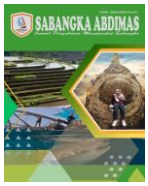

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PRODUCTION OF ECO-ENZYME AS A WASTE AWARENESS INITIATIVE AT MCC LEARNING HOUSE IN RUTONG

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Abstract: *A simple and environmentally friendly solution to waste management is the use of eco-enzyme, which offers numerous benefits. Knowledge about eco-enzyme is important to be disseminated to the community, particularly among school-aged children. This community service activity was conducted with the aim of training children at the MCC Learning House to process fruit peel waste into eco-enzyme. The activity took place at the MCC Learning House in Rutong and was attended by 20 participants. The methods employed included lectures and hands-on training on the production of eco-enzyme from pineapple and banana peel waste. The team, together with the participants, practiced the eco-enzyme production process, beginning with an explanation of the functions and uses of the prepared tools and materials. This was followed by weighing brown sugar and fruit peels according to the specified ratio, after which water was added and the mixture was placed into plastic containers and labeled. Following the training, all participants gained an understanding of eco-enzyme. As a closing activity, the community service team and participants took a group photograph.*

Abstrak: Solusi permasalahan sampah yang mudah dilakukan serta ramah lingkungan yaitu eco enzyme yang memiliki sejuta manfaat. Pengetahuan tentang eco enzyme penting dibagikan kepada masyarakat khususnya anak-anak usia sekolah. Kegiatan pengabdian kepada masyarakat ini dilakukan dengan tujuan melatih anak-anak rumah belajar MCC mengolah sampah kulit buah menjadi eco enzyme. Kegiatan ini dilakukan di rumah belajar MCC, Rutong dan diikuti oleh 20 orang. Metode yang digunakan yaitu ceramah dan pelatihan tentang pembuatan eco enzyme dari sampah kulit buah nenas dan pisang. Tim bersama-sama dengan peserta mempraktekan cara pembuatan eco enzyme, diawali dengan menjelaskan fungsi dan kegunaan alat bahan yang telah dipersiapkan. Selanjutnya dilakukan penimbangan gula merah dan kulit buah sesuai dengan perbandingan yang ditentukan, kemudian ditambahkan air dan dimasukan dalam wadah plastik. serta diberi label. Setelah pelatihan dilakukan, seluruh peserta telah mengetahui tentang eco enzyme. Sebagai penutup, tim PKM dan peserta melakukan foto bersama.

INTRODUCTION

Every human generates waste through daily activities (Gatta et al., 2022). As population size increases, along with the range and intensity of human activities, the volume of waste produced also rises (Alves et al., 2025). However, individuals often perceive waste as harmless when it is simply discarded into the surrounding environment. This perception reflects a lack of concern for environmental sustainability, despite the fact that waste-related issues can lead to serious disasters for human populations (Bangun et al., 2024). The landfill landslide tragedy at the Leuwigajah Final Disposal Site on 21 February 2005, which claimed hundreds of lives, provides clear evidence that improperly managed waste can result in catastrophic outcomes. This disaster is commemorated as National Waste Awareness Day. Furthermore, it underscores that Indonesia is facing a waste emergency that requires not only government intervention but also the active participation of all sectors of society (Mukhlis, 2024).

Numerous efforts have been undertaken by the Indonesian government to address waste-related problems, including initiatives by the Ambon City government. These measures include the implementation of regulatory frameworks as well as environmental clean-up actions carried out at both governmental and community levels (N. C. Tuhumury et al., 2023). Despite various limitations, the Ambon City government has conducted clean-up and improvement efforts in several strategic locations, such as the revitalization of the Mardika market complex into a more modern and hygienic facility; the installation of trash booms in several rivers flowing into Ambon Bay to prevent waste from entering coastal and marine environments; the expansion of waste collection fleets operating both on land and in marine areas, particularly within Ambon Bay; and other ongoing initiatives that continue to the present day.

Scattered waste has become a common daily sight. In general, the waste generated consists of both organic and inorganic materials (Zuraidah et al., 2022). Both types of waste have significant impacts on human life and the environment. Inorganic waste, particularly plastic debris, has been shown to contribute to flooding due to the blockage of drainage systems by plastic bottles and other non-biodegradable materials (Wirawan & Nandari, 2020). In addition, microplastic pollution has been demonstrated to pose serious risks not only to aquatic organisms but also to humans through trophic transfer within the food chain (N. Tuhumury & Ritonga, 2020). There is a common assumption that organic waste does not require management due to its biodegradable nature, unlike plastic waste, which may take decades to centuries to decompose. However, this

assumption is misleading, as organic waste can also pose hazards at both local and global scales. Locally, the decomposition of organic waste produces unpleasant odors and can contribute to the spread of disease. Globally, the breakdown of organic waste releases methane, a potent greenhouse gas that contributes to global warming (Hatuwe et al., 2020).

