Circocus, Liquid Organic Eco-Enzymes As A Utilization Of Citrus Waste In Dau District

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ABSTRACT

Dau district has the distinction of being the largest citrus producer in Malang district. However, the distribution process is ineffective, resulting in an abundance of citrus waste. This has a negative impact on environmental health. The objective of this research is to optimize the utilization of citrus fruit waste into eco-enzymes to enhance the use value of citrus waste. The experimental design employed in this study utilizes a complete randomized design (CRD), wherein the tested treatments are administered to plants at random. The results of the effect of eco-enzymes were analyzed using quantitative descriptive methods. The results demonstrated that Circocus eco-enzymes exhibited a pH range of 3-4 and a temperature range of 23-25°C. Eco-enzymes have a positive impact on the environment, such as pest control and providing nutrients for plants. They are also easy to produce and apply.

Keywords: *Citrus waste, liquid organic fertilizer, and papaya leaf.*

INTRODUCTION

Indonesia is an agrarian country with high productivity of fruits. Oranges are a fruit commodity that is widely consumed by the people of Indonesia. Orange fruits can be found throughout the year, as they are not seasonal. Orange trees grow well in both lowland and highland areas. Dau District, Malang Regency, is one of the largest orange-producing centres in Indonesia. The geographical location, which is at an altitude of 763-1,299 meters, with rainfall of 100-1,300 mm per year, temperatures of 13-35°C, and humidity of 70-80%, meets the requirements for orange trees to grow well. The productivity of orange plants in one hectare, consisting of 512 plants at harvest time, can yield 25.6 tons.

The high productivity of citrus plants is inversely proportional to the efficiency of their distribution process. Consequently, large quantities of orange peels and inedible fruits accumulate as organic waste. The improper management and subsequent decomposition of these oranges, which could have otherwise been consumed, significantly harm both farmers and local communities. This is due to the negative environmental impacts of decomposition, such as water and soil pollution, and the generation of unpleasant odours.

Orange peels are rich in macro- and micronutrients that benefit both plants and soil. Additionally, they contain phenolic compounds with antimicrobial and antioxidant properties (Indrastuti N, et al., 2020), making them suitable for Eco Enzyme production. Eco Enzyme is produced by fermenting organic waste—specifically fruit or vegetable residues, sugar, and water—and contains essential nutrients such as nitrogen (N), phosphorus (P), potassium (K), and organic carbon (Istanti et al., 2023). Utilizing Eco Enzyme provides an environmentally friendly solution for reducing pollution and offers added value to the community.

So far, people tend to dispose of orange waste without further processing, even though this waste actually has great potential to be reused as products with both economic and environmental value, such as organic fertilizer, eco-enzyme, alternative chemicals, and many others. Unfortunately, there has not been much research or application at the local level to process orange waste into an eco-enzyme. The utilization of eco-enzymes can be an environmentally friendly solution to reduce pollution while also providing added value for the community. Therefore, the author develops "CIRCOCUS, LIQUID ORGANIC" as an eco-enzyme. Here, the researcher examines the pH and temperature of the eco-enzyme as well as its benefits.

MATERIALS AND METHODOLOGY

A. Research Duration

The time used by the researcher for this study was carried out from March to September 2024, within a period of approximately six (6) months, consisting of 2 months for data collection and 4 months for data processing, which included the preparation of the scientific paper and the supervision process. The research was conducted at SMA Ar-Rohmah Putri IIBS Malang, located at Jl. Raya Sempu No.1, Gadingkulon, Dau District, Malang, East Java 65151.

In this research, several tools and materials were required. The tools needed included a used 5-liter gallon, a knife, a cutting board, a stirrer (wooden stick), a gallon lid for fermentation, a measuring cup, and a digital scale. The materials required were 1 kg of rotten oranges, 200 ml of liquid palm sugar, 1 liter of coconut water, 400 ml of rice-washing water, and 400 ml of clean water. The process of creating an eco-enzyme was shown in Figure 1.

