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Utilization of Organic Waste into Environmentally Friendly Household Cleaning Agents: Eco-Enzyme

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ABSTRACT

Waste is one of the major problems in terms of preserving the natural environment for humans. When waste is produced in large quantities, improper management will endanger human health and the environment. Making Eco-Enzyme (EE) products from waste, especially organic waste from homes, is one possible answer. Since Eco-Enzyme is made by fermenting organic waste using brown sugar as a substrate, it can be produced on a small scale. The aim of this project is to find out the advantages of producing Eco-Enzyme products from household organic waste, especially fruit and vegetable waste. This experiment uses the method of literature review and simple experimentation. The result of this experiment is an Eco-Enzyme product that is used as a disinfectant, a mixture of floor cleaning detergents, a pesticide residue cleaner, a descaler and a decrease in car radiator temperature, a hand-sanitizer (hand sanitizer) and also a skin wound medicine.

Keywords: Organic Waste, Eco- Enzyme and Fermentation

INTRODUCTION

Waste is still an environmental problem that continues to this day. In addition, the general public is getting used to handling waste that is not environmentally friendly [1]. The latest Sustainable Waste Indonesia (SWI) research shows that up to 24% of waste in Indonesia is still not managed properly. This indicates that due to untreated waste, nearly 65 million tons of waste damage the environment and ecosystem. Meanwhile, only 7% of waste is recycled, and 69% of waste is dumped into landfills. According to the survey, the two most commonly generated types of waste are organic waste (60%) and plastic waste (14%). In addition to lowering plastic recycling rates and increasing the risk of landfill explosions, organic waste in landfills also releases unpleasant odors into the surrounding air. Methane gas is also produced from the decomposition of organic waste. Waste that contains plants and is able to decompose again is called organic waste. There is a difference between dry waste

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and organic waste. Waste is classified as organic waste, such as damp waste, if it comes from food waste such as hides and grains. On the other hand, dry waste includes items such as paper, twigs, and dry leaves. Daily life in the household involves organic waste. A lot of waste decomposes, resulting in environmental damage and disease outbreaks.

In light of this, waste or garbage that becomes a problem can be turned into valuable resources, the most notable of which is the creation of Eco-Enzymes [2]. Eco-enzyme is the product of fermentation, which lasts for about three months and involves a mixture of organic waste. This solution is a multipurpose liquid for home, livestock, and agricultural use. It is dark brown in color with a sweet and sour smell. The organic liquid made from sugar, water, and organic waste is called Eco-Enzyme (EE) [3]. Dr. Rasukon Poompanvong, a scientist and environmentalist from Thailand, is the person who invented Eco-Enzyme. His findings have a huge positive impact on the environment. Dr. Rasukon collaborated closely with Thai farmers to create a profitable and ecologically sustainable product. Eco-Enzyme is a multifunctional liquid made by fermenting fruit peels and vegetable waste with sugar and water [4]. Mimicking food waste into useful items by mimicking the biochemical mechanisms found in nature to create usable enzymes. Disinfectants, floor cleaning detergent blends, pesticide residue removers, descaling and temperature lowering car radiators, hand sanitizers, and skin wound remedies are just some of the benefits.

METHODS

Stage 1. Literature review on March 26, 2024

Stage 2. Preparing tools and materials on April 1, 2024, including molasses, water, organic waste in the form of fruit peels and also raw vegetable scraps, as well as containers/ plastic jars with tight lids, knives, cutting boards, measuring cups and filters. Doing independent practice of the process of making Eco-Enzyme.

Literature Review

Table 1. Results of literature review on organic waste utilization

No	Discussion	Source
1	The by-product of the organic and molecular lime fermentation process is environmentally friendly enzymes. It usually takes 90 days or more for enzyme fermentation to produce the best enzymes.	[5]
2	High-quality and easily reusable materials are used to makeenvironmentally friendly products. The only components required for enzyme synthesis are air, sugar as a carbon source, and organic compoundssuch as meat and sugar. The enzyme has antibacterial and antifungalproperties.	[6]

