

## ECOENZYME EDUCATION AS A SOLUTION TO REDUCE HOUSEHOLD ORGANIC WASTE IN HULUNG VILLAGE

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### Abstract

Waste is a major problem facing Indonesian and global communities. Poorly managed household organic waste can lead to environmental pollution and public health problems. One environmentally friendly solution is the use of ecoenzymes, a liquid fermented from organic waste that is beneficial for hygiene and simple farming. This community service activity aims to improve the knowledge and skills of the Hulung Hamlet community in processing organic waste into ecoenzymes as an effort to reduce household waste volume. Implementation methods include education through outreach, interactive discussions, and live demonstrations of the ecoenzyme production process using readily available organic materials. Evaluation was conducted through participant observation and increased understanding before and after the activity. The results of the community service show an increase in community knowledge about the benefits of ecoenzymes and the ability of participants to practice ecoenzyme production independently. Furthermore, there has been a change in community attitudes, leading to greater concern for organic waste management. The recommendations from this activity are the need for continued mentoring and the sustainable implementation of ecoenzymes to support a cleaner and healthier environment in Hulung Hamlet.

**Keywords:** Ecoenzyme, Organic Waste, Waste Management, Community Empowerment

### INTRODUCTION

The environment is a place where all living things live and carry out various activities. A clean environment will improve public health (Elamin et al., 2018). In 2023, Indonesia will dominate almost 50% of the population in Southeast Asia, ranking fourth with a population of 679.69 million. Furthermore, Indonesia's population growth rate in 2023 is 1.13%, which is lower than the previous year. Indonesia's large population is certainly in line with various forms of daily human activities in all aspects of life. Along with the increase in public consumption, it is followed by an increase in household waste production, both from small and large industries. The Ministry of Environment and Forestry (KLHK) reported that total national waste production had reached 21.1 million tons in 2023. In other words, this indicates a decline in waste volume compared to previous years. In 2020, national waste

production reached 67.8 million tons out of a total population of 275.77 million (Hayat, 2023).

Organic waste accounts for the largest proportion of total waste production, with household organic waste being the primary contributor (Pakki et al., 2021). Waste is the residue of daily human activities or natural processes in solid or semi-solid form, consisting of organic and inorganic substances, whether biodegradable or not, deemed useless and discarded into the environment (Deviona et al., 2023). This is a problem for many cities worldwide, as the growing population and human activity lead to a continuous increase in waste volume. Waste management requires significant costs and land use. However, if not managed properly, it can endanger human health and the environment. The environment is an area where all organisms live and carry out various activities, and the level of health is also influenced by environmental factors (Prabowo et al., 2022).

One method to address the accumulation of waste in Indonesia is through ecoenzyme production, which produces no waste. Ecoenzymes are liquids produced by the fermentation of organic materials that have significant benefits for human health and the environment (Rukmini & Astuti Herawati, 2023). Ecoenzymes offer various benefits, including as a natural cleaner, liquid fertilizer, and simple pest control. The use of ecoenzymes not only helps reduce the amount of organic waste but also provides added value to the community in their daily lives (Nurhamidah et al., 2021). Household organic waste is a common environmental problem faced by rural communities, including those in Hulung Hamlet. Most food scraps and kitchen waste are disposed of directly without any processing, resulting in unpleasant odors, environmental pollution, and the potential for disease. Low public awareness and skills in managing organic waste are major factors contributing to the increasing volume of household waste. However, most residents of Hulung Hamlet do not yet know how to optimally produce and utilize ecoenzymes. This lack of information and hands-on practice has resulted in unsustainable organic waste management. Therefore, a structured community service education program is needed to improve the community's knowledge and skills in processing organic waste into ecoenzymes. The goal of this community service activity is to increase environmental awareness and the ability of the Hulung Hamlet community to utilize organic waste into ecoenzymes as an environmentally friendly solution for reducing household waste.

