Open Acess
Jurnal Biota Vol. 9 No. 1 (2023) https://doi.org/10.19109/Biota.v9i1.13166

Research Article

Analyzing the Quality of Eco-Enzymes Based on Differences in Plant Tissue on the Organic Matter

Nadia Natasya[1], Muhyiatul Fadilah[1]*, Rahmadhani Fitri[1], Siska Alicia Farma[1,2], Martin Simwela[3]

[1] Biology Education, Faculty of Math and Science, Padang State University, West Sumatra, Indonesia

[2] Center of Research on Recycling Organic Waste Management, Universitas Negeri Padang, West Sumatera, Indonesia

[3] Mangochi District Hospital, Malawi, Southeastern Africa

*Email: muhyifadilah@fmipa.unp.ac.id

Received: 08/07/2022	Revised: 14/10/2022	Accepted: 06/11/2022

ABSTRACT

This research focused on analyzing the quality of eco-enzymes based on differences in plant tissue on the organic matter used in the manufacture of eco-enzymes. The purpose of this research was to determine and compare the quality of eco-enzymes made from organic matters, namely pineapple peel (dominated by epidermal tissue) and pineapple flesh (dominated by parenchyma tissue). This research method is an experimental method with 3 repetitions. The parameters in this research were the color of the eco-enzyme solution, the organic matter (condition/texture and position), the aroma of the eco-enzyme, the pH of the eco-enzyme and the presence of pitera fungus. Based on this research, it is known that the eco-enzyme produced has good quality, and after doing a comparison, it is found that between the two eco-enzymes the one with the better quality is the eco-enzyme made from organic pineapple flesh. So, it can be said that the eco-enzyme produced from tissue dominated by parenchyma tissue has better quality than that which is dominated by epidermal tissue.

Key words: *Eco-enzyme; Pineapple flesh; Pineapple peel.*

Introduction

Eco-enzyme or in Indonesian called ekoenzim is a solution of complex organic substances produced from the fermentation process of organic waste, sugar, and water. This eco-enzyme solution is dark brown and has a strong sour/fresh aroma (Hemalatha & Visantini, 2020).

Making eco-enzymes only requires water, sugar as a carbon source, and organic matter and fruit waste. In its manufacture, eco-enzyme requires a container in the form of a container made of plastic, the use of materials made of glass is strictly avoided because it can cause the container to break due to microbial fermentation activity. The type of organic waste that is processed into eco-enzyme is only the rest of raw vegetables or fruit. If you want your organic waste to be processed by a garbage agent, make sure the vegetable and fruit waste is separated from other organic or non-organic waste. Organic waste that is not suitable for use for the manufacture of eco-enzymes includes dry leaves from garden or agricultural waste, banana leaves and banana stems, coconut shells, bagasse, pineapple heads, cassava peels, sweet potato

skins, taro, seeds large grains such as mango seeds, durian, and others. Then the kitchen waste that has been exposed to oil or which is already in a public garbage dump. The fermentation process will last 3 months. In the first month, alcohol will be produced, then in the second month it will produce vinegar and in the third month, it will produce enzymes. In the third month, the eco-enzyme can be harvested. The trick is to filter using cloth that is not used or clothes can also be used for filters (Prasetio, 2021). The process of making eco-enzymes also requires special treatment, such as releasing gas once every two days for the first week, stirring on the 7^{th} and 30^{th} days, and a special storage location as well (Jannah, 2021). According to Yuliana (2022), during the eco-enzyme fermentation process, ozone and oxygen will be produced which is equivalent to that produced by 10 trees.

The principle of the process of making eco-enzyme is almost the same as the process of making compost, but water is added as a growth medium so that the final product obtained is a liquid which is preferred because it is easier to use and has many benefits. The specialty of eco-enzyme compared to composting is that it does not require a large area for the fermentation process as in the composting process, even though this product does not require a composter tank with certain specifications (Junaidi et al., 2021).