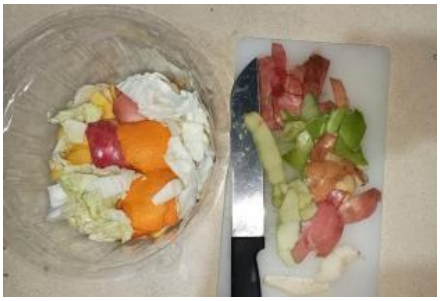
3	Produced from lime and organic gum, this product can be used as a semi-sweet potato, a mild pesticide for potatoes, an air freshener, and a skin brightener.	[7]
4	Eco-Enzyme, the end result of fermentation, are created when organic waste materials, such as fruit and vegetable peels, are combined with molasses ina 10:3:1 ratio. This product performs a number of useful tasks.	[8]
5	Eco-Enzyme is a liquid produced by fermenting organic waste, such as fruit and vegetable scraps, and is used for various daily purposes.	[8]
6	Eco-Enzyme is a liquid made when organic waste is fermented and combined with sugar and water of a certain type. The end product is a dark brown solution that has a fruity aroma.	[9]
7	Eco-Enzyme is produced by fermenting organic waste, such as fresh vegetable and fruit waste, with the addition of a certain amount of brown sugar and water. This makes it highly adaptable and can be used as a product for cleaning bathroom floors, both as a disinfectant and agriculturalfertilizer.	[10]
8	Eco-Enzyme has a high organic content as it is made from organic kitchen waste with added brown sugar as a fermentation substrate.	[11]
9	Since nitrogen is a very important element for plant growth, the applicationof EE can accelerate the process of converting nitrogen molecules into nitrogen macro nutrients, which are needed for soil fertility.	[12]
10	There was counseling and practice of making Eco-Enzyme and the results can reduce organic waste, maintain cleanliness, maintain and care for our earth.	[13]
11	Eco-Enzyme products can be commercialized, thus improving the economyof the local community.	[14]
12	In the process, it can produce O3 (Ozone) gas. This gas is needed by the earth for the sustainability of the ecosystem. The solution of Eco-Enzyme when mixed with water, will react and can produce a liquid that can be used for cleaning.	[15]
13	Eco-enzyme has antioxidant and antibacterial properties that can be used to neutralize wastewater and indoor air and kill bacteria.	[16]
14	During fermentation carbohydrates are converted into volatile acids and in addition, organic acids present in the waste material are also leached into the fermentation solution because the pH of waste enzymes is acidic in nature.	[17]
15	During the enzyme fermentation process, O3 gas is produced, which is a gas known as ozone that has many benefits.	[18]
16	During the first week, the container for making Eco-Enzyme should be opened every day, to remove the gas that appears due to fermentation.	[19]
17	This eco-friendly enzyme liquid has a sour/fresh aroma and is dark brown in color. This versatile liquid can be used as a detergent, house cleaner, and pesticide for plants.	[21]

18	The alcohol and acetic acid content in eco-enzyme can kill germs, viruses and bacteria.	[22]
19	During the fermentation process EE will produce ozone and oxygen equivalent to that produced by 10 trees.	[23]
20	Since cleaning fluids and disinfectants made from synthetic chemicals are often used, producing Eco-Enzyme from organic waste can help people save money and reduce chemical pollution in the environment.	[24]
21	Generates NO3 and CO3 gases that are needed by the soil as nutrients for plants.	[25]
22	Home air purifiers (humidifiers), natural organic fertilizers, rat, fly and cockroach repellents can also be made using Eco-Enzyme.	[26]
23	Enzyme are organic insecticides and herbicides as well as natural hormones for plants and trees.	[27]
24	These containers should be made in the form of plastic containers; glass materials should not be used as they may break due to microbiological fermentation.	[28]
25	prioritizes virtual socialization to turn garbage or organic waste into Eco-friendly cleaning products for the home that use the idea of eco-friendly enzymes, such as hand sanitizers, disinfectants, and antiseptics.	[29]
26	allows partners to turn organic waste from homes that would otherwise be thrown away into compost and other useful items.	[30]
27	Acquire knowledge and educate the community to process householdorganic waste into natural alternatives for organic fertilizers, disinfectants,and cleaning solutions using environmentally friendly technology.	[31]
28	Educate the community on how to convert organic waste into environmentally friendly enzymes that can be used as plant fertilizer in an effort to foster an environmentally conscious mindset.	[32]
29	It is more environmentally friendly and effective to use organic materials made from plants as mosquito repellents. It consists of three substances that are more effective in repelling mosquitoes: capric acid, undecanoic acid, and lauric acid.	[33]
30	Spinach-based Eco-Enzyme is the most successful Eco-Enzyme made forcherry tomato preservation.	[5]

RESULTS AND DISCUSSION

The equipment used is plastic containers with lids, wooden stirrers, scales, cutting knives, and cutting boards. The container used is plastic and has a wide-mouthed lid. It is not recommended to use narrow-mouthed containers because they are prone to exploding, and

glass containers are not allowed to be used because they are prone to breaking. Meanwhile, the materials used are household organic waste in the form of vegetable pieces (such as cabbage and chicory) and fruit peels (such as orange peels, red and green apple peels, and mango peels). All types of fruits/vegetables can be used to make Eco-Enzyme as long as they are unripe (still raw), not dry and not hard, not fatty, not rotten, mouldy and rounded. The type of sugar used is cane brown sugar (molasses).



