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Effectiveness Assay Of Ecoenzyme Based On Household Organic Waste On The Growth Of *Fusarium Spp*. In Vitro

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ABSTRACT

The aim of this study is to find out how well eco-enzyme (EE), which is made from household waste, stops the pathogenic fungus Fusarium oxysporum from growing. An eco-enzyme is a fermentation solution produced from a mixture of organic waste, sugar, and water. In this study, various types of agricultural waste, such as fruit peels, vegetable waste, or other plants parts, were used US raw materials for making Eco-enzyme. The method used includes making EE with 2 types of raw material composition and various dilution concentrations of eco-enzyme dilution, namely 1: 0; 1: 10; 1:50; and 1: 100. Eco-enzyme testing was carried out in vitro on the growth of F. oxysporum mycelium. The results showed that Ecoenzyme from a mixture of fruit peel and vegetable waste had the highest inhibitory power against F. oxysporum at a dilution variation of 1: 100. This study concludes that ecoenzyme made from agricultural waste has the potential as a biological control agent against F. oxysporum. Using eco-enzymes can be an environmentally friendly solution for controlling plant diseases while reducing agriculture waste and overcoming environmental pollution.

Keywords: Concentration; dilution; eco enzyme; *Fusarium oxysporum*

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1. INTRODUCTION

Eco-enzyme (EE) is a fluid multifunctional product made from organic ingredients through an anaerobic fermentation process. Ecoenzyme own color chocolate young until dark brown and slightly sour, depending on the type of sugar used. Organic materials that are used in the manufacture of eco-enzymes in the form of fruit skin or vegetable waste, such as stem vegetables, are not used. During fermentation, sugar red/sugar cane/molasses is a source of carbon and nutrition for microorganisms. To describe material organic, it becomes more simple. Eco-enzyme products are products that are friendly to the environment, which are very functional, easy to use, and easy to produce. Eco-enzyme is the same as a type of artificial vinegar house that is reduced from alcohol with fermented waste kitchen as a substrate with sugar. Different material standards will naturally give different influences, which are also different from the results of the conversion process that is done. Microbes use sugar additionally as nutrition. Eco-enzyme works as an agent that is antibacterial, antifungal, and insecticidal.

Many scientific articles try to develop ideas for reducing rubbish food house ladder. Good with how to compost and make soil fertilizer, which is rich in good organic materials, processed to become feed for cattle, or utilized as a biofuel to replace fossil fuels. However, because the solution still needs energy and power sources, recent research is starting to lean in that direction, which is more easy, friendly to the environment, and free of waste in converting waste into eco-friendly enzymes. Eco-enzyme produced and used as a fluid cleaner and disinfectant multifunctional. Findings show that eco-enzymes are often used in the field of agriculture as organic liquid fertilizer (Dondo et al., 2023; Lubis et al., 2024) as a natural pesticide, as a disinfectant (Eskundari et al., 2022), as an antibacteria (N. Ginting & Prayitno, 2022), and product cleaner (Gaspersz & Fitrihidajati, 2022),and for application household (as replacement soap and drug gargle). Ecoenzyme as a bioactivator in the fermentation of animal feed from cassava (R. B. Ginting et al., 2023). In life daily, eco-enzyme has many benefits including being able toto break down the

various elements that causewater become dirty, make ecoenzyme as an alternative water purifier. Apart from being a water purifier, ecoenzymecan also be used as a hand sanitizer (Wasito, 2023) and a natural disinfectant because it has bactericidal properties (capable of killing bacteria) and is antimicrobial. Secondary metabolite content, such as alkaloids and flavonoids, tannins, saponins, and the content of lipase, amylase, and the enzyme protease, make ecoenzymes. Also can be utilized as an antimicrobial And acts as a natural disinfectant, so that it is useful in the era of a pandemic. Covid-19. Mechanism compound bioactive in hindered microbes that is with method, hinder function membrane cell, hinder metabolism bacterial energy, and cell membranes across bacteria Because of the gradient pH, which causes the disturbance activity of metabolism in mobile bacteria (Permatananda et al., 2023).

