


## Innovation in processing household waste into eco-enzymes in the community in Merak Batin village

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Article Info	ABSTRACT
<b>Keywords:</b> Citerep Village, Ecoenzym, Waste Management	Citerep Hamlet is one of the hamlets in Merak Batin Village, Natar District, South Lampung Regency, Lampung Province. This village is dominated by residential land covering an area of 1,351 hectares which results in a lot of human activity which cannot be separated from waste or rubbish, especially household waste.. There is no final disposal site (TPA) around Citerep Hamlet and a lack of rubbish dumps. The aim of this activity is to provide outreach and training to the Citerep Hamlet community regarding the use of organic waste into ecoenzymes. The method used is the socialization and training method. The target audience for the service is a sample of at least 20 residents to serve as socialization and training participants. The activity implementation stage includes the initial stage, core and closing stages. The initial stage consists of an interview process, socialization, and training manufacture of ecoenzymes. The closing stage is post-activity evaluation. The results can increase people's knowledge and make people independent by making ecoenzymes at home and being able to process organic waste, especially vegetable and fruit waste, into useful products. Innovation in processing household waste in the manufacture of ecoenzymes is a solution for reducing the waste that occurs.
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### INTRODUCTION

Citerep Hamlet is one of the hamlets in Merak Batin Village, Natar District, South Lampung Regency, Lampung Province. Merak Batin Village is located on the Jalan Lintas Sumatra, precisely KM 29, and is around 80 km from the capital. This village also has an area of 2,072 Ha, consisting of 1,351 Ha of residential land, 250 Ha of rice fields, 400 Ha of plantation land, 55 Ha of livestock land, 10 Ha of forest, and 6 Ha of other land. Merak Batin Village consists of 7 hamlets, one of which is Citerep Hamlet. The majority of the people's livelihood is labor. This village is dominated by residential land covering an area of 1,351 hectares which results in a lot of human activity which cannot be separated from waste or rubbish, especially household waste. The majority of mothers who live there are housewives who cannot be separated from vegetables, fruit, food waste and other organic household waste every day.

If these leftover vegetables, fruit and food scraps are left and thrown away, they will of course become waste or kitchen waste which can pollute the surrounding environment, thereby producing methane gas which will certainly contribute to worsening global warming. Apart from that, there is no final disposal site (TPA) around Citerep Hamlet and a lack of rubbish disposal sites which is a problem. The rubbish dump is provided in the hamlet, but it is located in an oil palm plantation adjacent to the entrance to Citerep Hamlet. This of course disrupts the surrounding landscape and health and causes land pollution. In connection with the problems related to rubbish and waste faced, the community service team took the initiative to provide education and outreach on ecoenzymes as an effort to reduce household organic waste.

The creation of ecoenzymes not only helps reduce waste disposal in landfills but also becomes an alternative to reducing the use of synthetic chemicals(Muliarta and Darmawan, 2021). Ecoenzym is a discovery from DR. Rosukon Poompanyong from Thailand(Megah, Dewi, & Wilany, 2018) and introduced more widely by Dr. Joean Oon, researcher from Malaysia(Sasetyaningtyas, 2021).. Ecoenzym is a solution of complex organic substances produced from the fermentation process of organic residues originating from organic waste (vegetable and fruit residues), sugar and water. The use of different fruit and vegetable residues shows different enzyme activity and antimicrobial activity(Karuna Neupane and Rama Khadka, 2019). The resulting liquid is dark brown in color according to the color of the molasses used and has a strong sour/fresh aroma depending on the filling ingredients used.(M. Hemalatha, 2020).Ecoenzymes have been shown to have potential benefits in waste degradation and environmental improvement(Ardianita, 2023). Ecoenzymes also have the potential to contribute to waste management and sanitation, such as controlling lake water quality(Pharma, 2022). Ecoenzymes are versatile in providing fruit-derived benefits in various fields, including agriculture, waste management, and sanitation (Eskund ari et al., 2022).