During the fermentation process, the reaction takes place: CO_2 + N2O + O2 → O3 + NO3 + CO3. After the fermentation process is complete, a new eco-enzyme (dark brown liquid) is formed. This final result also produces a suspended residue at the bottom which is the rest of the vegetables and fruit. The residue can be used as organic fertilizer (Rochyani et al., 2016). The manufacture of eco-enzymes has a broad positive impact on the global environment and economy (Aurora et al., 2022). According Mar'ah et al., (2021) the eco-enzyme liquid itself can be used as 1) very effective for cleaning floor and room floor vacuum cleaners, 2) can be used as an antiseptic and antibacterial in the bathroom, 3) insecticide, is used to kill insects (mix yeast with water and use it as a spray), 4) Sewer, especially a small sewer cleaning solution as a sewage treatment channel, while according Nurfajriah et al., (2021) to the benefits of eco-enzymes include agriculture (to water plants) and improve the quality of fruit in horticulture), animal husbandry (removing the fishy smell in the aquarium while at the same time nourishing fish), household (washing fruit from pesticide residues, cleaning the floor of the house, etc.), health (relaxation by soaking the feet in warm water that has been mixed with water) eco-enzyme, purifying the air in the room, cleaning the body, mouthwash, natural hand sanitizer, etc.), and many other benefits from eco-enzymes.

Many types of research on eco-enzymes themselves have been carried out, such as the following studies: Vika (2020) researched organoleptic tests including color, aroma, and water content produced by eco-enzymes at harvest, where the organic matter comes from leaves mustard greens, spinach leaves, cassava leaves, banana peels, baby orange peels, pineapple peels, orange peels, papaya peels, watermelon peel, melon peels, mango peels, and yam peels. Rochyani et al., (2016) conducted a study on the analysis of the results of eco-enzyme conversion using pineapple (*Ananas comosus*) and papaya (*Carica papaya* L.), where the purpose of this study was to determine the chemical analysis in the form of pH and TDS from the fermentation of eco-enzymes whose organic matter came from pineapple and papaya. Furthermore, Pratamadina & Wikaningrum (2022) conducted a study on eco-enzyme as a sustainable engineering technology in wastewater treatment, where the purpose of this study was to determine the potential use of eco-enzyme to reduce ammonia concentration in wastewater, as an alternative to sustainable engineering technology and organic materials used namely pineapple peel and pineapple flesh.

From the several studies above, it can be said that no research examines the differences in the quality of eco-enzymes

made from organic materials that have different plant tissues. According to Ramdhani (2021), there are two types of tissue in plants, namely, meristem tissue and adult or permanent tissue. Meristematic tissue, based on its characteristics is grouped into two, namely, primary meristem tissue and secondary meristem tissue. Then, based on the position in the plant body the meristem tissue is grouped into three, namely, apical meristem, intercalary meristem, and lateral meristem. Meanwhile, according to Nugroho (2021), adult tissue based on its constituent cells is divided into simple tissue and complex tissue. Then, based on the function and structure of adult tissue, it is divided into skin / protective /epidermal tissue, ground tissue /parenchyma, strengthening / sclerenchyma, and collenchyma tissue, and transport /vascular tissue.

Therefore, this research focused on analyzing the quality of eco-enzymes based on differences in plant tissue on the organic matter used in the manufacture of eco-enzymes. The purpose of this research was to determine and compare the quality of eco-enzymes made from organic matters, namely pineapple peel (dominated by epidermal tissue) and pineapple flesh (dominated by parenchyma tissue).

Materials and Methods

This research method is an experimental method with 3 repetitions. Where to use water, molasses (palm sugar solution), pineapple peel, and pineapple flesh. The composition ratio of each ingredient is 1 parts molasses, 3 parts pineapple peel/pineapple flesh, and 10 parts waters.

The research was conducted for 1 month, from June 3, 2021, to July 3, 2021. This research was conducted in Jorong Lolo Kaciak, Kenagarian Sako Selatan Pasia Talang, Kec. Sungai Pagu, Kab. Solok Selatan, West Sumatra.

1. Research design: Production of eco-enzyme from pineapple peel (Experiment A).
2. Production of eco-enzyme from pineapple flesh (Experiment B).

The tools used in the manufacture of eco-enzyme are containers, measuring cups, scales, stirring spoons, cutting boards, knives, tape, scissors, stationery, label paper, plastic bottles, filters, and funnels. While the materials used in the manufacture of eco-enzymes are water/aquadest, molasses/palm sugar solution, and organic matters (pineapple peel and pineapple flesh).

