

## Training In Manufacturing Multipurpose Eco-Enzyme Liquids for Farmers Group

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**Abstract:** Eco-enzyme is an active ingredient from organic waste that can be used for various daily purposes such as fertilizer, herbicide, cleaning fluid, and even medicine, this is because it contains *Lactobacillus*, *Asotobacter xylinum*, yeast fungi, and *lactic acid bacteria*, enzymes (such as protease, amylase, lipase), minerals, and secondary metabolites (such as polyphenols, alkaloids, antioxidants). By utilizing coenzymes optimally, it will support the use of household organic waste with an environmentally friendly concept. And this is also an effort to reduce disruption to the environment due to landfills, which can be done by utilizing household organic waste to make eco-enzymes. The aim of this service is to provide training in making eco-enzymes as a multi-purpose liquid which will have an impact on waste utilization. Organic which is oriented towards maintaining a clean environment. The first method used was socialization and continued with presentation of material about what eco-enzymes, why we need to develop them, how to make eco-enzymes and how to use them. The material was delivered through a presentation using a projector and the production was carried out by demonstrating how to make eco-enzymes. This activity was carried out by delivering presentation material about eco-enzymes. The training was carried out at the homes of Tanah Baru Village residents with the permission of the Village Head. The training participants were farmers of the Tanah Baru Subdistrict Farmers Group, totalling 20 people and several village officials. The training was held on June 13 2022 which included counselling and demonstrations on making eco-enzyme solutions from fruit peels and vegetable waste. The training participants seemed very enthusiastic by asking questions and having lots of discussions about eco-enzymes and their uses, participants also actively participated in manufacturing activities.

**Keywords:** Eco-Enzyme; Environmentally friendly; Fermentation; Organic trash

### 1. INTRODUCTION

One effort to reduce disruption to the environment due to landfills can be done by using household organic waste to make eco-enzymes. Eco-enzyme is a complex solution resulting from processing organic waste such as fruit and vegetable waste through a fermentation process. The process is by adding brown sugar or molasses, water with help of selective microorganisms from groups of fungi and bacteria such as *Lactobacillus*, *Asotobacter xylinum*, yeast fungi, and *lactic acid bacteria*) for approximately 3 months (Neupane *et al*, 2019).

The resulting fermentation solution has a light to dark brown colour depending on the ingredients used and has a fresh sweet and sour aroma typical of fermented products (Rusdianasari, 2021).

The main aim of making eco-enzymes was initially to reduce household waste by processing it into products that could be reused by residents (Mahali *et al.*, 2022), but in its development it turned out that it was not only useful in reducing waste, but also produced products with high efficiency. Eco-enzymes are rich in benefits apart from being used as a cleaning agent which includes cleaning materials for stoves, plates, clothes, floors, hair, body, hand sanitizer, body detox, air cleaner/purifier, anti-radiation, as a pool cleaner, for pets and as fertilizer. Organics and pesticides can also be used as medicines such as wound and skin medicine, therefore eco-enzymes are called multi-purpose liquids. Knowledge about eco-enzymes is very beneficial for society, because apart from being able to reduce the negative effects of organic waste accumulation on the environment, eco-enzymes are also useful in reducing the use of inorganic fertilizers and synthetic pesticides in plant cultivation activities.

Bioconversion of organic waste into new products can contribute to improving environmental quality and has economic value. Biotechnology is one way to resolve the buildup of organic waste by not producing waste again. One of the biotechnology processes that is being activated is eco-enzyme production (Rukmini and Herawati, 2023). Eco-enzyme comes from two words, namely Eco and Enzyme. Eco means ecology or environment and enzyme means an organic biocatalyst produced by living organisms in protoplasm, which consists of protein or a compound that binds to protein.

Eco-enzyme was developed by a researcher from Thailand, namely Dr. Rosukon Poompanvong, in 2006, the founder of the Thai Organic Agriculture Association, which has conducted research since the 1980s (Rasit *et al* 2018), was subsequently introduced more widely by Dr. Joean Oon, a Naturopathy researcher from Penang, Malaysia. Eco-enzymes are said to contain protein chains in the form of enzymes, organic acids and mineral salts which are easily obtained from the fermentation of organic waste. Eco-enzymes are similar to enzymes in that they have a high level of degradation in a short time, and it is even stated that eco-enzymes can also play a role in composition, transformation and catalysis.

The principle of the eco-enzyme making process is actually similar to the process of making compost, but water is added as a growth medium so that the final product obtained is in the form of a liquid which is preferable because it is easier to use. The specialty of this eco enzyme is that it does not require a large area of land for the fermentation process such as making compost, and this product does not even require a composter tank with certain specifications (Septiani, *et al.* 2021).

