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Utilization of Household Waste into Eco-Enzyme in Gitik Village, Rogojampi District, Banyuwangi

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Abstract
The waste heap of Banyuwangi Regency in 2019 was ± 3,387 m^3/day with an increasing trend over the last 10 years. It came from settlements, markets, parks, drainage, and other places, which only part of it could be transported to the landfill due to the declining capacity of the landfill. In addition, waste management services mostly only cover urban areas, while in rural areas are usually carried out on-site by people as did in Gitik Village, Rogojampi District. Waste management did traditionally and partly subscribing to waste transport services. Waste transported by the service is only dumped with an open dumping way, due to the unavailability of landfil facilities in Gitik Village. The existence of waste transport services has not been utilized by all the rural people, because some of them were constrained by the cost of waste service fees. As a result, many piles of household waste are still found in various places that cause environmental pollution. The most common complaint felt by the people regarding the impact of pollution is the pungent smell of waste which usually comes from household organic waste. The solution that can be done to overcome these problems is to process household organic waste into eco-enzymes. The eco-enzyme produced from this program can be used by people for many household activities including farming. In addition, environmental cleanliness can also be improved by reducing the amount of household organic waste that is disposed of around settlements.

Keywords: Waste, Pollution, Organic

I. INTRODUCTION

Banyuwangi Regency is the largest district in East Java (5,782.40 km^2 or equivalent to 12.10% of the total area of East Java Province)[1]. Banyuwangi Regency consists of 25 sub-districts with a population in 2020 of 1,708,114 people[2]. This large population indirectly contributes to the accumulation of waste generated due to people's activities. It recorded that the Banyuwangi Regency waste heap in 2019 was ± 3,387 m^3/day with an increasing trend over the last 10 years[3]. It came from settlements, , markets, parks, drainage, and other places, which only part of it could be transported to the landfill due to the declining capacity of the landfill. This phenomenon is also similar with other areas in Indonesia, such as in Yogyakarta, where technological advances that lead to people lifestyle have contributed to the increase in household waste. Whereas on the

[1] Wikipedia, "Kabupaten Banyuwangi", (24 September 2021), online: *Wikipedia Ensiklopedia Bebas* ‹https://id.wikipedia.org/wiki/Kabupaten_Banyuwangi›.
[2] Badan Pusat Statistik, "Penduduk Banyuwangi menurut Kecamatan, 1980, 1990, 2000, 2010 dan 2020", (23 February 2021), online: ‹https://banyuwangikab.bps.go.id/statictable/2015/01/27/33/penduduk-banyuwangi-menurut-kecamatan-1980-1990-2000-2010-dan-2020.html›.
[3] Dinas Lingkungan Hidup Banyuwangi, "Sosialisasi dan Pemanfaatan Sampah", online: ‹http://dlh.banyuwangikab.go.id/›.

other hand the area designated for the operation of landfill and temporary shelter has not developed significantly so that the overflow condition of them often found[4].

Due to the increase of population every year, it is rare to find the open spaces that can be used for decent housing areas in a city. This is because the open space turned into a dumping ground for various kinds of waste from the results of human activities, in the form of household waste activities, offices, institutions, markets, terminals, restaurants and industry. Broadly speaking, urban waste comes from pollution caused by industries and domestic sectors that produce domestic waste[5].

Currently, waste management in the community still relies on the end-of-pipe approach. The waste is collected first, transported, and then disposed to the landfill. In fact, heaps of waste with large volumes in landfill have the potential to release methane gas (CH_4) which can increase greenhouse gas emissions and contribute to global warming, while decomposition of waste through natural processes requires a long period of time and high cost handling.

In addition to the various problems above, waste management services mostly cover urban areas, so that the dominant rural areas do not receive the same attention. Waste management carried out in rural areas is usually did on-site[6], like the people in Gitik Village, Rogojampi District, who do not have landfill. In addition, in every hamlet in Gitik Village, there is no public trash for the people. The people of Gitik Village traditionally did the waste management like burning, burying, throwing into rivers or empty kailyard, and some peoples subscribe to waste transport services managed by village youth or other parties with a frequency of picking up trash 2-3 days once a week. Waste transported by waste transport services is only dumped behind the Rogojampi Cattle Market by the open dumping way. This activity resulting environmental pollution, both air, soil, and water pollution. Furthermore, the existence of waste transport services has not been utilized by all the rural people, because some of them were constrained by the cost of waste service fees ranging from 15,000-25,000/per month. As a result, many piles of household waste are still found around people's settlements.

