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## Processing Household Organic Waste into Eco-Enzyme as an Effort to Realize Zero Waste

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### Abstract

*Households have become one of the sources of waste and their utilization so far is also fairly minimal. Household waste tends to end up in landfills when it can be processed into materials of economic value. Waste ingredients such as vegetable waste or fruit peels can be processed into a multipurpose eco-enzyme liquid. Making eco-enzyme is very simple and can be done by anyone. Eco-enzyme is an organic compound in the form of a complex solution resulting from the fermentation process of kitchen waste materials in the form of fruit peels and vegetable waste. The term Eco-enzyme was initiated by Dr. Rosukon Poompanvong, a founder of the Organic Agriculture Association, Thailand who has researched since the 1980s. A Naturopathy researcher from Penang, Malaysia, Dr. Joean Oon later introduced the term more broadly. The use of eco-enzyme in its development is expanding, so it is not uncommon to be referred to as a multipurpose liquid. This liquid in the environmental field has been commonly used in liquid waste treatment, lake water purification, improved air, and soil quality. Utilization in the field of health is usually used to prevent hair loss, hives, and hand sanitizer. Eco-enzyme is also commonly used as fertilizer and biopesticide. The creation of eco-enzyme not only helps reduce waste disposal to landfills but also becomes an alternative to reducing the use of synthetic chemicals that are harmful to human health and the environment. Awareness of household waste processing into eco-enzyme is also a step in the effort to realize zero waste at the household level.*

**Keyword:** *Management, organic waste, household, eco-enzyme, zero.*

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### 1. Introduction

Waste in the Law of the Republic of Indonesia Number 18 of 2008 on Waste Management is defined as the rest of human daily activities and or natural processes in solid form. According to [1], the problem of waste management in Indonesia is quite complex due to the increasing amount of waste, public awareness, and policies between regions in different waste management. The increase in waste occurs one of them due to the increasing population and the onset of waste becomes a challenge in its management. The existing waste management technology and policies have not been able to keep up with the increase in waste production [2]. The impact of waste dumped into landfills continues to increase and shorten the utilization life of landfills [3].

One source of waste is household waste, where 48% of household waste is organic and 33% inert materials. Where the inert material in household solid waste is mostly sand produced by household sweeping on unpaved surfaces especially in low-income areas [4]. Family size and income can be important indicators in estimating the amount of waste produced [5]. A small percentage of residents tend to throw their trash into nearby bushes. Practice can lead to the spread of disease, thus requiring intensive health counselling [4]. Composting practice is one of the recommended ways because it is considered to be the most economical and efficient technique among other management options [5].

Processing household waste into eco-enzyme is one of the alternative methods of processing organic waste biologically. The manufacture of eco-enzyme through fermentation of waste of

fruits and vegetables becomes a solution to minimize and reduce waste from the source [6]. Continuous production in large quantities with short time and low cost is needed to meet the needs amid the growing amount of industrial waste [7]. Dissolving non-dissolved organic compounds into dissolved organic compounds is one of the capabilities of eco-enzyme [8]. The presence of enzyme protease, amylase, and lipase will be very useful to lower proteins, carbohydrates, and lipids in the decomposition process [9].

The production of eco-enzyme in the future is expected to not only contribute to the reduction of the amount of waste disposal to landfills but also an effort in establishing zero waste at the household level. The zero-waste framework covers the responsibility of producing waste materials to reduce waste, reuse, and recycle [10]. [11] defines the concept of zero waste as treating waste into zero or no-one condition. This thinking is more on the approach of philosophical studies that encourages a paradigm change 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.

## 2. Materials and Methods

This article is compiled through a library study approach, through the collection of theories and research results sourced from books or scientific journals. The data obtained first in the compilation, for further analysis and made conclusions about the processing of household waste into eco enzyme and its utilization.

