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# Training on Making Eco Enzymes from Household Waste with the 'Aisyiah Grogol Sukoharjo

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***Abstract***
*The goal of this community service is to improve society and the environment. One type of service that tries to inform the public about eco-friendly methods for handling organic waste is eco enzyme training. Delivering interactive content, giving demonstrations, and getting hands-on experience creating eco enzymes are all part of the implementation strategy. The community's understanding of the advantages and production processes of eco enzymes, as well as their capacity to efficiently handle organic waste, has increased as a result of this eco enzyme training exercise. It is envisaged that following this training, people will be able to incorporate eco-friendly habits into their daily life, lessen the quantity of organic waste that is disposed of, and generally enhance environmental circumstances. The relevance of a participatory and educational approach in altering people's behavior toward the environment is the training's conclusion. By using this method, people can gain practical skills to support environmental conservation initiatives and have a greater understanding of how their actions affect the environment. In addition, cooperation between many stakeholders, including the community, government, and educational institutions, is crucial to achieving sustainable development goals in prudent and long-term environmental management.*
***Keywords****: Training;Eco enzym;Organic waste.*

## 1. INTRODUCTION

The amount of household waste generated is influenced by conditions in the most populous area of Sukoharjo Regency, Grogol. SIPSN data shows that 235 Indonesian regencies and cities accumulated 36,218,012.28 tons of garbage annually, with a waste reduction of 14.88% from 5,390,999.15 tons annually and waste management of 49.12% from 17,791,815.35 tons annually. 64.01% of the 23,182,814.50 tons of trash produced annually in Indonesia are managed, whereas 35.99% of the 13,035,197.78 tons of rubbish produced annually are not (sipsn.menlhk.go.id). The public's awareness of waste management is not keeping up with Sukoharjo Regency's growing population and number of industries. In Sukoharjo Regency, household garbage amounts to 2,115.63 m3/day (91.77%), whilst industrial waste amounts to 189.62 m3/day (8.23%). Industrial garbage is less common than household waste. In Sukoharjo Regency, a lot of people still don't separate their organic and non-organic waste. The 118 permanent TPS, 42 container TPS, and 1 Mojorejo TPA in Sukoharjo Regency are insufficient to handle all waste produced, particularly in urban, residential, and industrial sectors (Sukoharjo Regency Government, 2018).

The average daily household waste output in Grogol Village is 0.7 kg per person, while the daily total waste production in Grogol District is roughly 6.8 tons. The majority of rubbish is either burned or dumped in rivers. There are no waste banks or integrated waste management facilities, and household recycling and composting rates are still quite low. There is still a lot of household trash strewn all over residential neighborhoods. There is a dearth of public knowledge about managing domestic garbage. Aisyiyah Grogol has the ability to actively participate in recycling programs and the production of eco-enzymes from household waste, which can lower waste disposal volumes and enhance community quality of life, resulting in a healthier lifestyle, given the demographics of the area and these household waste issues.

The 'Aisyiyah Grogol Branch's issue is the local community's lack of empowerment with regard to managing domestic garbage. Therefore, increasing community involvement in enhancing empowerment in the field of household waste management and educating people about the advantages of domestic trash management is the solution to this partner's issue. Eco-enzyme training will be used in the community service program for managing household trash. Housewives in Grogol Village are given an introduction to eco-enzymes, help in producing eco-enzymes, and support in using eco-enzymes to make products. The absence of community empowerment with relation to home trash processing in the surrounding region is the issue that the Grogol Branch of 'Aisyiyah is dealing with. Consequently, the partner's issue can be resolved by teaching the public about the advantages of domestic trash processing and increasing community involvement in the area of greatest empowerment. This household waste processing empowerment service is planned using the eco-enzyme manufacturing training method. Activities include presenting eco-enzymes to Grogol Village housewives, helping them make eco-enzymes, and helping them use items made from eco-enzymes.

Eco-enzyme is a processed organic waste product that can come from leftover fruit peels or vegetable scraps that have not yet rotted. Eco-enzyme production is based on a fermentation process between water, sugar, and organic waste (Abidin et al., 2024.).