Fusarium spp. is a type of pectate fungus that enters the xylem vessels. Then it is very detrimental because it can attack chili plants from time to time, experiencing further development until ripe, which is called fusarium wilt in horticultural plants such as chili. Cases of this disease attack often occur in the lowlands. Generally, these plants will wither and die within 14-90 days. Although known as a soil-borne pathogen, this fungal infection is not only on the roots but can also infect other organs such as stems, leaves, flowers, and fruits, for example, through wounds. The characteristics of this fungus are attacks on horticultural plants, which are weak due to drought, lack of nutrients, too much sunlight, and too much fruit.

Fusarium oxysporum, or *F. oxysporum,* is a fungal that causes disease in horticultural plants, like wilting in red chili plants, causes disease in tomato plants, and causes rotten stems in vanilla plants. There is lots loss that was caused by the attack of *F. oxysporum*. So far, research has been conducted with biological, chemical, and plant-based agents as pesticides. Utilization chemistry mold If done in a way that is continuous, it will have a negative impact on the environment and also the consumer. For that, it is necessary to use biological agents and convict in a way continuously for the cultivation of *F. oxysporum*. Research on materials that can be used as pesticide vegetables needs to be done in a way over and over again so that the type of pest vegetable that is attacked can be known. Study-related use of ecoenzymes as antifungals Already, there is done, but still limited and not discussing special development eco-enzymes as anti-fungal *Fusarium spp.* on concentration dilution certain. Ecoenzymes with concentrations of 50% and 75% are effective in hindering the growth of bacteria *X. campestris* and *Bacillus sp.; however,* they are ineffective in inhibiting the growth of the mold *Fusarium spp.* (R. K. Salsabila & Winarsih, 2023). Even though thus, eco-enzymes are rated as having potential as anti-pathogenic fungi, contents of secondary metabolites like alkaloids and flavonoids, tannins, and saponins, as well as content enzymes like lipase, amylase, and protease, make eco-enzymes also able to be utilized as anti-mold pathogens to *Fusarium spp.* Study this aiming for knowing the influence of giving ecoenzymes with various concentrations to activity mold pathogens, or antifungal activity of *F. oxysporum,* which furthermore can be used as a natural pesticide.

2. RESEARCH METHOD

This research was conducted in Suka Mulia village, Secanggang sub-district, Langkat; the Agrotechnology study program laboratory, Universitas Pembangunan Panca Budi, Medan; and an in vitro antifungal assay in the Microbiology Laboratory, Faculty of Mathematics and Natural Sciences, USU. Material Which used in making eco-enzyme is waste fruit peel and vegetables, molasses, and water. Fermenter container Wide-mouthed plastic containers are used and own closed.

Material for testing antifungal which used that is NA, alcohol, chloramphenicol, and Aquadest. The tools used are tweezers, a glass beaker, a glass measuring cup, a petri dish, a term push, a caliper, a paper filter, and a ruler.

A. Multifunctional Liquid Manufacturing Ecoenzyme

Ecoenzyme (EE) made with using various types of organic wastewhich consists of a mixture of fruit waste and vegetables and given the sample code Bioz-n (Bioz1 and Bioz2), where is :

Bioz n (n=1) = pineapple peel, orange peel, papaya peel, starfruit, kuini fruit peel (Bioz1)

Bioz n (n=2) = pineapple peel , orange peel, banana stump, noni fruit (Bioz 2)

And this Sample Which tested with ratio EE : water = 0% (pure) for Biozn -0; 1 : 10 (Biozn -1); 1 : 50 (Biozn -2); and 1 : 100 (Biozn -3); for the second Bioz type. EE making is done by use principle 1 : 3 : 10 (1 part carbohydrates: 3 parts fruit waste or vegetables : 10 part water), with ingredientsin the form of 1 kg of molasses, 3 kg of fruit/vegetable waste kg, And 10 L water well. All material mixed until

homogeneous in a container plastic And closed meeting For process anaerobic fermentation for 100 days (Lubis, Wasito, et al., 2024) (Fig 1).