In essence, waste is not always detrimental to humans, in fact, if processed in the right way it will produce products that are very useful. The simplest waste processing activities carried out by most people still use traditional or simple methods and are still not environmentally friendly (Budiyanto, *et al.* 2022). The use of eco-enzymes will support the use of household organic waste with an environmentally friendly concept (Wuni *et al.*, 2021; Rochyani *et al.*, 2020). Eco-enzymes are solutions of complex organic compounds produced from the fermentation process of organic waste, sugar and water (Prasetio, *et.al.* 2021).

The fermentation process produces O<sub>3</sub> (ozone) gas, and the final result of the eco-enzyme solution is useful, among other things, as a multi-purpose cleaning fluid and environmentally friendly plant fertilizer (Megah *et al.*, 2018). According to Rochyani *et al.*, (2020), apart from this, eco-enzymes can also be used to control various plant pests, and maintain the cleanliness of the surrounding environment because eco-enzymes can neutralize various pollutants that pollute the environment. Apart from being a bio-sanitizer, eco-enzymes can also be used as botanical pesticides and fertilizers for plants (Rochyani *et al.*, 2020).

As a plant fertilizer, the results of research conducted by Yuliandewi *et al.* (2018) shows that the macro element content contained in eco-enzymes includes potassium (K) 203 mg/L and phosphorus (P) 21.79 mg/L. Eco-enzymes can be applied directly to the soil with a ratio of eco-enzymes: water = 1: 1000, if they are to be used as plant fertilizer and to fertilize the soil. Meanwhile, if it is to be used as a vegetable insecticide, the eco-enzyme can be sprayed directly onto plants that are attacked by pests with a ratio of eco-enzyme to water of 1: 1000 (Agustina *et al.*, 2020). Apart from that, Eco-enzyme has a role as a biocatalyst and metal-based waste treatment (Zultaqwa, *et al.* 2023).

Making eco-enzymes from vegetable and fruit waste can be done very simply, it only requires adding water and molasses or brown sugar in a certain ratio. Molasses needs to be added as an energy source for

fermenter microorganisms. Making the maximum eco-enzyme only takes about 3 months. The ratio between brown sugar or molasses, vegetable and/ or fruit waste, and water is 1:3:10. In order to produce an eco-enzyme solution that has an aromatic odour, the use of waste from fruit can be increased (Nazim, 2013). Furthermore, the eco-enzymes produced will contain good microbes such as *Lactobacillus*, *Asotobacter xylinum*, yeast/yeast fungi, and lactic acid bacteria, enzymes such as protease, amylase, lipase, minerals/nutrients (depending on the organic material used), and secondary metabolites such as polyphenols, alkaloids, other antioxidants.

Increasing awareness of the Tanah Baru community regarding the importance of environmental cleanliness and the potential for utilizing household waste in the form of organic materials, they are planning to cut the flow of waste distribution to the landfill in an effective way, namely speeding up the processing of waste, especially organic waste, into more useful products. This effective method can be realized through, among other things, making eco-enzymes which are applied at the household level, so the Community Service Team for the Biology Study Program, Faculty of Mathematics and Natural Sciences, Universitas Pakuan intends to hold training on making multi-purpose liquid eco-enzymes. By making Eco-enzyme, we have participated in reducing the burden on the earth while adopting a lifestyle that minimizes synthetic chemicals. The training participants were the ladies and gentlemen of the Tanah Baru Village Farmers Group, North Bogor District, Bogor City on June 13 2022.

## **2. METHOD**

Community service activities were carried out in Tanah Baru sub-district, North Bogor, Bogor city on June 13 2022. The method used in this community service activity was two stages, the first stage carried out socialization and counselling, this activity was carried out by delivering material in a presentation using a projector about eco-enzymes, the benefits and functions of eco-enzymes. In the second stage, the practice of making eco-enzymes was carried out from organic materials in the form of vegetable waste and fruit waste which had been provided by the community service team. Apart from organic materials from leftover vegetables and fruit, the community service activities committee also provided molasses and containers for making eco-enzymes. The container used to make eco-enzymes should not be made of glass or metal, or

another container with a small mouth, but use a plastic container with a large mouth and which can be closed tightly. All materials in the form of vegetable waste or fruit waste can be used provided they have not been cooked or boiled, not rotten, have no worms, not mild, not oily and not hard or woody.

The participant who is the target of community service activities is the Tanah Baru village farmers group, North Bogor District, Bogor City on June 13 2022, total 20 people. Each participant in this activity was given a free sample of the eco-enzyme solution that had previously been made by the community service team, with the aim of allowing participants to experience directly the benefits of eco-enzymes. Community service activities were carried out in one of the houses of the residents of Tanah Baru Village, North Bogor District, Bogor City.