Here are some summaries of Eco-enzyme's uses (Kumar et al., 2019; Wen Low et al., 2021.):

1. Multipurpose Cleaner: Eco-enzyme can be used as a cleaner for floors, walls, glass, and various other surfaces. This enzyme has antibacterial and antifungal properties that can clean dirt and kill germs.
2. Odor Eliminator: Eco-enzyme effectively eliminates unpleasant odors in kitchens, bathrooms, trash cans, and other areas.
3. Organic Fertilizer: Eco-enzyme residue can be used as a liquid fertilizer for plants. This enzyme can help improve soil fertility and plant growth.
4. Pesticide Remover: Eco-enzyme can be used to wash vegetables and fruits, helping to remove pesticide residue.
5. Wastewater Treatment: Eco Enzyme can be used in domestic and industrial wastewater treatment to reduce pollution and improve water quality.
6. Deodorant: Eco Enzyme can be used as a natural deodorant to eliminate body odor.
7. Pet Care: Eco Enzyme can be used to clean pet cages and bedding, eliminating unpleasant odors.
8. Air Purifier: Spraying Eco Enzyme into the air can help reduce indoor air pollution and provide a fresh scent.

Using Eco Enzyme provides benefits by providing an environmentally friendly and beneficial product, but also contributes to reducing organic waste and reducing the use of hazardous chemicals. Eco Enzyme has also been used in various health studies (Ben Hamad & Gargouri, 2024; Mavani et al., 2020).

## 2. METHOD

The community service program involved direct training for partners, followed by a pre-test to determine their initial understanding of eco-enzymes. After the pre-test, training was conducted, followed by a Q&A session, followed by a post-test using the same questions.

For sustainability purposes, after the training, each participant received a demo kit consisting of a 3-liter jar, 250 grams of palm sugar, and instructions for making eco-enzymes. An evaluation of the eco-enzymes was conducted through a WhatsApp group. The fermentation period for Eco-enzymes is between 60 and 90 days. In this training, we used a 90-day fermentation period (Janarthanan et al., 2020).

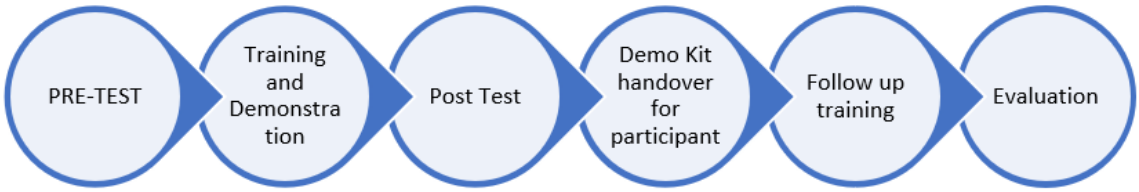


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Figure 1. Activity Flowchart

## 3. RESULT AND DISCUSSION

During the eco-enzyme training community service activity with 'Aisyiah Grogol Sukoharjo, a pre-test and post-test on eco-enzymes were administered before and after the training, with 10 questions about eco-enzymes. The results of the pre-test and post-test were then analyzed using a paired t-test, with the results shown in Table 1.

Table 1. Pre-Test dan Post-Test Result

| | Number | Mean | Standard Deviation | 95% Confidence interval | | p-value |
|---|---|---|---|---|---|---|
| | | | | lower | upper | |
| Pre-test | 38 | 6,28 | 1,64 | -2,78 | -1,58 | 0,000 |
| Post-test | 38 | 8,47 | 2,14 | | | |

Figure 2. Women Participant from Aisyiah Grogol.

Figure 3. Training Demonstration for Eco Enzym

The statistical test results on participants' knowledge of Eco Enzyme indicated that they were unfamiliar with the product and its uses. The statistical analysis demonstrated a significant increase in participants' knowledge after the training ($p < 0.001$). The mean score increased from 6.28 before training to 8.47 after training, indicating that participants experienced substantial improvement in understanding eco-enzyme concepts, production techniques, and benefits. The confidence interval values (-2.78 to -1.58) indicate that the increase in scores was statistically meaningful and unlikely to occur by chance. The average increase of 2.19 points reflects the effectiveness of participatory learning methods involving direct demonstrations and practical activities. The training approach used in this program encouraged active learning and hands-on experience, which are known to improve retention of knowledge compared with conventional lecture-only methods. Furthermore, participants were able to immediately practice eco-enzyme production independently, thereby strengthening their understanding through experiential learning. These findings are consistent with previous community empowerment studies showing that environmental education combined with practical activities can significantly improve community awareness and environmentally friendly behavior

Following the training and demonstration, the next step was mentoring on how to make Eco Enzyme, conducted in groups and supervised by one instructor. Monitoring was conducted via a WhatsApp group. Based on the monitoring results, over approximately three months (90 days), approximately 20 (52%) of the 38 participants successfully made Eco Enzyme, while the remainder were unsuccessful and required further mentoring. Eco Enzyme is considered successful if it meets the following requirements (Morita et al., 2024):

- Fresh, sour odor, not foul odor.
- White layer of pitera fungus.
- The color of the liquid varies from yellow-brown, light brown, to dark brown, depending on the type of material used.
- The pH of the Eco Enzyme liquid is 3.5-4.5.

