeping containers tightly closed, releasing gas by opening the containers only a few times during the first month, and avoiding direct sunlight to ensure a successful fermentation. And at this moment, participants learned that organic waste could be transformed into a helpful and environmentally friendly product.



Figure 5. Hands-on training of Eco-Enzyme Production

During the hands-on training, the residents were guided through the steps of making eco-enzymes. The process started with the preparation process and ended with storing the containers that contained the mixture product in a safe place. The residents were free to ask questions about the eco-enzyme production process and to discuss the challenges that may arise when they do it at home. This method can help the residents build their confidence to do the eco-enzyme production process at home.

At the end, the residents were introduced to what eco-enzymes are used for in daily life, such as a cleaner for floors, bathrooms, and kitchen surfaces. The facilitator also reminded the residents that by applying the conversion of organic waste into eco-enzymes, they will obtain benefits by reducing the amount of household waste they generate.

Suggestion

Processing the organic waste into eco-enzymes can be implemented in many locations, and doing this activity will reduce waste generation. Implementing eco-enzymes as a cleaner for floors, bathrooms, and kitchen surfaces can help to minimize the use of chemical cleaners.

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