Poorly managed waste is projected to accumulate to levels that may surpass marine fish resources. Currently, waste management concepts should no longer rely heavily on landfills, as waste should be managed at the household level. Waste processing should not create new environmental problems; for example, burning plastic waste for brick production generates air pollution due to the release of toxic gases into the atmosphere. One environmentally friendly waste management method is eco-enzyme (N. C. Tuhumury et al., 2025). Eco-enzyme is a liquid produced through the fermentation of organic waste, such as fruit and vegetable peels, for approximately three months, mixed with brown sugar and water. Eco-enzyme represents a simple waste-processing technology because it can be carried out by anyone, and it is environmentally friendly as it converts waste into a multipurpose liquid that can be reused for daily needs.

Knowledge of converting waste into eco-enzyme needs to be disseminated to the community, not only to women—who are often considered the primary producers of household waste—but also to early childhood and school-age groups. Both formal and informal education on waste management aims to educate and train school-age children to take responsibility for maintaining a clean and healthy environment. Children who are taught and trained to manage waste will develop positive character traits, fostering a generation accustomed to living cleanly. The purpose of this community service activity is to train children at the MCC (Moluccas Coastal Care) learning center in producing eco-enzyme from fruit peel waste. It is expected that through this training, children will transfer this knowledge to their families and surrounding communities. In this way, children can become agents of environmental change through the processing of organic waste into eco-enzyme.

METHOD

The community service activity was conducted on March 17, 2026, at MCC Learning House in Rutong Village, Ambon City. The activity was carried out using lecture and training methods through the following stages:

1. *Preparation Stage*
   - The team prepared instructional materials containing the tools, materials, and procedures for producing eco-enzyme. The fruit peels used in this activity were pineapple and banana peels.
   - The team issued an official assignment letter online through the Institute for Research and Community Service of Pattimura University as proof of the team's performance in fulfilling one of the Tri Dharma of Higher Education.
2. *Implementation Stage*
   - Materials on eco-enzyme production were provided to participants to be read and understood.
   - Participants were divided into groups to facilitate the children in carrying out and understanding the steps of eco-enzyme soap production.
   - Prior to delivering the material on eco-enzyme soap, the service team assessed the children's prior knowledge of eco-enzyme to measure their baseline understanding of the topic.
   - After the material presentation, the activity continued with hands-on practice in producing eco-enzyme according to the outlined procedures. The children read aloud the steps, while the service team assisted them during the process.
   - Upon completion of the eco-enzyme production, the team conducted a question-and-answer session related to the activity. Children who answered correctly were given rewards.
   - As a closing activity, the service team and the children of the Learning House took a group photograph.

RESULTS AND DISCUSSION

The community service activity was attended by 20 children from MCC Learning House, ranging from grades 3 to 5 of elementary school. The participants were children residing in Rutong Village. Prior to the activity, the team prepared the tools and materials for eco-enzyme production (Figure 1). The activity began with guidance from one of the MCC staff members to the participants regarding the production of eco-enzyme, with the expectation that all participants would pay close attention.

Figure 1. Preparation of tools and materials for eco-enzyme production

Prior to delivering the material on eco-enzyme production, the service team provided a brief introduction on the importance of maintaining environmental sustainability and cleanliness. The team also explained the impacts and hazards of waste on the environment if it is not properly managed. Several examples were presented to the participants, such as flooding caused by the accumulation of plastic waste and unpleasant odors from organic waste that may negatively affect human health. Before proceeding with the main material, the team assessed the participants' prior knowledge of eco-enzyme. All participants indicated that they were not familiar with eco-enzyme. The team then explained that eco-enzyme is a fermented liquid produced from a mixture of brown sugar, fruit peels, and water in a ratio of 1:3:10, obtained after a fermentation period of approximately three months. The team further explained that, in addition to fruit peels, certain vegetables can also be used to produce eco-enzyme. The fruit peels used must be fresh and not rotten, as this will affect the quality of the resulting eco-enzyme. Examples of suitable fruit peels include pineapple, mango, banana, apple, and others. Additionally, the team emphasized that hard fruit peels, such as coconut and durian, are not suitable for eco-enzyme production due to their long decomposition time. Subsequently, the participants were asked to read the provided materials to ensure their understanding of the steps involved in eco-enzyme production.

The participants practiced the process of eco-enzyme production under the guidance of the community service team. First, one participant was asked to read aloud the materials and equipment required for eco-enzyme production. The team then explained the functions of each material and tool, such as the use of brown sugar to support the fermentation process due to its higher mineral content compared to white sugar. A knife was used to cut the fruit peels into smaller pieces to facilitate their

placement into the plastic container. Second, one participant read the step-by-step procedure for eco-enzyme production. The first group conducted the practical activity, while the other groups followed simultaneously. The participants carried out each step with assistance from the community service team. The procedures included weighing the fruit peels and brown sugar using a digital scale, adjusted to the capacity of the plastic container. The measured quantities consisted of 200 g of brown sugar, 600 g of fruit peels, and 2 liters of water. All prepared materials were then placed into a plastic container and thoroughly mixed (Figure 2). The container was tightly sealed to prevent contamination from external microorganisms. Subsequently, using paper and a marker, the production date and the expected harvest date of the eco-enzyme were labeled on the plastic container (Figure 3).

