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## THE MAKING OF LIQUID ORGANIC FERTILIZER FROM GINGER WASTE BY HIGH SCHOOL STUDENTS AT AL HIDAYAH DLANGGU MOJOKERTO

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### ABSTRACT

**Introduction:** After the production of "Hidayah" ginger drinks, there has been a significant accumulation of ginger waste around AL Hidayah High School. This waste has led to unpleasant odors, attracting flies and creating an unsightly environment. This community service program aims to repurpose ginger waste into something beneficial, such as liquid organic fertilizer.

**Methods:** The community service project employed an educational approach followed by practical sessions in producing organic liquid fertilizer through a biorefinery system. All students at AL Hidayah High School in Dlanggu Mojokerto were involved in this activity, which took place on May 25, 2023.

**Results:** The outcome of this initiative was the production of organic liquid fertilizer using biorefinery methods.

**Conclusion:** The liquid organic fertilizer derived from ginger waste through biorefinery methods has the potential to mitigate several associated issues. It proves to be advantageous for the local community, serving as a plant nutrient and potentially contributing to the school's economic growth if produced in sufficient quantities for market distribution. Furthermore, this endeavor nurtured creativity and entrepreneurial skills among the students.

### KEYWORDS

Biorefinery; ginger waste; liquid organic fertilizer.

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## 1. INTRODUCTION

Ginger waste is a recurring issue around the school premises each time the production of "Hidayah" ginger drinks concludes, resulting in a substantial accumulation of approximately 10-20 kg of ginger waste. The piled-up ginger waste emits unpleasant odors, attracts numerous flies, creates a dirty environment, and spoils the surroundings' aesthetic

appeal. This has become a concern for the school community as the ginger waste remains unused and unprocessed into something beneficial.

The production of "Hidayah" ginger drinks at SMA Dlanggu Mojokerto has been ongoing for a while, and it was initiated in 2019. This routine activity, unique to this school in East Java, involves students converting ginger into an economically viable product

(Nabila, 2022). While this process yields economically valuable items, it also generates leftover materials that could be repurposed. One such material is the waste or remnants from the "Hidayah" ginger production, which currently remains underutilized, posing an issue that needs resolution. To address this, it is essential to convert this ginger waste into something beneficial for the environment, such as liquid fertilizer and compost, using renewable technology.

One renewable technology that can be used to process ginger waste is Biorefinery. According to the International Energy Agency (IEA), Biorefinery refers to the sustainable processing of biomass to produce a range of marketable products and energy (Hadiyanto & Adetya, 2018). Biorefinery has been employed in the last decade to create outstanding products that can benefit society. Ginger production always leaves behind remnants or what we commonly refer to as waste. This waste can be transformed into organic fertilizer, which is beneficial for farmers and gardeners (Pareira & Naikofi, 2022). Farmers currently use market-bought fertilizers, yet fertilizers can be self-produced by utilizing materials that are no longer in use, such as ginger pulp and organic household waste (Hambali et al., 2022). Organic fertilizers are safer to use because the plants treated with organic fertilizers are safer for human consumption due to the minimal chemicals absorbed by the body (Mangalisu et al., 2022).

The issue of production waste can be addressed in various ways, as demonstrated by studies conducted by researchers (Hambali et al., 2022) who investigated the Processing of Instant Ginger Powder Industry Waste with Distillation to Produce Essential Oils. Another study by Dwi (Handayani, 2022) focused on utilizing ginger waste from traditional medicine and beverages to produce ginger oil using Vacuum Kohobasi Distillation, among many others. Research on ginger processing into compost fertilizer has also been conducted. However, (Hambali et al.,

2022) about the Technology Transfer and Utilization of Ginger Waste as Liquid Organic Fertilizer in the Barugae Maros Village was conducted with a community group rather than a high school student group.

Through community service, empowering partners to create liquid organic fertilizer from ginger waste using biorefinery strategies will involve education on how to create liquid organic fertilizer, followed by direct practice sessions. This community service including students and teachers at Al Hidayah High School in Mojokerto, through training in liquid organic fertilizer (LOF) production.

## 2. MATERIAL AND METHODS

The community service program was conducted for seven months, from January to July 2023. The service team comprised two faculty members and two students from the Faculty of Nursing. The execution method for the ginger waste processing into liquid organic fertilizer (LOF) community service program proceeded in the following stages:

### **Preparation**

This phase involved direct activities, including initial information gathering through interviews with the head of Al Hidayah High School in Dlanggu, Mojokerto. These interviews were conducted to gather information about the surrounding community conditions and the issues faced by the partners related to ginger health drink production (Tarigan, et al., 2020). During the preparation phase, the partners were provided with ginger grinding equipment to aid in crushing ginger in large quantities within a short period.

### **Socialization**

This phase involved conducting PRA (Participatory Rural Appraisal) using the Focus Group Discussion method. It served as an introduction to the community service program and the technology to be implemented—ginger waste management into organic fertilizer (Tarigan, et al., 2020). Through the

FGD socialization, the aim was to review policies that could be used as comprehensive guidelines for empowerment, ensuring that the intended targets could be achieved. The socialization activities were conducted directly with the students to prepare them for the training on producing liquid organic fertilizer. Following the socialization, the service team delivered equipment, supplies, and guidebooks for producing liquid organic fertilizer to the partners. This phase also included socialization about the Zero Waste Action: Utilizing Waste to Reduce Trash.