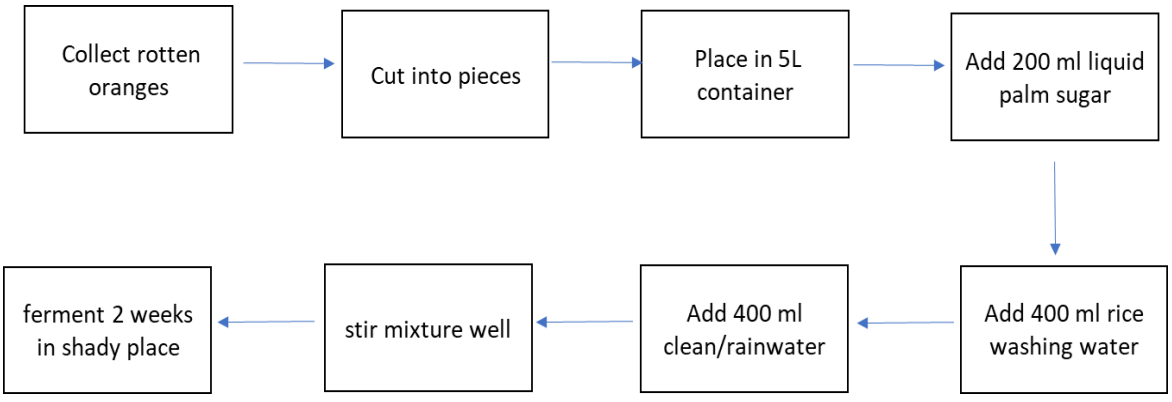

Figure 1. The process for creating eco-enzyme from orange skin

B. Data Analysis Technique

The author employs two combined research methods, namely literature review and quantitative descriptive analysis. A literature review is a systematic and critical summary of recent research on a particular theme, involving the review and integration of findings from previous studies to obtain a deeper understanding (Raut, A. P., 2025). The author uses the literature review method because secondary data sourced from existing theories are utilized and integrated into this research.

Quantitative descriptive analysis is a statistical method used to describe, summarize, and analyze quantitative data. Its purpose is to provide a clear and detailed description of the data that has been collected, thereby facilitating interpretation and decision-making based on the data (Nurul Aziza, 2023).

RESULTS AND DISCUSSION

Organoleptic Test

The results of the analysis of the influence of pH and temperature on Circocus, a Eco Enzyme made from orange waste, which has been analyzed in the Biology Laboratory of SMA Ar-Rohmah International Islamic Boarding School Malang. The result of pH and temperature shown in Figure 2.1 and Figure 2.2.

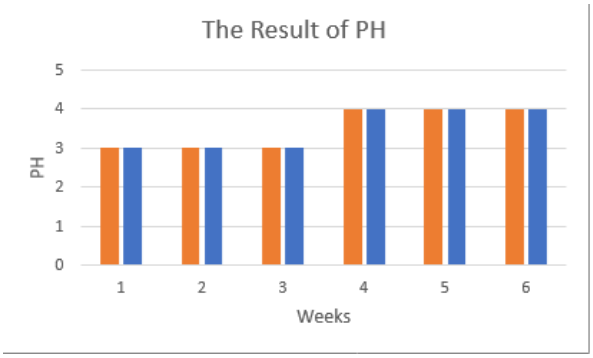

Figure 2.1. pH measurement results

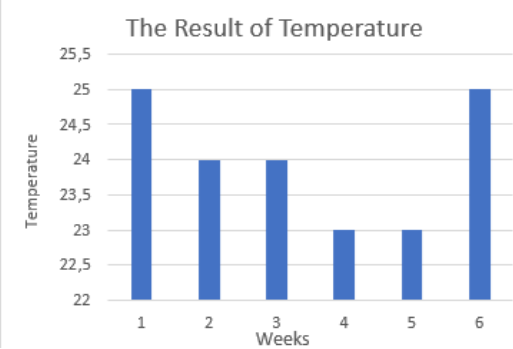

Figure 2.2. temperature measurement results

The measurement results of pH (Figure 2.1) and temperature (Figure 2.2) indicate that the fermentation of the eco-enzyme from orange waste proceeded well, although optimal conditions had not yet been achieved. The average pH value ranged from 3 to 4, indicating the acidic nature of the solution. This condition aligns with the characteristics of oranges, which are rich in citric acid. It is consistent with the findings of Sulfianti (2021), who reported that the fermentation of acidic fruits resulted in a final pH of 3.5–4.5. Rahayu et al. (2019) also found that the fermentation of fruit waste resulted in a pH of approximately 4.1. This low pH value indicates that the activity of decomposer microbes successfully broke down the substrate, resulting in the formation of organic acid compounds, which serve as an indicator of successful fermentation.

Meanwhile, the solution temperature during fermentation was recorded in the range of 23–25 °C, which is considered room temperature. This value has not yet reached the optimal range for microbial activity (28–40 °C) as reported by Purba (2019) and Sulfianti (2021). The relatively low temperature may inhibit the metabolic rate of microbes, resulting in a slower decomposition process compared to optimal conditions. However, even though the temperature was not ideal, fermentation still resulted in a low pH because acidophilic microorganisms can adapt at the cellular level to regulate pH. Many extracellular enzymes from acidophiles are known to function at much lower pH than cytoplasmic pH (Icer et al., 2022).

The combination of acidic pH and room temperature also has implications for the function of the eco-enzyme. Low pH supports the eco-enzyme's properties as a natural antimicrobial solution, making it effective for use as a cleaning liquid and an inhibitor of pathogen growth (Pratiwi et al., 2020). On the other hand, room temperature shows that the eco-enzyme fermentation process can be carried out simply in the community without the need for special temperature control, making its application and utilization easier at the household or organic farming scale (Sulastri et al., 2021). Thus, the results of pH and temperature measurements not only reflect the success of the fermentation process but also strengthen the applicative potential of eco-enzyme as an environmentally friendly product.