This ecoenzyme requires a fermentation time of 3 months which produces O<sub>3</sub> or ozone. Ecoenzyme contains Flavonoids, Alkaloids, Quinones, Saponins with the presence of different metabolites. The IR spectrum shows the presence of -OH, COOH groups. Also, Amylase, protease and lipase are found in the filtrate(Vama and Cherekar, 2020). Based on this background, the problem in this service is how to socialize and train ecoenzymes in Citerep Merak Inner hamlet as a multifunctional liquid to reduce household organic waste. Meanwhile, the aim to be achieved from this activity is to provide outreach and training to the Citerep Hamlet community regarding the use of organic waste into ecoenzymes.

## METHODS

The method used is a socialization and training method to increase understanding and awareness of the Citerep Hamlet community regarding reducing household organic waste through making ecoenzymes. The target audience for the service is a sample of at least 20 residents to serve as socialization and training participants. Next, the service team prepares tools and materials for service activities. This activity was based on collaboration with the Citerep Hamlet cadre women and the head of RT 01-07.

The activity implementation stage includes the initial stage, core and closing stages. The initial stage consists of an interview process with participants regarding their initial knowledge regarding ecoenzymes with the aim of providing direction regarding the manufacture of ecoenzymes and explaining ecoenzym material. Then there was socialization regarding ecoenzymes as well as collecting Family Cards (KK) which were directly delivered by the 2022 KKN service team and assisted by the Citerep Hamlet cadre head, this activity was carried out on July 2 2022, the output of this activity was preparing and collecting household organic waste, especially leftover vegetables and fruit.

At the core stage, the service team conducted training on making ecoenzymes which was held on July 16 2022 with the mothers who had attended the previous socialization. At this stage training and training participants are required to bring household kitchen waste in the form of leftover vegetables and fruit. The waste or rubbish will later be weighed in accordance with the rules for making ecoenzyme, namely 270 grams, while for 90 grams of molasses or brown sugar, 1 liter of water and used bottles have been provided. Socialization activities and ecoenzyme training were carried out at the same place, namely in the Al-Ikhlas Multipurpose Building (GSG) Citerep Hamlet. The output of this activity is that the community can mix molasses, pieces of fruit/vegetables and water that is ready to be fermented.

The closing stage is post-activity evaluation. The service team held meetings to discuss the program's weaknesses and successes. At the evaluation stage, the implementation of using ecoenzyme liquid for daily life, such as cleaning the house, was also carried out, while the continuation of activities was coordinated with the village head and PKK women to carry out a program after this activity was completed in the form of making personal ecoenzymes in their respective homes.

## RESULTS AND DISCUSSION

Before holding the first stage of activity, namely the socialization of ecoenzyme material, the Team coordinated first with the cadre leader and the Head of RT 01-07 Citerep Hamlet, with the aim of ensuring that the activities to be held ran smoothly. After that, the Team made an invitation letter with a minimum sample of 20 people or 20 Family Cards (KK). The targets of this activity were women from the Citerep Hamlet community.

### Initial stage

#### Comprehension analysis

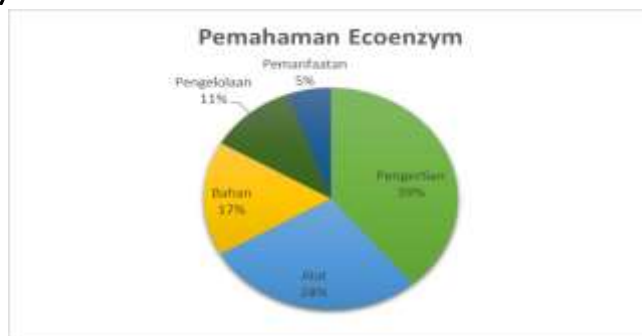


Figure 1. Public understanding of eco-enzymes.

The first stage of the activity will be held on July 2 2022. This activity is the initial stage to find out the extent of understanding regarding ecoenzymes, starting from the definition, tools and materials used, utilization and management. At this stage of analysis, the team obtained the results that of the 20 sample families, only 39% knew about ecoenzymes, 28% knew about tools and 17% about materials, but there were still a few who managed them, only 11% and utilized around 5%. At this stage, it can be seen that residents are still unfamiliar with ecoenzymes.