The most common complaint felt by the people of Gitik Village is the pungent smell of waste which usually comes from organic household waste. This type of waste cannot be burned immediately because it is usually wet, so it takes several days to get dry and not smelling. Examples of this type of waste include vegetable, fruit, and food waste. Even though household activities that produce organic waste do every day, resulting this type of waste has increased.

The waste has long been a problem for human life. The increase in human activities in the household causes the volume of waste generated from time to time to

[4] Radjali Amin et al, "Pengelolaan timbulan sampah rumah tangga oleh Bumdes Kalurahan Sendangtirto Kapenawon Berbah Kabupaten Sleman" (2021) 4:2 KACANEGARA J Pengabdi Pada Masy 229.
[5] *Peraturan Daerah Kabupaten Banyuwangi, Nomor 9 Tahun 2013 Tentang Pengelolaan Sampah rumah Tangga*, 2013.
[6] Jihan Nabilah, *Evaluasi Pelayanan Pengelolaan Sampah Domestik Dengan Pendekatan Sistem Di Kabupaten Banyuwangi* Universitas Airlangga, 2020) [unpublished].

increase[7]. Therefore, it is necessary to take a step to utilize household waste as a useful object and have a use value. Example of processed waste products that have long been known to the public is compost. However, this compost processing also encounters various obstacles, for example, large-scale processing requires a large area of land. Compost processing on a small scale, for example a household scale is also less effective because it requires a composter and bioactivator tank which is quite expensive, especially if it is not projected on a commercial scale. Compost that is solid is less attractive to its users. The solid form is also more difficult to apply in the field than the liquid form[8]

The way to overcome this problem is by process household organic waste into eco-enzymes that are environmentally friendly and useful. Eco-enzyme products are environmentally friendly that very functional, easy to use, and easy to manufacture[9]. Eco-enzymes are the result of the fermentation of organic kitchen waste such as fruit and vegetable pulp, sugar (molasses, brown sugar, or cane sugar), and water[10]. The principle of making eco-enzyme itself is similar to make compost, but in this process the water is added as a growth medium so that the final product obtained a liquid which is preferred because it is easier to use[11]. The specialty of this eco-enzyme is it does not require a large area for the fermentation process as in the composting process, even this product does not require a composter tub with certain specifications. Empty bottles of mineral water and other products can be reused as eco-enzyme fermentation tanks. It also supports the concept of reuse in saving the environment. Eco-enzyme only requires media as big as a bottle size so it can save processing space and can be applied at home. In addition, eco-enzyme has many benefits such as being used as a plant growth factor, a mixture of floor cleaning detergents, cleaning pesticide residues, descaling, and reducing car radiator temperatures[12]

II. IMPLEMENTATION METHOD

The targets in this service to the community program are housewives in Gitik Village, Rogojampi District. The stages of implementing the program as a solution offered to partners are:

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[7] Guntur Yusuf, "Bioremediasi Limbah Rumah Tangga Dengan Sistem Simulasi Tanaman Air" (2008) 8:2 Bumi Lestari J Environ, online: ‹https://ojs.unud.ac.id/index.php/blje/article/view/2436›.

[8] Atika Luthfiyyah, Yolanda Sylvia P & Aldian Farabi, *Konsep Eco-Community Melalui Pengembangan Eco-Enyme Sebagai USaha Pengolahan Sampah Organik Secara Tuntas PAda Level Rumah Tangga* (IPB, 2010).

[9] *Ibid*.

[10] BPTP Sumbar, "Mengenal Eco Enzym Cairan Multi Fungsi", (6 September 2021), online: ‹http://sumbar.litbang.pertanian.go.id/index.php/info-tek/1948-mengenal-eco-enzym-cairan-multi-fungsi›.

[11] Syarifah Putri Agustini Alkadri & Kristin Damay Asmara, "Pelatihan Pembuatan Eco-Enzyme Sebagai Hand sanitizer dan Desinfektan Pada Masyarakat Dusun Margo Sari Desa Rasau Jaya Tiga Dalam Upaya Mewujudkan Desa Mandiri Tangguh Covid-19 Berbasis Eco-Community" (2020) 17:2 J Bul Al-Ribaath 98.