(a)

(b)

Figure 1. *a) Selection of organic waste, and b) Cutting organic waste (source: personal documentation)*

Clean water sources that can be used are well water, tap water or gallon water [34]. Sugar and starch are the main components of Eco-Enzyme production. These substances will dissolve in water and then break down into proteins, lipids, carbohydrates, and acetyl-CoA. Once the derivatives known as acetic acid compounds are created, ozone will become stable [35].

$$CH_3COOH_{(aq)} + O_{2(g)} + 5O_{2(g)} \rightarrow O_{3(g)} + H_2CO_{3(aq)} + H_2O_{(I)}$$

Bicarbonate/carbonate is an inhibitor that can completely block the radical reaction chain andeven re-form ozone.

$$CO^{2-} + HO \rightarrow CO_3 + OH^-$$

$$CO_3 + O_3 \rightarrow CO^{2-} + O_3$$

The process of making Eco-Enzyme is based on research developed by Megah [36], which begins with the fermentation stage of clean water: Household organic waste: Brown sugar/molasses with the ratio = 10: 3 : 1. Next, stir gently until approximately homogeneous and all ingredients are evenly mixed, then close the container tightly. The next step is to open the container containing the Eco-Enzyme for the first month every day so that the gas produced by the Eco-Enzyme comes out.

For optimal effectiveness, anaerobic enzyme production takes place over a three-month period. Ozone gas (O_3), which is created during fermentation, has the ability to lower carbon dioxide (CO_2) in the atmosphere, which traps heat in the clouds. Global warming and

the greenhouse effect will be reduced as a result. Ammonia is converted by enzymes into nitrate (NO_3), a plant nutrient and natural hormone. In addition, it converts CO_2 into carbonate (CO_3), which is good for marine and plant life. When combined with water, the Eco-Enzyme solution reacts and becomes a cleaner, freshener, and disinfectant. The fermented organic household waste dredging can be used as organic fertilizer and cleaning agent.

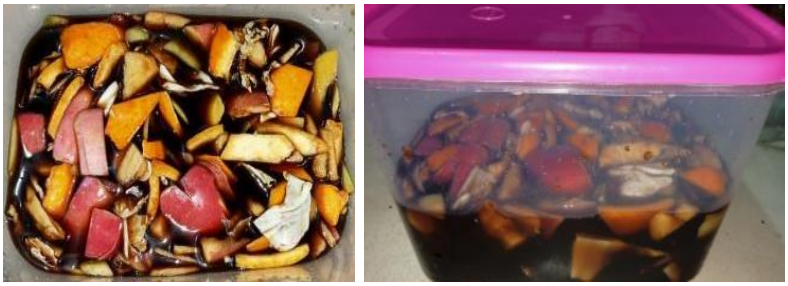


Figure 2. *Fermentation process (Source: personal documentation)*

Fermentation solution containers should be kept out of direct sunlight, with excellent air circulation, and away from chemicals, toilets, trash bins, and trash incinerators to prevent contamination. Standards for container storage are designed to guarantee that the rate of Eco-Enzyme production is optimal and that the final product is of high quality (i.e., free of impurities that could degrade or reduce its benefits and content).

Figure 3. *Eco-enzyme liquid (Source: personal documentation)*

During the fermentation process, the macromolecular polymers of sugar break down, producing alcohol in the first month, vinegar in the second month, and enzymes in the third month. Pitera, or white mold, and mama-enzyme, or a brown jelly-like coating, are the results of fermentation. A kind of rotten mold called pitera is created by the synthesis of Eco-Enzyme. Since it is made from cellulose fibers derived from organic matter, mama- enzyme is a "starter" that creates the enzyme itself from organic waste. This enzyme has a jelly-like

shape. However, the pitera and mama-enzyme molds have only recently emerged and do not indicate that the Eco-Enzyme creation process has been successful [22].

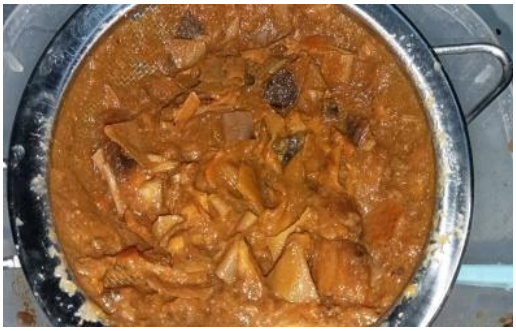


Figure 4. *Fermentation Residue (Source: personal documentation)*

The Eco-Enzyme can be harvested after three months of fermentation; it is then filtered through a cloth and put into a plastic bottle until transparent. The remains can be composted or combined with poor soil in the ratio of one part Eco-Enzyme residue to five parts soil. After that, add fertilizer containing Eco-Enzyme diluted 1:1000 with water, water daily, and watch the soil become more fertile and the plants become beautiful and attractive [37].

CONCLUSION

If waste management is not done properly, it is a serious problem that can harm the ecology. For waste management to benefit society as a whole, proper waste treatment must be provided. By creating Eco-Enzyme for home use, this efficient approach can be achieved. Eco-Enzyme is a multipurpose liquid made from fermented fruit and vegetable scraps along with sugar and water. The main objective of this project was to see if the community could turn household waste from food scraps, such as leftover vegetables or fruit peels, into useful items. This was done in an effort to reduce the amount of waste that accumulates in homes.

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CONFLICT OF INTEREST

The authors declare there is no conflict of interest related to this research article.

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