Community Education and Service Journal
https://scholar.ummetro.ac.id/index.php/cesj/index
Vol. 1, No. 1 (2025), 1-5
e-ISSN 3090-5796 p-ISSN 3090-5613

TRAINING ON MAKING ECO ENZYME AS AN ALTERNATIVE TO ORGANIC WASTE MANAGEMENT

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Article Info

Article history:

Received April 28, 2025
Revised May 15, 2025
Accepted May 18, 2025

Keywords:

eco enzyme;
organic waste;
training

ABSTRACT

Community service is one of the important contributions from academics and other parties to help solve problems in society. One example of community service activities that is quite interesting is the Eco Enzyme Manufacturing Training project as an Alternative to Organic Waste Management." This project aims to help develop the creativity of the community in the margoreo village RT 06 RW 02. Not only aims to develop creativity but with this training it can also empower the community in and utilize household waste in the form of organic waste such as vegetable scraps or fruit peels which can be managed into organic materials that have many benefits as plant fertilizers, soap, and others. The solution applied by the Community Service (PKM) students of margorejo village is to hold a training on making Eco Enzyme as an alternative to organic waste management with tools and materials that we can easily find around us. The implementation method includes lectures, simulations, and hands-on practice, focusing on the use of simple materials such as sugar, water, and leather. The results of the training showed that participants understood how to make Ecoenzymes and their benefits as natural cleaners and organic fertilizers. In , the training raised awareness of the importance of environmentally friendly waste management, as well as encouraging active participation in keeping the surrounding environment clean.

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INTRODUCTION

According to the Directorate of Research and Community Engagement at the University of Indonesia, community service—commonly referred to as “Pengabdian kepada Masyarakat” (PKM)—involves activities aimed at enhancing the quality of human resources. These activities include broadening perspectives, increasing knowledge, and developing practical skills, carried out by academic members as a form of social responsibility and commitment to contribute actively to the welfare and empowerment of society, particularly those from economically disadvantaged groups.

PKM is defined as an academic response by the university community to societal needs, challenges, or problems, whether directly or indirectly encountered. Drawing upon academic expertise, PKM represents the realization of social responsibility and concern from higher education institutions toward the wider public. It consists of concrete efforts to improve the

quality of human resources through knowledge sharing and life skill development. PKM activities demand active, creative, and innovative participation from academic stakeholders in transformative community development efforts, enabling individuals and communities to lead independent and dignified lives.

Beyond social services, PKM also encompasses various forms of professional engagement, including the application of scientific and technological knowledge to support societal advancement in multiple sectors. Based on their respective areas of expertise, academic personnel are expected to be responsive and ready to serve the real needs of communities.

Community service has long been recognized as an integral component of the mission of universities and educational institutions around the world. Its main objective is to make a tangible contribution to surrounding communities by utilizing the knowledge, skills, and resources of academics and other stakeholders. A notable example of such community engagement is the project entitled *"Training on Eco-Enzyme Production as an Alternative for Organic Waste Management."* Organic waste is generated from various sources, including households, markets, industries, and institutions. According to Rabbani (2020), 68% of household waste consists of organic materials. Waste, in this context, refers to residual materials from human activities, whether domestic, industrial, or mining-related (Sunarsih, 2014). The daily increase in waste generation continues to rise in parallel with the growing needs of humans as consumer beings, making it a significant issue for the nation (Pranata, et.al., 2021).The daily increase in waste generation, driven by human consumption patterns, has emerged as a critical issue with various environmental consequences. Therefore, addressing organic waste requires solutions that are practical, cost-effective, and beneficial.

At Universitas Muhammadiyah Metro, students are provided with the opportunity to select community locations for their PKM projects. Our group chose Margorejo Village in Metro City, specifically within RT 06 and RW 02. This location was selected due to the high volume of household waste, particularly fruit and vegetable peels scattered around residential areas.

Our proposed solution involves converting this waste into eco-enzyme, a natural alternative for reducing household organic waste. This method is considered effective because the raw materials—fruit and vegetable scraps—are readily available and inexpensive. Eco-enzyme is a dark brown liquid produced through the fermentation of organic waste, such as fruit peels, vegetables, water, and brown sugar. It emits a strong sweet-sour aroma (Galintin et al., 2021). As reported by Suryani & Sinuraya (2024), eco-enzyme is a multifunctional liquid used as fertilizer, soap, and natural cleaning agent. Jannah, Rahajeng, and Sutyiono (2022) highlight its practicality for various household purposes, made simply through fermenting kitchen waste. The quality of eco-enzyme is indicated by its brownish color, fruity-alcoholic aroma, pH of 3–4, and the absence of mold or maggots (Putra et al., 2022).