[12] Adelliya Novianti & I Nengah Muliarta, "Eco-Enzym Based on Household Organic Waste as Multi-Purpose Liquid" (2021) 1:1 13–18.

A. Field Survey

The field survey aimed to find the problem faced by the partner and discussed to determine the method to solve the problem. The location survey was carried out by observing the people in Gitik Village and collecting information from target partners, that are housewives regarding the management of household waste that had been carried out so far and the various impacts felt by the people. Based on the results of the initial survey, it was obtained information regarding the management of household waste by the Gitik Village community which has a negative impact on the environment.

The field survey also aimed to observe the potential of existing resources in Gitik Village. From the results, it was found that the people in Gitik Village used their yards to plant ornamental plants or others. This can be a proponent of community service programs related to the benefits of eco-enzyme applications to household plants.

B. Sosialization of People Service Program

After finding the problem and solution that will be applied to the partners, the next step is to socialize the program to the group of housewives as the main target. This program aimed to introduce the program that will be carried out and as a means to build better communication with the target partners. Program socialization is carried out by socializing the activities to be carried out to local community leaders. The discussion was did regarding the problems and solutions that will be offered to housewives, that is processing household organic waste into eco-enzymes. It is hoped with the involvement of community leaders will help to become a provocateur in the program and after the program is over. The discussions with community leaders went well.

C. Making of Work Planning Program

The making of the work planning program includes counseling activities to the people about how to make eco-enzymes from household organic waste. The people will be explained how to make eco-enzymes, how to handle care, how to harvest and use Eco-enzymes for household needs, and even household agriculture. In this activity also did practice together to make eco-enzymes. The preparation of the work plan program is carried out by discussed in teams with community leaders and the source persons individually.

D. Training and Mentoring

After the target group had sufficient knowledge regarding eco-enzymes, the people were invited to carry out joint practical activities to make eco-enzymes from organic household waste. The target group assisted until they could make Eco-enzyme products and taught how to use them.

E. Monitoring and Evaluation Program

Monitoring and evaluation program is carried out by the team during the program as a program accompaniment to partners. Monitoring and evaluation program will also be carried out internally by the Center for Research and Service (CRS) from the college to assess and evaluate the level of effectiveness of the implemented program.

III. RESULTS AND DISCUSSION

Waste is the residue of human daily activities or natural processes in the form of solid or semi-solid organic or inorganic substances that are biodegradable or non-biodegradable which are considered no longer useful and are disposed of in the environment. [13]Alexander Abe's (2001) explains the types of waste around us are quite diverse, some of which are household waste, industrial waste, market waste, hospital waste, agricultural waste, plantation waste, livestock waste, institutional/office/school waste, etc. Household waste is waste originating from daily activities in the household, excluding feces and specific waste[14]. Most of the household waste is organic material. This includes organic waste, such as kitchen waste, food scraps, wrapping (other than paper, rubber and plastic), flour, vegetables, fruit peels, leaves and twigs. This waste can easily be decomposed through natural processes. Inorganic waste is waste produced from non-biological materials, either in the form of synthetic products or the result of technological processes for processing mining materials. Inorganic waste is divided into: metal waste and its processed products, plastic waste, paper waste, glass and ceramic waste, detergent waste. Most of the inorganic can not be decomposed by nature/microorganisms as a whole (unbiodegradable). Meanwhile, others can only be degrated in a long time. This type of waste at the household level includes plastic bottles, glass bottles, plastic bags, and cans[15].

Utilization of organic waste into eco-enzymes is very suitable to reduce the amount of household waste. It is because the type of household organic waste is the largest proportion of total waste production. The average composition of waste in several big cities in Indonesia is: organic (25%), paper (10%), plastic (18%), wood (12%), metal (11%), cloth (11%), glass (11%), others (12%)[16]. Household waste production alone is around 70-90% of the total waste production in Indonesia[17]. Meanwhile, in Banyuwangi, the waste heap in 2019 was ± 3,387 m^3/day with an increasing trend over the last 10 years[18].

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[13] Alexander Abe, *Perencanaan Daerah : Memperkuat Prakarsa Rakyat Dalam Otonomi Daerah* (Yogyakarta: Lapera Pustaka Utama, 2001).