### Socialization



Figure 2. First Stage Activities, socialization and provision of materials.

The next stage, the team carried out outreach activities to broaden residents' understanding by providing ecoenzyme material as well as explaining what tools and materials are used, as well as explaining what ecoenzyme is and some of the benefits of ecoenzyme. As has been explained, ecoenzyme is a multifunctional liquid which has a multitude of benefits, including in agriculture, households and can even be used as medicine. Ecoenzyme is a solution of complex organic substances produced from the fermentation process of organic residues, sugar and water. This Ecoenzym liquid is dark brown in color and has a strong sour/fresh aroma. The tools and materials used in making ecoenzyme are 1.5 L bottles, water, organic waste which includes vegetable and fruit waste, and molasses or brown sugar. In the process of making ecoenzyme there is a ratio of the ingredients used, the ratio is 10:3:1, this ratio is equivalent to 900g of water: 270g of organic waste: 90g of molasses/brown sugar. The higher the organic acid content, the lower the pH value. Ecoenzyme fluid has a high acid content, high Total Solid (TS), high Total Soluble Solid (TST), citric acid and also contains biocatalytic enzyme activity, namely protease, amylase and lipase(Rasit, Lim, & Azxlina, 2019).

The ingredients for making ecoenzymes have their respective roles. Molasses sugar is a waste substance from sugar production that contains active microorganisms(Rochyani, Utpalasar, & Dahliana, 2020). Molasses can also affect the color of the ecoenzyme produced. The use of brown sugar is highly recommended, because it does not contain bleaching chemical residues. The presence of water acts as a medium for partitioning

between dissolved and suspended solid phases. Meanwhile, fruit pulp containing organic acids is converted into an enzyme solution (Rasit & Mohammad, 2018).

The results of the first stage of the socialization of ecoenzyme material are that mothers have begun to understand what is meant by multipurpose liquid. In this activity mothers are encouraged not to throw away household organic waste but are advised to collect it and later in the second stage of activities training will be held. ecoenzyme. So with this, the reduction of household organic waste has begun to be implemented in accordance with the initial aim of community service in Citerep Hamlet, namely increasing understanding and awareness regarding the dangers of household organic waste if it is simply thrown away.

### **Ecoenzym Training Activities**

The second phase of activities will be carried out on July 16 2022, this activity is ecoenzyme training. Before carrying out the activity of making eco-enzyme liquid, the Team prepared the tools and materials needed, namely: 1). Brown sugar or molasses, 2). Water, and 3). Used 1.5L bottle. Meanwhile, household organic waste in the form of leftover vegetables and fruit is prepared by women from the Citerep Hamlet community. After preparing the tools and materials needed, the next process is to start training or making ecoenzyme solutions with the women of the Citerep Hamlet community.

#### **The manufacturing stages are as follows:**

1. Pour clean water into the bucket. The ratio of water to other ingredients is 10. While the ratio of remaining fruit or vegetables is 3, and the ratio for molasses is 1. So the ratio becomes Water: fruit/vegetable: molasses = 10 : 3 : 1
2. It is important to pay attention to the accumulation of all the materials that will be put into the bucket so that it does not completely fill the volume of the bucket. Space is needed for fermentation gases.
3. Add the molasses and then stir until dissolved with water until homogeneous. Molasses functions as a source of sugar for bacteria to carry out fermentation.
4. Put the fruit and vegetables into their respective buckets. The fruit and vegetables included should be cut into small pieces, weighed according to the specified ratio size and squeezed so that they are small. This aims to ensure that the fermentation process can run well.
5. After all the ingredients are mixed well, close the bottle so that outside air does not enter. This can interfere with the fermentation process (to make it more tight you can also use plastic tied with rubber or raffia) then cover.
6. The ecoenzymes that have been made are stored in a place where sunlight cannot reach them, so the system is completely closed.
7. Complete fermentation takes up to 3 months

The fermentation process takes 3 months, the result is a dark brown organic liquid, this liquid is a complex organic liquid (Rochyani et al., 2020). The eco-enzyme fermentation process usually takes around 90 days or more to produce the optimal amount of enzyme (Fadlurrahman & Aznury, 2022). Ecoenzym can be made with a mixture of orange peels to get fresh results and reduce odor. Based on phytochemical tests, it was found that

the metabolite activity of flavonoids, quinines, saponins and alkaloids can be used as a cleaning fluid and mosquito repellent.(Vama and Cherekar, 2020). However, 3 months is quite a long time so the TEAM cannot monitor it until that time.