Fig 1. Eco-enzyme Fermentation Process

B. Production of EE with various concentration

Done mixing EE pure (code sample Bioz1-0) with aquadest for making EE with concentration variation 1:10, 1:50, and 1:100 (wt/wt%). For making a concentration of 1:10 (10%) done by taking 10 mL of pure EE and entering it into the receptacle, then adding aquadest until the volume 100 mL (code sample Bioz1-1). Do it the same way, for concentration 1: 50 (2%), namely by taking 2 mL of EE pure and entering it into a receptacle, then adding distilled water until the volume reaches 100 mL (Bioz1-2). For making a concentration of 1:100 (1%), namely by taking 1 mL of pure EE and entering it into a receptacle and adding aquadest until the volume 100 mL (Bioz1-3) (Lubis, Damayanti, et al., 2024). Sample given code Bioz1 and Bioz2, according to the materials used, and ready for tested activity antifungal (Fig. 2).

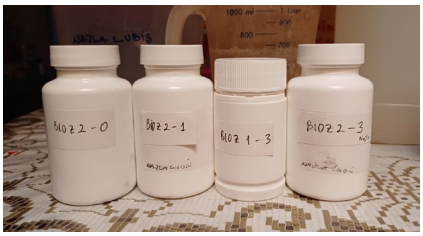


Fig 2. Sample Bioz2

C. Anti-fungal assay

After rejuvenating the return mold, which was used, a microbial suspension is made. Made ecoenzyme solution at concentrations of 1:0, 1:10, 1:50, and 1:100 v/v. Petri dishes filled with suspension 0.3 mL mold test, followed with the addition 15 mL media NA, homogenization, and compaction. For each test concentration, 10 µL of test solution was obtained, deposited on a paper disc, and then placed on media inoculum and incubated at a temperature of 25˚C during 72 hours. Calipers are used to measure the clear zone that forms around the disc and for monitoring the growth of microorganisms, or mold. As a point comparison, 100 IU nystatin was used (Octaviani et al., 2019).

3. RESULTS AND DISCUSSION

A. Results

The results of the ecoenzyme activity test on the fungus F. oxysporum is shown in Table 1. The code the sample given is Bioz1-0 for variation concentration 1 : 10 ; Bioz1-1 For concentration variation 1:50, and Bioz1-3 for variation concentration 1 : 100.

Table 1. Results assay of ecoenzyme to activity Fusarium sp

No	Sample code	Inhibition zone diameter (mm)
	BIOZ1	
1	BIOZ1-0	10,0
2	BIOZ1-1	11,2
3	BIOZ1-2	14,2
4	BIOZ1-3	14,9
	BIOZ2	
1	BIOZ2-0	10,2
2	BIOZ2-1	12,8
3	BIOZ2-2	14,3
4	BIOZ2-3	17,5
Chloramphenicol (control)		22,0

It is at on zone diameter 10-20 mm (Davis & Stout, 1971). Matter This possibility is due to material EE, which owns content skin fruit, combined with part from vegetables. This is in line with previous research. which states that EE from orange peel, pineapple, and papaya contains phenol, which is contained in eco-enzyme liquid and effectively reduces bacterial growth so that it can be used as a natural disinfectant. On sample dilution 1:10 in the antifungal test, it was seen that only a little bacteria or microorganisms would grow (Rusdianasari et al., 2021). Test eco-enzyme activity against *Fusarium fungus sp.* is shown in Fig. 3.

Table 2. Classification of inhibition zones

Diameter ofzone inhibition	Inhibition response
> 20	Very strong
10 – 20	Strong
5 - 10	Medium
< 5	Very weak

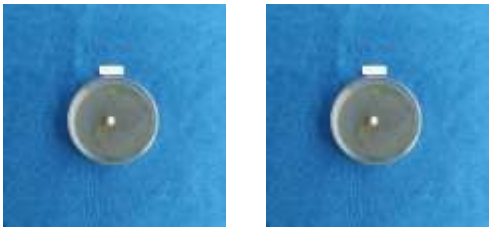
Source : (Davis & Stout, 1971)

B. Discussion

From results study seen that only on concentration 1 : 100 (EE : water) Which own activity resistor (antifungal) toFusarium sp on Bioz1 Which have strong resistance is 14.9 mm, thus also on other concentration variations, namely as big as 11.2 mm (concentration 1:10); 14.2 mm(concentration 1:50), And 10 mm on EE pure(1 : 0), all included in the strong category (Davis & Stout, 1971).