The parameters in this research were the color of the eco-enzyme solution, the organic matter (condition/texture and position), the aroma of the eco-enzyme, the pH of the eco-enzyme and the presence of pitera fungus. The data collection method used an instrument consisting of a check list for the occurrence of parameters, and a pH meter.

In this process, all the tools and materials to be used are prepared. In the research that will be conducted, it takes 6 plastic containers (plastic jars) which will later be divided into 3 repetitions (repetition 1, repetition 2, and repetition 3) and each repetition consists of 2 plastic containers.

The ingredients needed to make eco-enzymes are water, molasses and pineapple. For water, use water sourced from PDAM. For molasses, use palm sugar dissolved in water. As for the pineapple, it takes as much as 5 pieces. The parts that will be used are pineapple peel and pineapple flesh, while the pineapple hump is not used because it is hard so that it cannot be used in the manufacture of eco-enzymes. Don't forget, the pineapple peel and pineapple flesh are washed thoroughly before use.

Results and Discussion

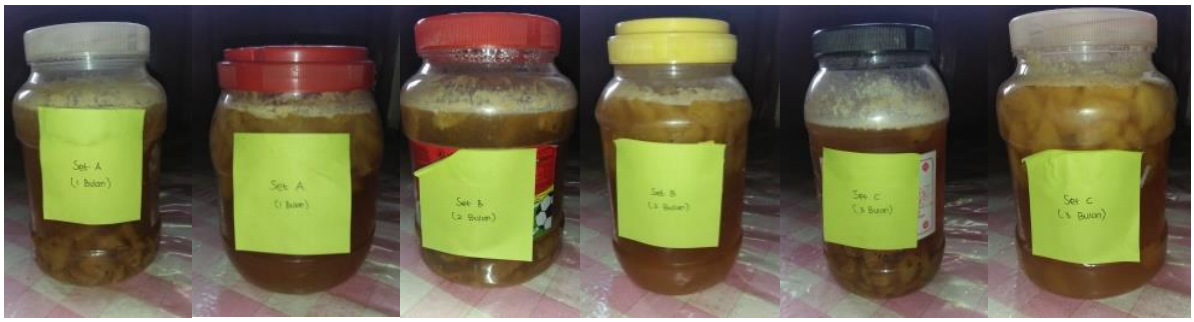
The results of observations made for 1 month (30 days) on eco-enzymes are presented in the table 1 and table 2.

Tabel 1. Eco-enzyme Observations for 30 Days

Repetition	Date	Pineapple Peel					Pineapple flesh				
		Color[1)]	Aroma[2)]	OM [3)]	Fungus[4)]	pH[5)]	Color[1)]	Aroma[2)]	OM[3)]	Fungus[4)]	pH [5)]
1	D2: June 5, 2022	+	+	√ +++	-	-	+	+	√ +++	-	-
	D7: June 10, 2022	+	+	√ ++	+	-	+	+	√ ++	++	-
	D30: July 3, 2022	+++	+	√√ ++	+	3,2	++	+	√ +	++	3,2
2	D2: June 5, 2022	+	+	√ +++	-	-	+	+	√ +++	-	-
	D7: June 10, 2022	+	+	√ ++	+	-	+	+	√ ++	++	-
	D30: July 3, 2022	+++	+	√√ ++	++	3,1	++	+	√ +	+++	3,0
3	D2: June 5, 2022	+	+	√ +++	-	-	+	+	√ +++	-	-
	D7: June 10, 2022	+	+	√ ++	+	-	+	+	√ ++	++	-
	D30: July 3, 2022	+++	+	√√ ++	+	3,2	++	+	√ +	++++	3,1

Tabel 2. Description of how to fill in the table:

Parameter	Description	Symbol
The color of the eco-enzyme solution	Brown	+
	Yellowish brown	++
	Dark brown	+++
The organic matter (OM) (condition/texture and position)	Condition/texture:	
	Very soft	+
	Soft	++
	Loud	+++
	Position:	
	Float	√
	Sink (located at the bottom of the container)	√√
The aroma of the eco-enzyme	Slightly sharp (sour and fresh), pineapple-flavored	+
	Sharp (sour and fresh), pineapple-flavored	++
	Very sharp (sour and fresh), pineapple-flavored	+++
The presence of pitera fungus	Thin	+
	Quite thick	++
	Thickness	+++
	Very thick	++++
The pH of the eco-enzyme	Is filled in as a number and measured on day 30	-



(a) (b) (c)

Figure 1. Eco-enzyme on day 30. a) Repetition 1, b) Repetition 2, c) Repetition 3

(a) (b)

Figure 2. Harvested Eco-Enzymes. a) OM: pineapple peel, b) OM: pineapple flesh

Figure 1 is a picture of eco enzyme on the 30th day that has not been harvested. a) is an image of the eco-enzyme repetition 1, b) is an image of the eco-enzyme repetition 2, c) is an image of the eco-enzyme repetition 3. Where each repetition consists of 2, namely eco-enzyme from organic pineapple peel (on the left), and eco-enzymes from organic pineapple flesh (on the right).

Figure 2 is an eco-enzyme that has been harvested. From the eco-enzyme that has been harvested, we can more clearly compare the color of the eco-enzyme solution and we can measure the pH of the eco-enzyme using a pH meter.

Based on Table 1 and table 2 description, it is known that eco-enzymes derived from pineapple peel (dominated by epidermal tissue) and pineapple flesh (dominated by parenchyma tissue) had a color change in the solution, which was originally brown, changing to dark brown on pineapple peel and yellowish brown on pineapple flesh. The color change is caused by the fermentation process and depends on the combination of organic materials used (Viza, 2022). According to Harahap et al., (2021), eco-enzymes derived from mixed waste (fruits and vegetables or various types of fruit) will be brown. If the color is darker or black, it can be fermented again with the addition of brown sugar as before. Eco-enzymes that come from one type of waste will look brighter and smell more specific, like the smell of pineapple and oranges.

For the eco-enzyme aroma, the pineapple peel and pineapple flesh both have a slightly sweet, sour, fresh aroma typical of fermentation. The presence of a fresh sweet and sour smell typical of the fermentation is due to the eco-enzyme that is made to contain a carboxylic group through an esterification process and produces acetic acid as a final product which can suppress the growth of microorganisms (Vika, 2022). In this study, there was a slight difference in the aroma of the eco-enzyme produced, which was located on whether or not the pineapple aroma was stinging. The eco-enzyme from pineapple peel has a slightly pungent pineapple aroma while the eco-enzyme from pineapple flesh has a quite pungent pineapple aroma.

For pH, only measured on day 30. The eco-enzyme derived from pineapple peel has a pH of 3.2 on average, while the eco-enzyme derived from pineapple flesh has an average pH of 3.1. The low pH of the eco-enzyme is caused by the high content of organic acids. The higher the organic acid content, the lower the pH of the eco-enzyme. This organic acid is a very important thing in determining acidity. Eco-enzyme contains organic acids in the form of acetic acid and lactic acid. The organic acids contained in eco-enzymes are the result of the fermentation process (Viza, 2022). The results in this study are from the literature review that the successful eco-enzymes are those that have a fresh sweet-sour aroma typical of fermentation, pH below 4, and light brown to dark brown (Farma et al., 2021). For the condition and position of the organic material itself, in the eco-enzyme derived from pineapple peel, the texture which originally hard turned soft, and the position of the organic material which originally floated to sink to the bottom of the container, while for the eco-enzyme derived from pineapple flesh, its texture which was originally hard turned into very soft and easily crushed and for the position of the organic material that originally floated, some floated and some sank to the bottom of the container.

During the eco-enzyme fermentation process, there is also a layer of white fungus and there is also a slightly yellowish/yellow color called Pitera. According to (Titiaryanti, 2022), the appearance of a layer of fungus in the fermentation solution is a natural thing. Why pitera fungus? Because this pitera fungus appears due to the fermentation process that occurs in the eco-enzyme solution. This fungus has benefits for skin beauty because it is a rich source of amino acids, peptides, proteins, carbohydrates, organic acids, and many micronutrients such as vitamins and

minerals. From this study, it can be seen that fungus are more abundant in eco-enzymes whose organic matter come from pineapple flesh. This is because pineapple flesh contains more water than pineapple peel, and this supports the emergence of more fungi in the eco-enzyme derived from pineapple flesh. In addition, fruit flesh is the right condition for growing spores on fungi because fungi grow well in humid places (Amalia, 2013). This is the basis for harboring microscopic fungi, and the flesh also provides nutrients and moisture for the fungus to thrive.