A literature review is a simple form of a summary that usually has an organizational pattern with a combination of summary and synthesis [12]. Literature studies play a fundamental role in the disclosure of theory, strengthening arguments, limiting, defining, and explaining key concepts [13]. The results of this study are expected to provide additional information to conduct research and as a basis in exploring the problem.

## 3. Results and Discussion

Processing waste to produce bioproducts will provide added value and be an effort to reduce greenhouse gas production [9]. The production of enzymes using organic waste or eco enzyme has gained significant attention in recent years, due to ongoing demand [14]. Optimization of eco-enzyme production on a large scale with higher hydrolytic enzyme activity should be possible [15]. Eco-Enzyme is a fermented product of fresh waste (fruit and vegetable skin), water, and brown sugar that is claimed as a multipurpose medium for household and agricultural purposes [16].

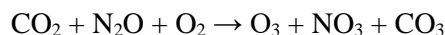
PH Eco-Enzyme is about 3.5 with a BOD concentration of about 150 mg /l [16]. Lower pH values indicate higher organic acids, such as acetic acid or citric acid [17]. Eco Enzyme is Acetic Acid ( $H_3COOH$ ), which can kill germs, viruses, and bacteria. While the enzyme content itself is Lipase, Trypsin, Amylase, and Able to kill/prevent pathogenic bacteria. In addition,  $NO_3$  (Nitrate) and  $CO_3$  (Carbon trioxide) are produced by soil as nutrients [18].

**Table 1.** Characteristics of eco-enzyme [19]

Parameter	Value	Unit
pH	3,59	-
TDS	1107	mg/l
BOD	88,6	mg/l
COD	178	mg/l
MPN	< 3	CFU/100 ml

Eco-enzyme is a complex dark brown color solution resulting from the fermentation of household waste with the composition of waste, water, and brown sugar with a ratio of 3: 10: 1

[20]. According to [18], generally, the fermentation process in the manufacture of eco-Enzyme lasts for 3 months with the reaction that occurs as follows:



### 3.1. Utilization of Eco-enzyme

The manufacture of eco-enzyme does not have to do the fermentation process for 3 months, the duration of fermentation is determined by the allocation of production. Manufacture with the purpose of a disinfectant is enough with a fermentation time of 8-10 days. Fermentation with a maximum time of 10 days has been produced eco-enzyme with an alcohol content of 60-70% and pH reached below 4.0. The resulting product can be used as a disinfectant because it can inhibit the growth of staphylococcus aureus bacteria with a very strong taste force category that ranges from 31.85-34.41 mm [21]. Eco-enzyme can serve as an antifungal, antibacterial, and insecticidal agent. This liquid can also be used as a cleanser, for example, eco-enzyme from orange peel [20].

The difference in materials between vegetable and fruit waste results in differences in enzyme activity and antimicrobial activity. So, garbage enzymes should be utilized to kill or inhibit pathogens at home [22]. Fermentation of organic waste has a variety of benefits, including floor cleaners, vegetable and fruit cleaners, insect repellents, and plant growers [23].

According to [24], the utilization of waste enzymes is developing as part of a viable strategy to process contaminated water. The addition of waste enzymes is proven to increase wastewater BOD which increases in proportion to the number of waste enzymes added. This means that eco-enzymes can be used as additives in wastewater treatment, to eliminate nitrogen and phosphorus ammonia [16]. This eco-friendly enzyme can degrade pollutants or hazardous materials in liquid waste so that it does not harm the environment [25].

Eco-enzyme can be used as a natural fertilizer and biopesticide because the ingredients to make it is kitchen waste which is an organic material. Organic matter can be used to support the growth of microorganisms and sugars source carbohydrates consisting of carbon, oxygen, and hydrogen when decomposed. Protein elements from vegetables will be decomposed into nitrogen that is beneficial for fertilizing the soil [26]. In a study, [27] obtained results if waste-based enzymes were able to improve the characteristics of metal-tainted soils. The processed soil is also able to provide good growth to chili plants and aloe vera. This enzyme of waste fermentation products can also be used as an environmentally friendly vegetable pesticide [28].