After three months of fermentation, the resulting liquid can be utilized for multiple purposes, including as fertilizer, biopesticide, or aromatic additive in homemade soaps. This environmentally friendly process also offers economic value to the community, as the production cost is low and the end product can be used personally or sold.

The training program on eco-enzyme production as an organic waste solution included several stages: planning, implementation (comprising material delivery and hands-on practice), and evaluation through assessment of outcomes, impact, and ongoing monitoring. This initiative has proven effective in enhancing participants' knowledge and skills while fostering greater environmental awareness and promoting sustainable behavior to reduce the negative impact of organic waste on ecosystems (Maulida, Herwina & Hamdan, 2023). As noted by Megasari et al. (2025), eco-enzyme training represents a strategic approach for addressing organic waste challenges within rural communities.

IMPLEMENTATION METHOD

The preparation stage at the beginning of our group conducted a survey to the waste bank in the RT06 / RW02 margorejo village. During the survey we asked about the problems in the margorejo village, what are the expectations of the person in that can be realized by our PKM

group. Utilizing household organic waste that is only thrown away and makes environmental pollution.

The implementation stage, after the material and video displays regarding matters related to the manufacture of ecoenzyme are presented, PKM activities are continued with training and workshops on making ecoenzyme extracts By making ecoenzyme accompanied by Dr. Agus Susanto. With ecoenzyme making materials/equipment such as fruit peel waste, kitchen knives, palm sugar, scales, water, talcans, buckets and used bottles.

The evaluation stage after making ecoenzyme from fruit peels for the RT06 / RW02 community is complete, we conduct an evaluation by discussing the attendance of participants and their ability to practice ecoenzyme making to show that knowledge is expected to be applied in household waste management.

RESULTS AND DISCUSSION

Preparation Stage.

Prior to the training, the team prepared materials and made eco enzyme as a pilot product. The preparation of materials used materials from existing research journals. The material was then summarized to get the important points which were then poured on a sheet of leaflet. Leaflets will be distributed to each participant as a learning medium as well as a record of the training material. In this training, the team did not present the material using powerpoint due to the limited tools available in the village. Making eco enzyme for pilot products was carried out by the team one week before the training. In addition, before conducting this eco-enzyme training, the team participated in the organic fertilizer training held by BPP Candi Subdistrict in Kebonsari Village to get an overview of the implementation of the training activities.

Implementation Stage.

The implementation of this training activity was carried out on August 25, 2024 at the Plp 2 student post of Muhammadiyah Metro University, Jalan Kapten Tandean rt 06 rw 02, Margorejo village, South Metro. The target of this service activity is housewives in the community around rt 06. This activity involved a team of servants consisting of 6 lecturers and 4 FKIP students of Muhammadiyah Metro University. The speaker divided the training discussion into 3 parts, namely, understanding eco enzyme and the use of eco enzyme, practice of making eco enzyme, as well as discussion and questions and answers. The presentation of the material was carried out using lecture, practice and discussion and questions and answers about eco enzyme. First of all, the service team distributed leaflets that had been prepared to each training participant.

The first session was a training material delivery session. The service team presented material about eco enzyme as an alternative to household organic waste management. The service team explained what was meant by eco enzyme and what materials and tools were needed in making it. The service team also explained the composition and procedures for making eco enzyme and its benefits for everyday life such as natural floor cleaners, natural hand sanitizers, natural air purifiers, natural liquid fertilizers, natural liquid soaps, and natural pest repellents.

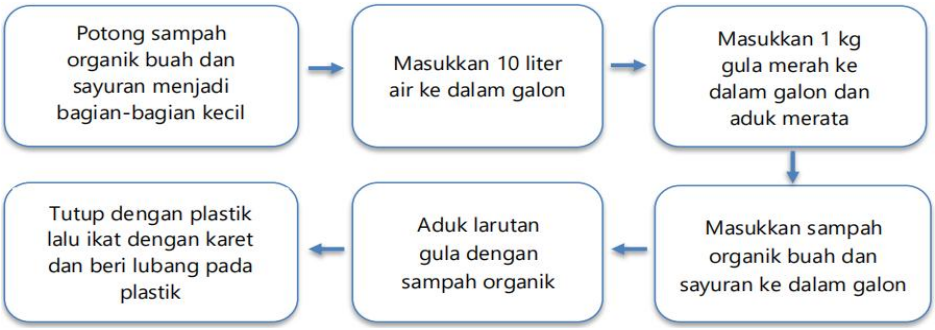

Figure 1. Procedure for making Eco Enzyme

The activity continued with the practice of making eco enzyme where the tools and materials needed are organic waste from vegetables and fruits, brown sugar, water, and gallons, and plastic covers. The tools and materials have been prepared by the service team then the team members practice making eco enzyme by mixing the ingredients for making eco enzyme in a ratio of 3:1:10. The ratio means that 3 kilograms of organic waste, 1 kilogram of molasses from brown sugar or palm sugar and 10 liters of well water are put into gallons of used mineral water which are then stirred until the sugar dissolves in water.