No.	Author	Title	Journal
1.	Dwi Hardestyariki, Dwi Puspa Indriani, Kamila Alawiyah, Doni Setiawan, Marieska Verawaty, Elsa Fitria Apriani, Annisa Amriani, Rennie Puspa Novita (2025)	Pemberdayaan Masyarakat Dalam Pembuatan Eco-Enzyme Berbasis Rumah Tangga Di Desa Tanjung Pering Indralaya Utara.	Pelita Sriwijaya, Vol. 4. No. 1, 2025
2.	Fahruddin Wakano (2024)	Potensi Eco-Enzyme Dalam Meningkatkan Pertumbuhan Dan Produksi Tanaman	JURNAL GALLUS-GALLUS Vol. 2 No. 3, Juli 2024, hlm. 38 - 44, eISSN: 2985-640X
3.	Terry Pakki, Robiatul Adawiyah*, Agung Yuswana, Namriah, Muhammad Arief Dirgantoro, Agustono Slamet (2021)	Pemanfaatan Eco-Enzyme Berbahan Dasar Sisa Bahan Organik Rumah Tangga Dalam Budidaya Tanaman Sayuran Di Pekarangan	Prosiding PEPADU 2021 Seminar Nasional Pengabdian kepada Masyarakat Tahun 2021 e-ISSN: 2715-5811 Vol. 3, 2021 LPPM Universitas Mataram
4.	Solfiyeni, Mairawita, Mildawati, Chairul, Suwirmen, Aldi Yulianda, Kasman Karimi, Tibrani (2023)	Pemanfaatan Sampah Kulit Jeruk (*Citrus Nobilis Lour.)* Sebagai Eco Enzyme Di Desa Kolok Nan Tuo, Kecamatan Barangin, Sawahlunto	Abdi Inovatif (Pengabdian Kepada Masyarakat), Vol. 2, No. 2 (2023)

5.	Marce Monica Gaspersz*, Herlina Fitrihidajati	Pemanfaatan Ekoenzim Berbahan Limbah Kulit Jeruk dan Kulit Nanas sebagai Agen Bioremediasi LAS Deterjen	LenteraBio, 2022; Volume 11, Nomor 3: 503-513

Figure 3. Table of reference journals

This research is based on an article that examines eco-enzymes made from oranges. The researcher synthesized data from various research journals related to the topic to eliminate irrelevant data and combine related information to strengthen the scientific arguments in the study. The table below lists the journals used by the researcher as references:

Research conducted by Terry Pakki (2021) indicates that eco-enzymes can be effectively used as soil fertilizers in agriculture. These eco-enzymes contain microbes that enhance the physical, chemical, and biological properties of the soil, making them beneficial not only as fertilizers but also as botanical pesticides. This is supported by findings from Fahruddin Wakano (2024), who discovered that eco-enzymes positively influence plant growth and soil health.

Eco-enzymes are versatile; in addition to serving as liquid organic fertilizers, they can also function as botanical pesticides, insecticides, disinfectants, and cleaning solutions for household use. Furthermore, eco-enzymes can help reduce household waste. According to research by Dwi Hardestyariki et al. (2025), the production of eco-enzymes in households can empower communities while minimizing organic waste generation. These household-produced eco-enzymes can act as disinfectants due to their alcohol and acetic acid content, which effectively eliminate pathogenic microorganisms.

Additionally, eco-enzymes contribute to the reduction of anionic surfactants commonly found in detergents, laundry soaps, and general household cleaners. This is corroborated by research conducted by Marce Monica Gaspersz (2022), which demonstrated that Biological Oxygen Demand (BOD) levels in water decreased alongside a reduction in Linear Alkylbenzene Sulfonate (LAS) levels due to the presence of eco-enzymes

Moreover, orange peels are a valuable ingredient for creating eco-enzymes. Utilizing orange peels not only benefits agriculture but also adds value because of their rich active compounds. Orange peels are recognized for their distinctive fragrance and flavor, high vitamin C content, various medicinal properties, and natural acidity (Fahruddin Wakano, 2024).

CONCLUSION AND SUGGESTION

A. Conclusion

Based on research on eco-enzyme as a utilization of orange waste, it can be concluded that the final pH obtained in the fermentation of Circocus eco-enzyme ranges from 3 to 4. This indicates that the acidity level of the fertilizer is consistent with the main ingredient, namely orange, which also has an acidic pH. Meanwhile, the final temperature obtained, which ranges from 23 to 25°C, shows that the temperature has not yet reached the optimum point for the decomposer bacteria in

the fermentation process. Eco-enzymes have many benefits, including enriching the soil, promoting plant growth, and controlling pests. In addition, eco-enzyme can reduce household organic waste, which can be used as a disinfectant and natural cleaner, and it also plays a role in reducing water pollutants, thereby supporting environmental sustainability.

B. Suggestions

Based on the results of this study, it is recommended that future researchers conduct more in-depth testing of eco-enzymes with varying concentrations and fermentation times to determine the optimal dosage for promoting plant growth and reducing environmental pollution. In addition, future researchers can also test the nutritional content of eco-enzymes and explore their potential as natural cleansers.

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