## IMPLEMENTATION METHOD

This community service activity was carried out in Hulung Hamlet, Leihitu District, Central Maluku Regency, with the main target community and hamlet officials. The implementation method used was lectures, discussions, and direct practice. This activity was carried out starting from planning, implementation, and feedback. This activity took the form of education and training. During the planning stage, a schedule and materials for the activity were created, and a careful calculation was made regarding the number of participants and the location to be used. We chose eco-enzymes as the focus of this service, because the amount of organic waste produced is increasing. Eco-enzymes can help reduce organic waste.

The second phase of implementation was carried out on January 13, 2026, with details of activities through education on processing organic waste into ecoenzymes, which included counseling on the impact of waste on the environment and a live demonstration of the ecoenzyme-making process using fruit and vegetable waste, sugar, and clean water. This activity was carried out in a participatory manner so that the community could practice directly. The evaluation phase was carried out by observing participant involvement during the activity, measuring understanding through question and answer discussions, and assessing the community's ability to repeat the ecoenzyme-making process independently at home.

## RESULTS AND DISCUSSION

The eco-enzyme training took place on Tuesday, January 13, 2026, in Hulung Hamlet, Leihitu District, Central Maluku Regency. The training began with a presentation on eco-enzymes, including their definition, benefits, and manufacturing techniques (Figure 1). The workshop then included practical exercises on making eco-enzyme solutions using ingredients such as fruit peels, vegetable scraps, brown sugar, and water (Figure 2).



**Figure 1. Explanation of Ecoenzymes**

Next, the ecoenzyme training stage is carried out using a lecture method accompanied by live demonstrations, discussions, and question and answer sessions or consultations between residents and presenters.

This community service program aims to empower communities to process household waste into useful products, such as ecoenzymes. This is done as an effort to shorten the distribution chain of waste into useful products. Ecoenzymes applied at the household level

can be an effective way to achieve this. This community service activity includes material presentations and practical exercises in ecoenzyme production. Ecoenzymes can function as multipurpose liquids, with applications in households, agriculture, and animal husbandry. Fundamentally, ecoenzymes accelerate biochemical reactions that occur in nature to produce useful enzymes using vegetable or fruit waste. Enzymes from food waste are one waste management method that utilizes kitchen scraps for something very useful (Yunita, 2023).

Ecoenzyme is an abbreviation of the words ecology and enzyme. Eco, an abbreviation of ecology, was introduced by Ernst Haeckel, a German zoologist, in 1869 (Rahmawati & Yaswinda, 2021). Ecology is a branch of science that studies the reciprocal relationship between organisms and their environment. The word enzyme, on the other hand, comes from the Greek word meaning "cause of change." Enzymes are the smallest components that function to accelerate chemical reactions without any chemical changes (Nurmandari et al., 2019).

Ecoenzyme is a liquid fermented from domestic waste or household waste. Ecoenzyme is an environmentally friendly product, highly functional, and easy to make and use. Enzymes processed from waste or organic waste can be used as an organic cleaner from the fermentation of fruit pulp, fruit peels, vegetables, sugar (brown sugar or cane sugar), and water. Ecoenzyme produces a dark brown color and has a distinctive fermentation aroma, with a strong fresh sour taste. Ecoenzyme can also accelerate biochemical reactions (Hemalatha & Visantini, 2020).

Ecoenzymes have various functions in their applications due to their antifungal and antibacterial properties (Neupane & Khadka, 2019) and their ability to decompose bacteria and dirt in water and break down sludge (Bharvi S. Patel et al., 2021). Ecoenzymes can accelerate chemical reactions and function as natural catalysts. Ecoenzymes can be used in everyday life as household cleaning fluids, disinfectants, and hand sanitizers (Rusdianasari et al., 2021). Ecoenzymes can also be used as soil conditioners. Materials that can improve the structure and ability of soil to retain nutrients are called soil conditioners (Dariah et al., 2023).

The production of Ecoenzyme has a positive impact on the community's economic conditions and environmental health, as it can reduce pollution caused by the presence of methane gas (Setyoningrum et al., 2023). The process of making Ecoenzyme follows a similar principle to making compost, only with the addition of water as a growth medium. Thus, this produces a liquid that is preferred because it is easier to use. The specialty of this Ecoenzyme is that it does not require a large area for the fermentation process, as in making compost, and this product does not even require a composter with certain specifications. Used mineral water bottles and other products that are no longer used can be used as Ecoenzyme fermentation containers. This Ecoenzyme functions as a growth factor for floor cleaners, pesticide residue cleaners, floor cleaning detergent mixtures, scale removers, and lowers the temperature of car radiators (Paranita et al., 2022).