Therefore, the alternative used is to provide samples of ecoenzyme that have been fermented for 3 months. These samples are distributed by several mothers to be used as an experiment regarding the benefits of ecoenzyme in the household sector such as washing dishes, washing fruit, replacing floor coverings and so on. Based on the results of the activities in this second stage, it is known that the women of the Citerep Hamlet Community have been able to make ecoenzyme liquid with the guidance of the Team. This training activity is a fun activity for the mothers who have attended and is also a new innovation in utilizing household organic waste, so that it can reduce the disposal of household organic waste around the Citerep Hamlet environment, especially at rubbish dumps in oil palm plantations. At this stage the women of the Citerep Hamlet Community were also very enthusiastic in asking questions and discussing.



**Figure 3.** Level of cutting and mixing of ecoenzym ingredients

The ingredients used, such as leftover fruit and vegetables, are cut into small pieces so that they fit into a bottle container, then mixed in a 1.5 liter aqua container, put in according to the measurements and the top part is given space for empty space, thus minimizing the occurrence of explosions. Because of the presence of gas, a container with a lid that is tight and easy to open is needed so that it is easy to control its development.



**Figure 4.** Process of mixing ingredients and fermentation

This mixing is done to ferment all the existing ingredients, so that later the remaining vegetable and fruit waste will be at the top, and the liquid water at the bottom. It is necessary to control whether there is fungal activity or not. The lid of the container can be opened on the 7th day, month and 3 months. For storage, it's best not to be exposed to direct sunlight, and keep away from chemicals, trash cans, rubbish incinerator, and Wi-Fi. Ecoenzymes have various applications in everyday life. Daily use is used to purify water because it has the ability to reduce impurities in water. In addition, eco-enzymes can function as hand sanitizers and disinfectants because of their bactericidal properties so they can kill microorganisms.(Puspita et al., 2021),and contains acetic acid ( $\text{CH}_3\text{COOH}$ ) which can kill microbes(Mahdia et al., 2020). Ecoenzymes can be a low-cost alternative solution for purifying wastewater(Joseph et al., 2021). Ecoenzymes can also be used to decontaminate dirt on clothes through lipase and protease enzymes which are able to hydrolyze oil and protein.(Gu et al., 2021).

#### **Closing Activities**

Of course there were obstacles to the smooth running of these activities, but during the socialization process there were no too big obstacles, such as late arrival. Meanwhile, the obstacle experienced in the training process is that consideration is needed in determining the appropriate ratio or scale for the fermentation container. If we fill it too full, the fermentation gas can explode because there is not enough space. So, the ratio or weight of the component ingredients must be considered correctly and appropriately.

#### **CONCLUSION**

By implementing socialization and training programs for making ecoenzymes, understanding awareness of the importance of the dangers of household organic waste can greatly increase the knowledge of women in the Citerep Hamlet community. The training activity on making eco-enzymes was also successfully carried out with quite a lot of enthusiasm from the community (active asking questions/high curiosity). In this case, Citerep Hamlet housewives gained knowledge about the meaning, method of making, and

benefits of eco-enzymes and were able to process organic waste, especially vegetable and fruit waste, into a useful product through the activities that had been carried out. Innovation in processing household waste in making ecoenzymes is a solution for reduction.