[14] *Peraturan Daerah Kabupaten Banyuwangi, Nomor 9 Tahun 2013 Tentang Pengelolaan Sampah rumah Tangga*, *supra* note 5.

[15] M al Gelbert, Dwi Prihanto & Suprihatin Agung, *Konsep Pendidikan Lingkungan Hidup dan Wall Chart. Buku Panduan Pendidikan Lingkungan Hidup* (Malang: PPPGT/VEDC, 1996).

[16] Anonim, "What is Garbage Enzyme", (2009), online: ‹www.waystosaveenergy.net›.

[17] Kompasianacom, "Hindari Banjir Sampah 2012", (22 February 2010), online: *KOMPASIANA* ‹https://www.kompasiana.com/ismawatiretno/54ff7d6aa33311184b51029d/hindari-banjir-sampah-2012›.

[18] Dinas Lingkungan Hidup Banyuwangi, *supra* note 3.

This community service program was carried out on Sunday, August 15, 2021, at one of the target partner's house in Gitik Village, Rogojampi District by implementing covid protocols and limiting the number of invitees attending. The counseling activity was carried out by inviting speaker, Mrs. Suartini, who is an environmental activist and is actively involved in the production of eco-enzymes.

The counseling process started with open remarks from the service team, followed by the presentation about eco-enzymes by Mrs. Suartini. Eco-enzyme was developed by Dr. Rosukon Poompanvong, founder of the Thai Organic Farming Association, which has been researched for 30 years, and was introduced more widely by Dr. Joean Oon, a Naturopathy researcher from Penang, Malaysia. Eco-enzyme is a versatile liquid generated from anaerobic fermentation for 90 days[19] from fruit and vegetable residues, sugar, and water.

The materials used to make eco-enzymes will determine the content of the eco-enzyme product. The proximate test of orange peel contains 20.6% carbohydrates, 13.9% pineapple peel, 3.7% water spinach and 2.9% mushrooms. The water content in orange and pineapple peels is 76.01% and 82.72%, respectively. The water content is lower than spinach and mushrooms that are 94.18% and 95.21%, respectively. During the initial week to 12 weeks, carbohydrate degradation occurs and generate reducing sugars, acid compounds, and alcohol. The level of reducing sugar in eco-enzymes from fruit waste material reached 14.35% and 33.53% in the 3rd and 6th weeks, respectively. Meanwhile, the reducing sugar content in vegetable waste was 12.78% and 13.28%, respectively. This showed that the increase of reducing sugar in fruits was greater and faster, because fruit waste had a higher carbohydrate content than vegetables[20]. The total acid compounds of orange and pineapple peels in the early and 6th weeks were 0.36% and 1.62%, respectively. Meanwhile, vegetable waste were 0.36% and 1.44%. This results indicate that the increase in the total level of eco-enzyme acid from fruit peel waste was higher than vegetable waste. During the fermentation process, carbohydrates will be fermented into reducing sugars first and followed by primary metabolites or the formation of acids and alcohols[21].

The Eco-enzyme solution contains many types of natural enzymes derived from fruits and vegetables, as well as those produced by microbes. Each type of enzyme has an important function in a biochemical process. During fermentation, fruit and vegetable waste will be degraded into simple compounds. The presence of nutrients during fermentation greatly affects the growth of microorganisms, and the number of microorganisms will decrease over time, which where this affects the production of enzymes[22]. Therefore, eco-enzymes have many benefits in the fields of health, agriculture, and environmental quality improvement, including being used as organic plant fertilizers, compost mixtures, healing various types of wounds, aromatherapy

[19] Kennedy Napitupulu, *Degradation of Fruit and Vegetable Wastes in Ecoenzyme Production* IPB University, 2021) [unpublished].
[20] *Ibid.*
[21] *Ibid.*
[22] *Ibid.*

liquids, air purifiers, hand sanitizers, dish soap and clothes detergents, cleaning toilet drains, and various other benefits[23].