Based on the explanation above, it can be said that there are differences in the eco-enzymes produced based on plant tissues used as organic matter in the manufacture of eco-enzymes, namely from pineapple peel which is dominated by epidermal tissue. While the pineapple flesh is dominated by parenchyma tissue. This difference is caused by several things. In terms of color parameters, this color difference occurs depending on the organic materials used in the manufacture of eco-enzymes. Then, in terms of positional parameters of organic matter. Pineapple peel which is dominated by epidermal tissue sinks faster because of its weight has dense cells (Wardhani, 2022), and has little fiber, while pineapple flesh is dominated by parenchyma tissue which has an irregular arrangement of cells and in between, there are intercellular spaces and textures, the flesh is fibrous (Khoirunnisa et al., 2009) so the pineapple flesh sinks more slowly to the bottom of the container. Furthermore, in terms of pH parameters, the pH of the eco-enzyme derived from pineapple flesh is lower than the eco-enzyme derived from pineapple peel because pineapple flesh contains more bromine enzymes. This makes the quality of eco-enzymes derived from pineapple flesh better quality, because the more acidic the pH, the better the eco-enzymes produced (Rudianasari et al., 2021).

Conclusion

Based on this research, it is known that the eco-enzyme produced has good quality, and after doing a comparison, it is found that between the two eco-enzymes the one with the better quality is the eco-enzyme made from organic pineapple flesh. So, it can be said that the eco-enzyme produced from tissue dominated by parenchyma tissue has better quality than that which is dominated by epidermal tissue.

References

Amalia, N. (2013). Identifikasi Jamur *Aspergillus sp*. pada Kacang Tanah (*Arachis hypogaea* L) Yang Dijual Di Pasar Kodim. *Jurnal Analis Kesehatan Klinikal Sains*, *1*(2), 1–10. https://www.academia.edu/6554036/4_identifikasi_jamur

Aurora, I. A. N., & Handayani, D. (2022). Keanekaragaman Cendawan dari Cairan Ecoenzyme dengan Sumber Bahan Organik Berbagai Jenis Kulit Jeruk. *Jurnal Serambi Biologi*, *7*(1), 114-119. Retrieved from https://serambibiologi.ppj.unp.ac.id/index.php/srmb/article/view/47

Farma, S. A., Dezi, H., Irma, L. E. P., Dwi, H. P. (2021). Pemanfaatan Sisa Buah dan Sayur sebagai Produk ECOBY *Eco-enzyme* di Kampus Universitas Negeri Padang. *Suluah Bendang : Jurnal Ilmiah Pengabdian Kepada Masyarakat*, *21*(2), 81-88. https://doi.org/10.24036/sb.01180

Harahap, R. G., Nurmawati., Anggoronadhi, D., Destyariani, L, P. (2021). Pelatihan Pembuatan *Eco-enzyme* Sebagai Alternatif Desinfektan Alami di Masa Pandemi Covid-19 bagi Warga Km. 15 Kelurahan Karang Joang. *Sinar Sang Surya* (*Jurnal Pusat Pengabdian Kepada Masyarakat*), *5*(1), 67-73.

Hemalatha, M., dan Visantini, P. (2020). Potential use of eco-enzyme for the treatment of metal based effluent.