#### REFERENCE

- Vama, l. And cherekar, m. N., (2020). Production, extraction and uses of eco-enzyme using citrus fruit waste: wealth from waste. *Asian jr. Of microbiol.biotech.env. Sc*, volume 22 (2), pp. 246-351.
- Puspita, d., gentraarinda, f. S., lidi, i. M., refla, s., nugroho, n. W., and kusumaningtyas, f. T., (2021). Inovasi cairan penyanyitasi tangan dari bahan alami. *Biosfer jurnal pendidikan biologi*, 6(1), pp. 25-31.
- Mahdia, a., saafitri, p. A., setiarini, r. F., maherani, v. F., ahsani, m. N., and soenarno, m. S., (2022). Analisis keefektifan ekoenzim sebagai pembersih kandang ayam dari limbah buah jeruk (citrus sp.). *Jurnal ilmu produksi dan teknologi hasil pertanian*, 10(1), pp. 42-46
- Joseph, a., joji, j. G., prince, n. M., rajendran, r., nainamalai, m., and m, v., (2021). Domestic wastewater treatment using garbage enzyme. *Kerala*, s.n.
- Gu, s., xu, d., zhou, f., chen, c., liu, c., tian, m., jiang, a., (2021). The garbage enzyme with chinese honeylocust fruits showed better properties and application than when using the garbage enzyme alone. *Foods*, volume 20, 2656.
- Rochyani, n.-, utpalasari, r. L., & dahliana, i. (2020). Analisis hasil konversi eco enzyme menggunakan nenas (ananas comosus) dan pepaya (carica papaya l.). *Jurnal redoks*, 5(2). <https://doi.org/10.31851/redoks.v5i2.5060>
- Rasit, n., & mohammad, f. S. (2018). Production and characterization of bio catalytic enzyme produced from fermentation of fruit and vegetable wastes and its influence on aquaculture sludge. *Matter: international journal of science and technology*, 4(2), 12–26. <https://doi.org/10.20319/mijst.2018.42.1226>
- Fadlurrahman dan aznury. (2022). Variasi fungsi penerapan ekoenzim dari limbah organik: tinjauan. *Jurnal selulosa* vol. 12 no. 2, desember 2022 hal. 61 – 70
- Ardianita, n., andriani, r., & maya, n. P. (2023). Efektivitas ekoenzim terhadap kelulushidupan ikan lele (clarias sp.) Pada media yang tercemar limbah batik. *Biology natural resources journal*, 2(1), 24–27. <https://doi.org/10.55719/binar.2023.2.1.24-27>
- Farma, dkk. Application of eco enzyme biotechnology as waste management organic for preparation the development of talang lake tourism kabupaten solok west sumatera. *Pelita eksakta: vol.05, no. 01, 2022 pp. 59-64. Doi 10.24036/pelitaeksakta/vol5-iss1/167*
- Ratna dewi eskundari, dkk. (2022). Phytochemical test of several eco-handsanitizer candidates. *Jurnal biologi tropis*, 22(1): 297 –303.
- M. Hemalatha and p. Visantini. (2020) *iop conf. Ser.: mater. Sci. Eng. Doi 10.1088/1757-899x/716/1/012016*

- Lapsia vama and makarand n. Cherekar. (2020). Production, extraction and uses of eco-enzyme using citrus fruit waste: wealth from waste. *Biotech. Env. Sc. Vol. 22 (2) : 346-351*
- I nengah muliarta, & i ketut darmawan. (2021). Processing household organic waste into eco-enzyme as an effort to realize zero waste. *Agriwar journal , 1(1), 6-11*. <https://doi.org/10.22225/aj.1.1.2021.6-11>
- Megah, S. I., Dewi, D. S., & Wilany, E. (2018). Pemanfaatan Limbah Rumah Tangga Digunakan untuk Obat dan Kebersihan. *MINDA BAHARU, 2(1)*. <https://doi.org/10.33373/jmb.v2i1.2275>
- Sasetyaningtyas, D. (2021). Manfaat dan Cara membuat Eco-Enzyme di rumah. *Sustaination.Id*.
- Rasit, N., Lim, H. F., & Azlina, W. (2019). Production and Characterization of Eco Enzyme Produced From Tomato and Orange Wastes and Its Influence on the Aquaculture Sludge. *International Journal of Civil Engineering and Technology, 10(3)*.