The application of the use of eco-enzymes in daily life was also clearly conveyed in this activity. For use on the body, eco-enzyme can be directly sprayed on the injured body part without being diluted. The application of eco-enzymes in daily life was also clearly demonstrated in this activity. For body using, eco-enzyme can be sprayed directly on the injured body part without being diluted. The complete dose of eco-enzyme application for daily needs described as follow:

Table 1. Eco-Enzyme Application Dose

No.	Application	Dose	Function/Description
1	Cleaning the stove and kitchen area	EE + soap + water = 1 : 1 : 5 or 10	Helps clean oil
2	Wash dishes	EE + soap + water = 1 : 1 : 5 or 10	Helps clean oil and bad smell
3	Wash clothes	EE + detergent + water = 1 : 500 - 1000	Removes stains and maintains fabric color. Soak a few minutes
4	Mopping the floor	EE + water 1-2 bottle cap + 1 bucket of water	Kills germs and oil, reduces insects and mice
5	Cleaning the bathroom/closet	Pure EE	Easy to clean, removes odors, does not clog easily, helps decompose bacteria in the septic tank
6	Eliminates pesticide, herbicide and insecticide residues on fruits and vegetables	EE + water = 1 bottle cap + 1 bucket of water	Soak the vegetables in a basin for 45 minutes
7	Mouthwash and toothbrush	EE + water = 10 ml : ½ glass of water	Freshen the mouth, prevent bleeding gums and canker sores
8.	Washing hair	EE + shampoo + water = 1:1:5 or 10	Prevents hair loss, dandruff and dandruff
9.	Take a shower, wash your hands	EE + soap + water = 1:1:5 or 10	Moisturizing skin, anti-allergy and itching
10.	Hand sanitizer	EE + water = 1ml : 400 ml	Clean germs
11.	Air purifier	EE + water = 1ml : 1000 ml	Cleans germs in the air

[23] Eco Enzyme Nusantara, *Modul Belajar Pembuatan Ecoenzyme 2020* (Eco Enzyme Nusantara, 2020).

12.	Body detox	EE + warm water (30-40°C) = 30 ml : 1 basin of water	Soak feet in a basin / bucket that has been given EE 20-30 minutes. Cover the entire leg with a towel. Can reduce or eliminate symptoms of cracked feet, hands and feet
13.	Ulcers/scratches	Pure EE	Compress/oil
14.	Anti radiation	Pure EE	Put it in a closed bottle and place it near electronic equipment
15.	Organic fertilizer	Pure EE + water = 1 : 1000	It is applied by spraying or pouring close to the roots
16.	Pet cleaner	EE + water = 1:5-10	Eliminate pet body odor, reduce parasite growth, improve skin condition

The ability of eco-enzyme liquid as a disinfectant is due to the presence of acetic acid (H_3COOH) which can kill germs, viruses, and bacteria, in addition to the various enzymes contained in it which function the same. Eco-enzyme made from apple slices has 456 OTU bacteria and 133 fungi with amylase, cellulase, lipase, and protease enzymes. In addition, there are trypsin enzymes which also play a role in preventing/eliminating pathogenic bacteria[24]. and Ecoenzyme added with pieces of gleditsia sinensis have 3x higher cellulase content[25].

Amylase is the most important enzyme in the washing industry. Some literature shows that it is able to degrade starchy food residues[26]. Cellulase has a role as a color lightener in detergents[27]. Lipase absorb the surface of the fabric to form a stable fiber lipase compound, and hydrolyze the remaining oil on the surface of the fabric during washing[28]. These compounds make eco-enzyme more effective used as detergents, even though their content is very small. The product has been widely used as a detergent components in recent years because of its low toxicity, non-corrosiveness, environmental friendliness, excellent degradation and environmental improvement[29]

[24] Neny- Rochyani, Rih Laksmi Utpalasari & Inka Dahliana, "Analisis Hasil Konversi Eco Enzyme Menggunakan Nenas (Ananas comosus) dan Pepaya (Carica papaya L.)" (2020) 5:2 J Redoks 135–140.
[25] Sitong Gu et al, "The Garbage Enzyme with Chinese Hoenylocust Fruits Showed Better Properties and Application than When Using the Garbage Enzyme Alone" (2021) 10:11 Foods 2656.
[26] Paula Souza & Pérola Magalhães, "Application of Microbial α-Amylase In Industry—A Review" (2010) 41 Braz J Microbiol Publ Braz Soc Microbiol 850–61.
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[28] Sanjay Sahay & Deepak Chauhan, "Study on the Potential of Cold-Active Lipases from Psychrotrophic Fungi for Detergent Formulation" (2018) 16 J Genet Eng Biotechnol.
[29] M Reddy et al, "Effective Feather Degradation and Keratinase Production by Bacillus pumilus GRK for its Application as bio-Detergent Additive" (2017) 243 Bioresour Technol; Ashwina Singh et al,

Beside application of eco-enzyme liquid, the residue from the eco-enzyme fermentation can still be used as solid fertilizer for plants by applying it around plant roots. The dreg can also be dried first, then crushed and buried in the ground. Or it can be reused as material for making new eco-enzyme[30]. In counseling activities of eco-enzymes application, it was guided by source persons. The practice of applying eco-enzymes to plants and the body was also carried out, so that target partners understood and able to apply eco-enzymes properly and correctly.