Figure 2. Eco-enzyme production by the children of MCC Learning House

After the eco-enzyme production process, the community service team presented eco-enzyme that had already been harvested and was ready for use. The team explained that high-quality eco-enzyme is characterized by a fresh acidic aroma. The color of the eco-enzyme depends on the type of fruit peels used. For instance, eco-enzyme produced from banana peels is generally light brown in color, whereas a mixture of pineapple, mango, and lemon peels typically results in a darker brown color. The team also demonstrated a dark-colored (blackish) eco-enzyme produced from a mixture of pineapple and beet peels. The participants commented that the aroma of the eco-enzyme resembled that of fermented grape products. This response indicates that the participants had an understanding of the fermentation process.

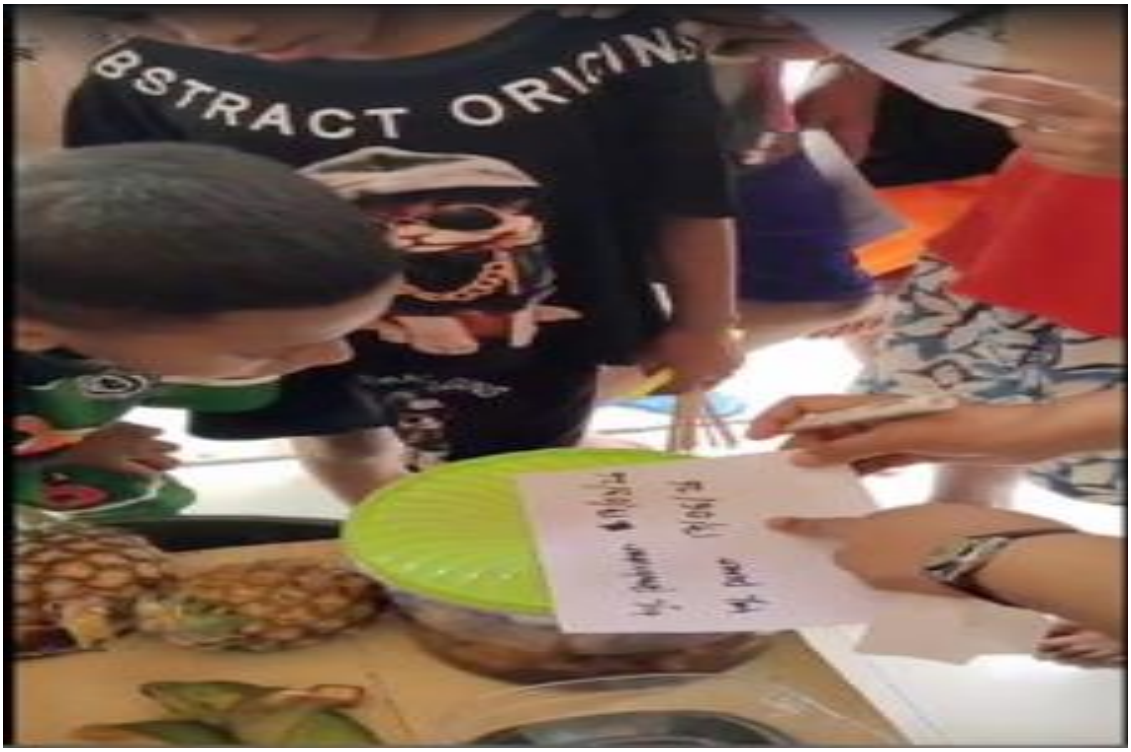

Figure 3. Labeling of the production and harvest dates of the eco-enzyme

After the eco-enzyme production activity, the community service team reassessed the participants' understanding by asking them to define eco-enzyme. All participants enthusiastically responded that eco-enzyme is a liquid derived from fruit peels. This response indicates that the participants had developed an understanding of eco-enzyme, whereas previously none of them were familiar with the concept. Furthermore, the team posed additional questions to the participants, including: what process occurs during eco-enzyme production; which types of fruit peels can be used; and what the resulting aroma of eco-enzyme is like. The participants responded correctly, stating that the process is fermentation; that fruit peels such as pineapple, mango, banana, and citrus can be used; and that the aroma is a fresh acidic scent resembling fermented grapes. These responses demonstrate that the children of MCC Learning House had understood both the material and the practical training on eco-enzyme production. The community service team and participants then took a group photograph with the eco-enzyme that had been produced (Figure 4). It is expected that this activity will motivate young children at MCC Learning House to develop environmental awareness and become agents of change within their families and the surrounding community.

Figure 4. Group photo of the community service team and the children of MCC Learning House

CONCLUSION

Overall, the community service activity on the utilization of fruit peel waste into eco-enzyme for children at MCC Learning House in Rutong was successfully implemented. This success can be assessed based on the participants' level of understanding of both the material and the practical training on eco-enzyme production. Based on the implementation of this activity, it is recommended that similar programs be conducted for groups of mothers and adolescent girls, as well as activities focusing on the conversion of organic waste into plant fertilizers.

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