IOP Conf. Series: Materials Science and Engineering, 716, 1-6. http://dx.doi.org/10.1088/1757-899X/716/1/012016

Jannah, M., Nisa, F., Hanifah, A, I., Siska, A, F. (2021). Organoleptic Test of *Eco-enzyme* Product from Vegetable and Fruit Waste. *Prosiding Semnas Bio 2021*, 01, 198-205. https://doi.org/10.24036/prosemnasbio/vol1/29

Junaidi, M. R., dkk. (2021). Pembuatan *Eco-enzyme* Sebagai Solusi Pengolahan Limbah Rumah Tangga. *Jurnal Pembelajaran Pemberdayaan Masyarakat*, *2*(2), 118-123. https://doi.org/10.33474/jp2m.v2i2.10760

Khoirunnisa, F., Abdul, M. (2009). Penentuan Kadar Vitamin C Dan Kadar Serat Kasar Yang Terkandung Dalam Buah-Buahan: Belimbing (*Averhoa Carambola*), Mangga (*Mangifera Indica*), Nanas (*Ananas Comosus*), Dan Pepaya (*Carica Papaya*). *Jurnal Zahra*, *2*(1). https://doi.org/10.31629/zarah.v2i1.22

Mar'ah, S., Siska, A. F. (2021). Pembuatan dan Pemanfaatan Sampah Organik Menjadi Bio *Eco-enzyme* Sebagai Indikator Pupuk Organik Tanaman. *Prosiding Seminar BIO 2021*, *01*, 689-699. https://doi.org/10.24036/prosemnasbio/vol1/89

Nugroho, L. H. (2021). *Struktur dan Produk Jaringan Sekretori Tumbuhan*. Yogyakarta: Gadjah Mada University Press.

Nurfajriah., Fajar, R, I, M., Mohammad, R, W., Halim, M. (2021). Pelatihan Pembuatan *Eco-enzyme* Sebagai Usaha Pengolahan Sampah Organik Pada Level Rumah Tangga. *Jurnal IKRAITH-ABDIMAS*, *4* (3).

Pratamadina, E. Temmy, W. (2022). Potensi Kegunaan *Eco-enzyme* Pada Degradasi Deterjen Dalam air Limbah Domestik. *Serambi Engineering*, *7* (1), 2722-2278. https://doi.org/10.32672/jse.v7i1.3881

Prasetio, V. M., Tia, R., Frida, P. (2021). Manfaat *Eco-enzyme* Pada Lingkungan Hidup Serta Workshop Pembuatan *Eco-enzyme*. *Darmacitya: Jurnal Pengabdian Kepada Masyarakat*, *1*(1), 21-29.

Ramdhani, R. N., dkk. (2021). *Anatomi Tumbuhan*. Medan: Yayasan Kita Menulis.

Rudianasari., Adi, S., Muhammad, Z., Febby, F. S., Nabila, P. N., Rizka, A. (2021). Production of Disinfectant by Utilizing Eco-enzyme from Fruit Peels Waste. *International Journal of Research in Vocational Studies (IJRVOCAS)*, *1*(3), 01-07. https://doi.org/10.53893/ijrvocas.v1i3.53

Rochyani, N., Rih L. U., Inka, D. (2016). 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

Titiaryanti, N. M., Pauliz, B. H., Dina, M. (2022). Pemanfaatan *Eco-enzyme* Sebagai Pupuk Cair Di KWT Sekar Melati. *Jurnal Dharma Bakti-LPPM IST AKPRIND*, *5*(1).

Vika, S. M., Andari, P. A., Endang, T. W. M. (2020). Perbandingan Uji Organoleptik Pada Delapan Variabel Produk Ekoenzim. *Seminar Nasional Edusaintek FMIPA UNIMUS 2020*, *4*. https://prosiding.unimus.ac.id/index.php/edusaintek/article/view/580/582

Viza, R. Y. (2022). Uji Organoleptik *Eco-enzyme* Dari Limbah Kulit Buah. *BIOEDUSAINS* : *Jurnal Pendidikan Biologi dan Sains*, *5* (1). https://doi.org/10.31539/bioedusains.v5i1.3387

Wardhani, S. P. R. (2022). *Intisari Biologi dasar Volume 2*. Yogyakarta: Percetakan Diandra.

Yuliana, S., Dezi, H. (2022). Jenis-jenis Cendawan dari Ampas *Eco-enzyme* Dengan Sumber Bahan Organik Berbagai Jenis Kulit Jeruk. *Serambi Biologi*, *7* (1), 120-12. https://serambibiologi.ppj.unp.ac.id/index.php/srmb/article/view/48