Thus Also brightener Ecoenzyme with code sample Bioz2 — 0 until Bioz2-4. EE own Power resistoragainst the strong Fusarium sp fungus, namely starting from dilution 1:10, 1:50; 1:100;up to 1 : 0 (pure) with zone diameter resistor as big as 12.8 mm, 14.3 mm, 17.5 mm,And 10.2 mm on EE pure without dilution.

With ratio dilution solution1:100 (Bioz1 and Bioz2) is already dilution Which most Good And effective (optimal), with existence zone resistor although including category **strong.**



(a) (b)

Fig 3. Ecoenzyme antifungal activity assay of *Fusarium oxysporum* : a) Bioz1-0 And b) Bioz2-0

In the antifungal activity assay, it was seen that:

- Bioz1 is made from pineapple peel, orange peel, papaya peel, starfruit, kuini fruit peel, then fermented for 100 days.
- Bioz2 is made from pineapple peel , orange peel, banana stump, noni fruit; this is in re-fermentation during 100

Contrary to research, which states that ecoenzyme is made from base skin banana chubby Manado young with a concentration of 50% and 75% effective in hindering growth of bacteria *Xanthomonas campestris* and *Bacillus sp.*

However, no effective hindrance of the growth of *Fusarium sp. activity* test EE against antimicrobials is used to see the inhibitory power of the EE against *Fusarium sp., X. campestris, and Bacillus sp.* As an effective antimicrobial, ecoenzyme made from Manadonese banana skin has effective properties as an antibacterial. Microorganisms that are on ecoenzymes have the ability to produce IAA and break phosphate. Chemical parameters of ecoenzymes derived from skin banana chubby Manado young, which have a pH between 4-5, and have TS and TDS values, which are more tall with increased test concentration, and contain phytochemical compounds, flavonoids, tannins, and saponins, which are reinforced with results from the infrared spectrum, which show existence similarity with group function. Eco-enzyme with a concentration of 50% and 75% is effective in hindering the growth of bacteria *X. campestris* and *Bacillus sp. However*, it is not effective in hindering the growth of the pathogen *Fusarium sp.* (A. Z. Salsabila, 2023).

From results assay activity antifungal on Table 1, proven that EE with dilution 1 : 100 Already functioning as antifungal *F. oxysporum* with category strong, whether derived from Bioz1 or Bioz2 materials,so there is no need to use pure EE For antifungal and also disinfectant experience. *Fusarium spp* . is a type of fungus that enter to in vessels xylem Which Then very harm Because can attacks chili plants starting from the planting period germination until mature Which calledas withered fusarium on plant horticulture such as red chilies and tomatoes. For the prevention of fungal wilt diseaseFusarium, on cultivation plant horticulture can be given ecoenzymes withratio 1 : 100. At this concentration, Eco-enzyme is effective in preventing disease withered fusarium And functioning as pesticide vegetable.ability EE in hinderFungal growth is caused by the presence of antifungal activity may also occur due to the presence of secondary metabolite content, namely alkaloids, flavonoids, and terpenoids. Terpenoids can bother permeability membranecell mold Which result in the occurrence damage to the mitochondrial cristae so that energy Which produced For process growth And development cell become decreases, and fungal growth becomes hampered. Flavonoid Also can hindergrowth pathogen in a way in vitro (Octaviani et al., 2019)

4. CONCLUSION

Ecoenzyme is effective as an anti-mold agent at a concentration of 1:100, so it can be used in disease prevention withered on plant horticulture, which is due to the mold *Fusarium spp.* However, thus, still need to do a study on advanced variation concentration, which is other than above 1:100, and activity tests on other fungal pathogens

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