In this practice, approximately 80% of the organic waste used consisted of orange peels, while the remaining 20% was made up of vegetable scraps. The predominant use of orange peels was due to their ability to produce a fresher aroma in the resulting eco-enzyme. Additionally, Octavianti et al. (2024) emphasized that the containers used in the fermentation process must be chosen carefully. Glass or metal containers are not recommended, as they may pose a risk of explosion. According to Waste4Change (2018), airtight plastic containers are preferred, ideally with a small hole to release fermentation gases and prevent pressure buildup. Vidalia et al. (2023) also advised using narrow containers equipped with gas release mechanisms during fermentation to avoid explosions.

Setiawati et al. (2023) further stated that granulated sugar should be avoided in eco-enzyme production because it undergoes chemical processing that may affect the enzymatic activity. As per Permatananda and Pandit (2023), the recommended ingredient ratio is 3 parts orange peels, 1 part brown sugar, and 10 parts water, with a fermentation period of 90 days. Mutiarni et al. (2023) suggested a similar ratio using a mix of orange and strawberry peels, also emphasizing the importance of releasing gas through a hole in the container cap.

The community service team also encouraged participants to directly engage in the eco-enzyme production process. Volunteers took turns helping to combine the prepared ingredients into plastic gallons. During the hands-on session, the team provided explanations about the proper method of sealing the container. On the first day, the gallon can be tightly sealed using a cap or plastic, but it must include a hole to allow methane gas—produced during the decomposition of organic waste—to escape. This step is crucial during the first week of fermentation.

In the second week, the solution can be sealed tightly without a hole, as gas production significantly decreases between the second and fourth weeks. At the end of each month during the fermentation period, the cap must be opened briefly to release any accumulated gas. After three months, the eco-enzyme is ready to be harvested and used by diluting it with water as needed. The eco-enzyme produced from this session was handed over to the Head of Gelam Village for further fermentation before being applied in various daily activities. This eco-enzyme can serve multiple purposes, including as a multi-purpose cleaning liquid, plant fertilizer, pest repellent, and a tool for environmental preservation (Rochyani et al., 2020).

Following the practical session, the team conducted a discussion and Q&A. The number of questions from participants reflected their strong interest and curiosity about using eco-enzymes for both household needs and plant fertilization. The team explained that eco-enzyme can be applied after the fermentation process is complete. For use as fertilizer or soil enhancer, it can be diluted in a ratio of 1 ml of eco-enzyme to 500 ml of water. As an insecticide, the solution can be prepared by mixing it with 1 liter of water and directly spraying it onto affected plant areas.

Margorejo Village, located in the Metro Selatan subdistrict, is known for its hydroponic plant cultivation. According to Syah & Ratnakanyaka (2024), the growing demand for organic agricultural products reflects increasing public awareness of healthy lifestyles and environmental conservation. The team also shared how eco-enzyme can be used in various household applications, such as dishwashing liquid, by mixing 10 ml of eco-enzyme with 1 liter of water. Usage compositions for other products such as disinfectants, floor cleaners, and river water purifiers were also provided in a leaflet distributed to participants.

Research by Fevria et al. (2023) found that applying 1–4 ml/L of eco-enzyme to hydroponic lettuce significantly increased chlorophyll content. Haryuni et al. (2024) reported that eco-enzymes made from orange peels and brown sugar (at a 3:1:10 ratio) and fermented for three

months, when applied in polybags with husk charcoal, led to increased height and weight in vanilla plants. These findings suggest that eco-enzymes can serve as valuable inputs for hydroponic farming. Their application in household activities is also highly beneficial due to the nutrient content resulting from fermentation, which can enhance soil fertility, improve soil structure, and promote the activity of beneficial microorganisms.

The community service team also developed a partner satisfaction questionnaire to assess the impact of the training and mentoring activities, as well as to identify any areas for improvement in the implementation process (Sholiha & Vahlia, 2024).

CONCLUSIONS AND SUGGESTIONS

In this activity, students observe the results of the training by monitoring the activities of the participants after a few weeks from the training time whether there is a change or not in terms of knowledge of waste management to be able to harvest Ecoenzymes and the use of Ecoenzymes made and their application in everyday life, in accordance with the results that have been taught during training.

Ecoenzymes are only fully formed after 3 months. This is needed for the fermentation and decay process that occurs naturally. Initially the water is clear, over time it will become cloudy and brownish. After one month, soda froth will appear like a carbonated drink. The bubbles will put pressure on the lid of the plastic container.

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