After the counseling activities was did, as a tangible manifestation of this program, the team did practical activities to make eco-enzyme and it application techniques (Figure 1). The tools needed to make eco-enzyme included closed plastic containers (open from glass), knives, placemats, scales, plastic bottles for harvesting, pH meters or litmus paper, and stationery. The use of bottles as eco-enzyme fermentation containers should have a wide-mouthed lid, can be large or small and made of plastic. The use of glass bottles is not recommended because they are prone to breakage. In addition to glass bottles, narrow-mouthed bottles are also not recommended because they are prone to bursting[31]. While the ingredients needed were 1 part of brown sugar/molasses, 3 parts of fruit/vegetable waste, and 10 parts of water[32].

Figure 1. Training of Eco-enzyme Making to Housewife in Gitik Village, Rogojampi

The first step to make eco-enzyme begins by cleaning the plastic container from dirt, measuring its volume, then adding clean water as much as 60% of the volume of the container. The second step is adding sugar according to the dose, which is 10% of the water volume. The next step is adding the remaining pieces of fruit and vegetables, which are 30% by weight of water, then mix them well. The container is then tightly

"Comparative Interaction Study of Amylase and Surfactants for Potential Detergent Formulation" (2018) 261 J Mol Liq.

[30] Yaya Hasanah, "Eco Enzyme and its Benefits for Organic Rice Production and Disinfectant" (2021) 3 J Saintech Transf 119–128.

[31] Eco Enzyme Nusantara, *supra* note 23.

[32] *Ibid.*

closed, labeled with the date of making and harvesting, stirred after a week, and checked after 3 weeks. After 30 days of fermentation, the container should not be opened at all, so that the microbes can carry out the fermentation process properly, resulting in a very good quality eco-enzyme. After the eco-enzyme is put in a tightly closed container, the container is labeled with a description of the date of manufacture and date of harvest. Furthermore, it is stored in a place protected from direct sunlight, has good air circulation, far from flammable places or materials and Wi-fi. When the fermentation process takes place, observations need to be made by opening the lid of the container at the age of 7 days, 30 days, and 90 days. If there are maggots or the smell of sewer, fix the density of the container then place the container (covered) in the morning sun for 30 minutes during 3 days, and check again after 7 days. If the smell of the sewer does not go away after 3 days of drying and a total of 7 days of repair, add the sugar in the initial measure of manufacture, then ferment it again for 1 month.

A good eco-enzyme has a BOD concentration of around 150 mg/l[33] and acidic pH below 4 with a fresh sour aroma typical of fermentation[34]. Lower pH indicates the abundance of organic acid compounds such as acetic acid or citrus acid[35]. Eco-enzyme derived from fruit waste had the lowest pH of 3.32 while vegetable waste was 3.46 at the 6th week. A decrease in pH and an increase in total acid indicated that carbohydrates had been converted to organic acids. The decrease in pH occurred significantly in the 3rd to 6th week which indicated that there was cellulolytic activity of microorganisms that hydrolyze cellulose. These microorganisms produce cellulose enzymes during the fermentation process as a response to the presence of cellulose derived from the fruit/vegetable waste materials used. This process occurs when there is direct contact between the cells of the microorganism and the surface containing cellulose[36].