The activity began with socialization and counselling by resource persons for the 20 participants who attended, most of who were members of the Farmer's group in Tanah Baru Village. On this occasion, the resource person explained that eco enzymes are fermented solutions from leftover vegetables and/ or fruit by adding water and brown sugar/ palm sugar/ molasses in certain proportions. The water that can be used here is gallon water, refill water, local water company water, rain water, AC waste water or well water. The main ingredient composition is household organic waste such as vegetables and/or fruit peels that do not have hard skin. On this occasion, there was also the introduction, manufacture and benefits of eco-enzymes as multi-purpose fluids in everyday life. Delivery of material is carried out by presentation using a projector (**Figure 1**).



**Figure 1. (a,b,c)** The resource person is delivering educational material regarding eco-enzymes.

At this stage, a question-and-answer session was also opened with the participants, to give the counselling participants the opportunity to explore further about eco-enzymes made from household organic waste. After



the outreach activities were completed, the community service activities team took a group photo with the training participants and Tanah Baru Village officials (**Figure 2.**).



**Figure 2.** (a) Photo with Eco-enzyme Production Training Participants; (b) Photo with Tanah Baru village officials

The next activity is to directly practice making eco-enzymes (**Figure 3.**), the materials needed consist of: sugar (you can use molasses, brown sugar, cane sugar, palm sugar, coconut sugar, palm sugar, don't use granulated sugar), fruit scraps and or vegetable waste, and water in a ratio of 1 (kg/g): 3 (Kg/g): 10 (L/ml). The method for making eco-enzymes is as follows, prepare a clean and dry container and fill it with clean water in the amount of 10% (L), then put 1% molasses (Kg) in the container, and finally fill it with pieces of leftover fruit and vegetables. as much as 3% (kg). Mix the eco-enzyme ingredients and try not to exceed 60% of the container volume.



**Figure 3.** (a) Briefing; (b) Practices for Making Eco-enzymes; (c) Shows the results of making eco-enzymes.

Next, after the ingredients are mixed in the container, stir well. Then the container is closed tightly and labelled with the date of manufacture. To avoid contamination, the fermentation solution container is then placed in a place that is not exposed to direct sunlight, has good air circulation, away from Wi-Fi, toilets, trash

cans, waste incinerator, and chemicals used for the fermentation process for 3 months. If the container appears bloated, open the container lid slightly to remove the gas that has formed in the first week.

Furthermore, after three months of storage the eco-enzyme solution was checked to determine the condition of the solution. If the solution is clear brown in colour with a fresh sour smell with a pH of 4, it means the eco-enzyme solution is good and can be harvested. If the eco-enzyme solution appears black/green mild, there is a possibility of contamination and a foul smell, then the density of the container needs to be improved and the storage location of the container needs to be considered. If there is damage to the eco-enzyme solution with signs as mentioned above, then the container is closed and dried in the morning sun for 30 minutes for 2-3 days. On the 7th day after drying, the solution was checked again. If it still smells bad and there is still black/ green mild, then the initial dose of sugar is added to the solution, and the fermentation time is increased by 1 month. Furthermore, after 3 months or 90 days, the eco-enzyme is ready to be harvested by filtering it and storing it in tightly closed containers. The eco-enzyme solution has a light yellowish-brown colour with a fresh, sour aroma with a pH of 4.

### 3. RESULT AND DISCUSSION

The results of the training on making Eco-enzyme in clear brown colour with a fresh sour aroma with pH 4 are presented in **Figure 4**. The eco-enzyme solution has no expiration date as long as it is not contaminated. The finished eco-enzyme can be used directly by first diluting it with water in the proportion according to its intended purpose.



**Figure 4.** (a) Practice results for making packaged eco-enzymes; (b) eco-enzymes results before packaging.

During the activity, both during the delivery of educational material and during the practice of making eco-enzymes, the participants who attended were very enthusiastic about the material presented. This was marked by questions asked by participants during the question-and-answer session related to the material presented, and the participation of participants in preparing materials and during demonstrations of making eco-enzymes. In the future, it is hoped that similar service activities can be carried out in a sustainable manner, thus encouraging people to be creative and innovative in creating a clean environment, free from waste, while at the same time utilizing organic waste into something that is very beneficial for people's lives, such as making eco-enzymes.

#### **4. CONCLUSION**

The training participants of the Tanah Baru Village Farmers Group, were very enthusiastic about taking part in the activity and playing an active role in making multi-purpose eco-enzyme solutions and hope that in the future there will be similar activities so that they can actively participate and take part in outreach activities and demonstrations on making eco-enzyme solutions from household organic waste carried out by the community service Team of the Biology Study Program, Faculty of Mathematics and Natural Sciences, Universitas Pakuan. Provide conclusions on the level of achievement of targets for community empowerment activities. Providing conformity to methods of community empowerment with problems, needs, and challenges that exist in the area of community empowerment activities. Give conclusions about the impact and benefits of community empowerment activities. Provide advice for further community empowerment.

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