### 3.2. Eco-Enzyme Production as an Effort to Realize Zero Waste

The production of environmentally friendly enzymes is part of efforts to recycle waste at the household level. The reuse of waste will help reduce waste and provide economic benefits because eco-enzyme provides multipurpose benefits [19]. Conversion of waste into economically added products in addition to profit is also part of realizing a clean environment [27]. The production of eco-enzyme is an important part of efforts to realize zero waste. According to [29], the point of the concept of zero waste is more on the strategy or steps in managing waste or waste so that nothing is wasted or pollutes the environment. The limitations of the zero-waste framework include the responsibility of waste producers in efforts to reduce waste, reuse, and recycle. To achieve zero waste, an integrated waste management policy is needed, starting from minimizing waste material, recycling to composting.

Eco-enzyme production if done widely in the community can be a way to reduce environmental pollution caused by organic waste sourced from household activities. Education in the community is needed so that the public understands and realizes if the waste produced can be reprocessed to contribute to efforts to reduce environmental pollution [23]. Waste processing into eco-enzyme becomes an effort to optimize the utilization of resources in line with the concept of zero waste. According to [11], the concept of zero waste is the step of treating waste into zero or no-one condition. This thinking is more on the approach of philosophical studies that encourages

a paradigm change 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.

### 3.3. Eco-Enzyme and Climate Change Mitigation

Processing household waste, especially kitchen waste can be a way to reduce waste disposal to landfills. Considering the landfill waste pile will produce methane gas triggering greenhouse gases that have an impact on climate change. So, processing kitchen waste into eco-enzyme is a small step in climate change mitigation. According to [30], waste is a contributor to non-greenhouse emissions in the form of CH<sub>4</sub> gas which has a potential of heating globally 21 times greater than carbon dioxide gas (CO<sub>2</sub>). Where emissions produced from household waste amounted to 1.35 Gg CH<sub>4</sub> and 3.72 Gg CO<sub>2</sub>.

The fermentation process in the production of eco-enzyme is produced by ozone gas (O<sub>3</sub>), where ozone has a role in reducing carbon dioxide (CO<sub>2</sub>) in the atmosphere that trapped heat in the clouds. According to [31], O<sub>3</sub> (ozone) gas produced in eco-enzyme production is needed in the Earth's atmosphere. Eco-enzyme solution when mixed with water, will react and can be used as a cleaning liquid ranging from plates, floors, clothes, latrines, to hair washes and body soap. The fermented organic waste pulp can be used as an ingredient for cleanliness and also as a good organic fertilizer. [32] a said economy can also be used to preserve red and black grapes.

### 4. Conclusion

Eco-enzyme production is not only an effort to reduce the disposal of household waste in landfills but also to add value economically. Economic added value because the environmentally friendly enzyme liquid can be used for various purposes. The field of the environment has been commonly used in liquid waste treatment, lake water purification, improved air, and soil quality. Utilization in the field of health is usually used to prevent hair loss, dandruff, hives, and hand sanitizer. Eco-enzyme is also commonly used as fertilizer and biopesticide.

Processing household waste into eco-enzyme becomes the first step in the implementation of the concept of zero waste at the household level. Producing eco-enzyme means that waste producers are responsible in efforts to reduce waste, reuse, and recycle. Commitment to produce environmentally friendly waste enzymes will be an integrated effort in the reuse of waste materials so that the volume of wasted materials is smaller, even becoming non-existent or zero.

The creation of eco-enzyme is a small step and the first step in efforts to participate in climate change mitigation. The utilization of household waste into waste enzymes will reduce the pile of waste in landfills because the garbage pile will produce methane gas that contributes to global warming. In the process of production of eco-enzyme is also produced ozone gas (O<sub>3</sub>), where ozone has a role in reducing carbon dioxide (CO<sub>2</sub>).

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