The fermentation process will also produce alcohol. Alcohol will be produce on the 3rd day of fermentation[37]. The smell of alcohol will appear after 1 month of fermentation, and a fresh sour smell like vinegar will appear after 2 months of fermentation[38]. The increase in alcohol concentration causes a decrease in the density of the ecoenzyme[39]. In addition, the top layer of the solution will appear a layer of fungus and a layer like jelly (Figure 2). If the closing of eco-enzyme is not tight, the fermentation will not successful and this causes contamination which is characterized by the presence of caterpillars in the 3-month-old eco-enzyme fluid[40]. Beside those, Escherichia coli and total coliform are also important indicators that show the solution

[33] I Nengah Muliarta & I Ketut Darmawan, "Processing Household Organic Waste into Eco-Enzyme as an Effort to Realize Zero Waste" (2021) 1:1 Agriwar J 6–11.
[34] Eco Enzyme Nusantara, *supra* note 23.
[35] Raquel Pedrosa Bezerra et al, "Extraction of amylase from fermentation broth in poly (Ethylene Glycol) salt aqueous two-phase system" (2006) 49:4 Braz Arch Biol Technol 547–555; Napitupulu, *supra* note 19.
[36] Napitupulu, *supra* note 19.
[37] *Ibid*.
[38] Eco Enzyme Nusantara, *supra* note 23.
[39] Napitupulu, *supra* note 19.
[40] Eco Enzyme Nusantara, *supra* note 23.

is contaminated or not. On the other hand, the dominant microflora contained in the eco-enzyme solution were Leuconostoc, Acetobacter and Lactobacillus. There are also Hanseniaspora and Kazachstania which are the dominant fungi[41].

Figure 2. Good Eco-enzyme with a White Layer of Fungus

After the eco-enzyme making process was completed, in this counseling activity also presented the example of failed eco-enzyme products due to poor closure, resulting in contamination and the presence of caterpillars in the 3-month-old eco-enzyme liquid. This eco-enzyme liquid cannot be used for body application, but it still can be used as additional nutrients for plants (as fertilizer). The dreg of the eco-enzyme fermentation also can still be used as solid fertilizer for plants[42].

From the program that was carried out, it can be observed and concluded that the target partners were very enthusiastic about counseling activities regarding the making of eco-enzymes. These can be seen from the various questions asked by the target partners regarding eco-enzymes on counseling and the training process. Indeed after the training activity was over, the partner took the initiative to directly make more eco-enzymes by themself with the hope that the more eco-enzymes they made, the more eco-enzymes they would harvest.

The mentoring process from the team after the counseling and training activities completed was carried out directly (offline) and indirectly (online). Online mentoring was carried out by creating a WhatsApp eco-enzyme group to facilitate communication between the team, speaker, and target partners.

After the eco-enzyme making training was completed, a training activity on the correct way to harvest eco-enzyme was carried out, accompanied by the source person, Mrs. Suartini. Eco-enzyme that is old enough to ferment is filtered and then put into a prepared container in the form of a plastic bottle. The dreg from the eco-enzyme sediment are squeezed and filtered to get the maximum eco-enzyme liquid. The liquid then can be stored and used as needed.

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[41] Zhao Chenyang et al, "Micrological Flora and Chemical Ingredient Analysis of Garbage Enzyme" (2019) 27:16 Technol Econ Guide 1–5.

[42] Suswanto Ismadi Megah, Desi Surlitasari Dewi & Eka Wilany, "Pemanfaatan Limbah Rumah Tangga Digunakan Untuk Obat dan Kebersihan" (2018) 2:1 MINDA BAHARU 50.

By making eco-enzymes, it means that we reduce the burden of the landfill due to our organic waste. As much as 60% of the waste in the landfill is organic waste, where poor management can cause many problems. The use of eco-enzyme in the future is predicted not only contribute to reducing the amount of waste disposed of in the landfill but also as effort to create 'zero waste' at the household level. The zero waste framework includes the responsibility of generating waste materials to reduce waste, reuse and recycle[43]. This thinking is rather lead to a philosophical study approach that encourages a change of paradigm in the use and management of natural resources more efficiently, so that all goods or products can be reused or can be decomposed in nature[44]. By using eco-enzymes as a substitute for market household products, we're not only maintain a healthy body, but also save on monthly household expenses. In addition, by making eco-enzyme we help prevent global warming due to overexploitation by humans.

IV. CONCLUSION AND SUGGESTION

The community service team had carried out counseling and training activities on processing household waste into multifunctional and environmentally friendly eco-enzymes to target partners. Partners have been able to understand well the importance of managing household waste and how to use it as an eco-enzyme also its application. It needs to be made to involve all components of society to manage organic household waste in every house so that environmental cleanliness is maintained and reduces household budgeting.

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