Econzyme is made by fermenting a mixture of brown sugar, water, kitchen waste, unrotten vegetables, and fruit waste. The fermentation process takes three months. In recent years, waste enzymes have been used to alter some characteristics of wastewater. Waste enzymes are crucial for achieving degradation rates comparable to commercial enzymes (Astuti & Maharani, 2020). After fermentation, glucose is converted to pyruvic acid (Rohmah et al., 2020). Under anaerobic conditions, pyruvic acid is broken down by pyruvate

decarboxylase to acetaldehyde. Then, alcohol dehydrogenase converts acetaldehyde to ethanol and carbon dioxide. Next, acetobacter bacteria convert alcohol to acetaldehyde and water, which then becomes acetic acid after conversion (Septiani & Fitria, 2021). However, humans cannot consume these ecological enzymes directly. However, they can be used as organic fertilizer, to clean drains, and to replace dish soap for various purposes such as insecticides and detergents. Figure 2. Demonstration of eco enzyme production. The production of eco enzyme liquid begins with collecting organic household waste, which is the material needed to make eco enzyme products.



**Figure 2. Ecoenzyme Manufacturing Process**

The process for making ecoenzymes involves washing organic kitchen waste thoroughly and then cutting it into small pieces. This is done to activate the decomposer bacteria for fermentation due to the smaller surface area, so the amount of organic kitchen waste placed in the bucket does not fill the entire bucket volume (Widiani & Novitasi, 2023). Next, brown sugar is added as food for the bacteria to initiate fermentation, and water is added in a ratio of 1:3:10 for molasses, organic waste, and water. Everything is mixed thoroughly (Nanda et al., 2023). Then, stir until dissolved and close tightly to prevent air from entering. Leave it for three months, releasing the gas during the first two weeks to prevent explosions. Avoid direct sunlight and use a bucket larger than the volume of the ecoenzyme. Fill the bucket only halfway. After three months, the ecoenzyme can be used or stored for a longer period. After harvesting the ecoenzyme, its color will be dark brown. If it is black, sugar can be added to repeat the fermentation process. All types of ecological enzymes have a sour and fresh taste (Viza, 2022).

The ecoenzyme fermentation process produces a liquid ecoenzyme product and the beneficial residue suspended at the bottom. Because it contains nitrite and the enzymes amylase, lipase, and trypsin, which are enzymes that can function as biocatalysts to reduce the concentration of pollutants in waste, the ecoenzyme fermentation residue can be used as fertilizer to nourish the soil (Wikaningrum et al., 2022). Ecoenzymes contain toxins that protect plants from insects and herbivores, plant regulatory factors, and storage compounds that can supply nitrogen and other nutrients to plants (Ningrum et al., 2017). As antibacterials and inhibitors, alkaloids can disrupt the part of bacterial cells that forms peptidoglycan (Fadlurrahman & Aznury, 2022). In addition to their antimicrobial properties, the flavonoids

contained in coenzymes also function to provide color, flavor, flowers, fruits, and seeds. They can also protect plants from environmental influences (Khalid et al., 2019).

## **CONCLUSIONS**

Community service activities through education on coenzyme production as a solution for reducing household organic waste in Hulung Hamlet have had a positive impact on increasing community knowledge, skills, and environmental awareness. Prior to the intervention, most residents managed waste by throwing it away and burning it, which has the potential to pollute the environment and impact health. After the education and demonstration on coenzyme production, the community was able to understand the organic waste processing process and demonstrated a commitment to implementing it independently at home. This activity is recommended to be continued through regular mentoring so that the coenzyme production practice can run sustainably. In addition, expanding the program to other areas is expected to provide an alternative solution for organic waste management based on community empowerment. Support from the village government and health workers is essential to strengthen the program's sustainability and increase its impact on environmental cleanliness and public health.

## **Thank-You Note**

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