Several factors systematically contributed to the failure of eco-enzyme production among participants:

**a. Use of Rotten Organic Materials**
Some participants used organic waste that had already undergone decomposition before fermentation. Rotten materials increased the risk of undesirable microbial growth and produced foul odors during fermentation.

**b. Inappropriate Ingredient Ratios**
Several participants did not follow the recommended fermentation ratio (1:3:10). Excessive water or insufficient sugar reduced fermentation efficiency and microbial activity.

c. **Poor Fermentation Hygiene**
Contamination occurred due to unclean containers or exposure to external contaminants during fermentation. Hygiene is essential because contamination may disrupt beneficial microbial growth.

**d. Inadequate Fermentation Monitoring**
Some participants did not routinely release gas pressure or inspect the fermentation process. Lack of monitoring increased the possibility of fermentation failure.

**e. Limited Availability of Organic Waste**
Many participants were working women with limited time for preparing fresh fruits and vegetables at home. Consequently, the availability of suitable organic waste materials was relatively low.

**f. Environmental Temperature and Storage Conditions**

Fermentation conditions such as temperature and direct sunlight exposure may affect microbial activity and enzyme formation.

These findings indicate that continuous mentoring and periodic supervision are necessary to improve production success rates in future programs.


Figure 4. Follow up the making of Eco Enzym through WhatsApp Group.

Figure 5. The successful appearance of Eco Enzym.


Picture 5. The result of Eco Enzym after 90 days fermentation.

This training program demonstrated several positive social impacts on the community like

**a. Increased Environmental Awareness.**

Based on participant discussions and post-training evaluations:

- Approximately 85% of participants reported increased awareness regarding household waste sorting.
- Around 70% of participants expressed willingness to continue eco-enzyme production independently.
- More than 60% of participants shared eco-enzyme knowledge with family members and neighbors.

These findings indicate that the program contributed to broader environmental education beyond direct participants.

**b. Strengthening Community Participation.**

The WhatsApp mentoring group facilitated continuous communication among participants and strengthened community collaboration in environmental activities.

**c. Household Waste Reduction Potential.**

Each participant used approximately 1–2 kg of organic waste during fermentation. If implemented continuously, this activity could potentially reduce organic household waste accumulation significantly at the community level.

Eco enzymes also demonstrated potential economic value for households like :

**a. Household Cost Savings**

Participants reported reduced dependence on commercial cleaning products because eco enzymes could be used as:

- Floor cleaners.
- Bathroom cleaners.
- Deodorizers.
- Plant fertilizers.

Simple calculations indicate that households may save approximately IDR 30,000–50,000 per month by substituting chemical cleaning products with eco enzymes.

**b. Small-Scale Business Opportunities**

Eco enzymes can be processed into value-added products such as:

- Multipurpose cleaning liquids.
- Organic fertilizers.
- Air fresheners.
- Natural disinfectants.

The increasing public interest in environmentally friendly products provides opportunities for community-based micro-enterprises. The use of household organic waste for eco-enzyme production supports circular economy principles by converting waste into useful products with economic **value**.

## 4. CONCLUSION

The eco-enzyme training program conducted with the ‘Aisyiyah Grogol Sukoharjo community successfully improved participants’ knowledge and awareness regarding household organic waste management. Statistical analysis showed a significant increase in participants’ understanding after training, with pre-test and post-test mean scores increasing from 6.28 to 8.47 ($p < 0.001$).

Approximately 52% of participants successfully produced eco enzymes after a 90-day fermentation period. Production failures were mainly caused by poor raw material selection, contamination, inappropriate fermentation ratios, and inconsistent monitoring.

In addition to environmental benefits, the program also demonstrated social and economic potential through increased environmental awareness, reduced household waste, and opportunities for small-scale eco-friendly product development. Future programs should include more intensive mentoring, periodic monitoring, and advanced training regarding eco-enzyme product commercialization to improve sustainability and community economic empowerment.

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