#### **Education (Initial Training Stage)**

This education stage was carried out directly to introduce and educate participants on the importance of converting waste into something beneficial for the community, specifically into organic fertilizer. Organic fertilizer can be made from ginger waste found in the surrounding environment (Tarigan, et al., 2020). Al Hidayah High School students attended this activity.

#### **Training on Liquid Organic Fertilizer Production (Advanced Training Stage)**

This advanced training was conducted on-site at Al Hidayah High School on the same day as the educational session. It involved hands-on practice in producing liquid organic fertilizer. The method applied involved creating an activator from a mixture of water (470ml), sugar/molasses (20ml), and EM4 (10ml) left for three days. Then, alternating layers of carbon and nitrogen materials were added into a composting bin, with an activator sprayed on each layer. The carbon-to-nitrogen ratio was 2:1. Carbon materials included branches, dry leaves, newspaper waste, and cleaned eggshells. Nitrogen materials comprised ginger waste, vegetable remnants, tea, and coffee grounds. The materials were regularly mixed once a week and could be harvested through a tap available in the composting bin. This method yielded two outputs: liquid organic fertilizer and solid organic fertilizer. The liquid fertilizer was sprayed beneath the leaves between 7 am and 11 am.

#### **Harvesting Process**

The harvesting process took place a week after the education and practical training sessions, evaluating the processed LOF from a week prior.

### **3. RESULTS**

The community service program commenced with an address from the head of the community service team, followed by a speech from the principal of Al Hidayah High School in Dlanggu, Mojokerto. All students of Al Hidayah High School attended the event and showed great enthusiasm during the session. They were eager to participate and actively posed questions regarding the process of producing liquid organic fertilizer from ginger waste.

After the speeches from the project leader and the school principal, the event proceeded with a presentation on Biorefinery and the production of liquid organic fertilizer. The community service team delivered the presentation. The students showed great enthusiasm during this session as it was their first exposure to biorefinery concepts. Following the completion of the presentation, an interactive Q&A discussion took place with the participants.

The material having been presented, the activity progressed to a demonstration or direct practice on how to make liquid organic fertilizer. The tools and materials had been prepared in advance. The tools used included a compost bin (large container), gallon containers, and a mixer. As for the materials, these comprised ginger waste (1kg), pineapple peel (1kg), vegetable waste (500g), dried branches (1kg), EM4 (100ml), molasses/brown sugar (1L), and 4 liters of water. The community service team and the students then engaged in the hands-on practice of making liquid organic fertilizer together.

After the production of the liquid organic fertilizer (LOF) was completed, an evaluation was conducted after two weeks to assess the quality of the liquid organic fertilizer resulting from the production process. This evaluation aimed to determine the success of the LOF creation. The evaluation revealed

that the liquid was odorless. So it can be concluded that the LOF production is considered successful because mold does not grow on the surface of the water, and no unpleasant odor comes from the container used to store LOF.



Figure 1. Participants in Community Service

research conducted by (Dewi et al., 2022) regarding ginger waste converted into liquid organic fertilizer. The choice of cultivating fertilizer was influenced by the conditions around the school, where the majority of the Dlanggu community earns a living as farmers



Figure 2. Presentation by the Speaker



Figure 3. LOF Making Process



Figure 4. Liquid Organic Fertilizer from Ginger Waste

The community service program yielded not only liquid organic fertilizer from ginger waste but also brought about positive impacts felt by the school community, including both students and teachers. They gained knowledge and skills to develop their 'Hidayah' ginger products further, thereby enhancing the school's well-being (Pareira & Naikofi, 2022).

#### 4. DISCUSSION

This community service at SMA AL Hidayah Dlanggu Mojokerto produces Liquid Organic Fertilizer (POC) by processing ginger waste using biorefinery technology. This biorefinery technology has been employed for the past 10 years to manufacture superior products that can benefit society. One of the studies utilizing biorefinery technology is the

and planters. Research on making liquid organic fertilizer from fruit waste with the addition of an EM4 bioactivator was conducted by (Putra & Ratnawati, 2019). The research results revealed that liquid organic fertilizer produced from papaya and banana had concentrations of C-organic: 3.96-7.34%, N: 1.37-3.21%, P: 2.22-3.81%, and K: 2.48-4.24%. Liquid organic fertilizer products using banana fruit waste as raw materials and the addition of 50 mL of EM4 constitute an optimal mixture compared to others. In this variation, the concentration of N, P, and K in liquid organic fertilizer with banana waste and 50 mL EM4 meets quality standards.

While much research has been conducted on making liquid organic fertilizer from organic waste, there has been limited exploration into producing

liquid organic fertilizer from ginger waste. Ginger waste is classified as organic waste, considered a sustainable resource for added value. Proper utilization of organic waste will integrate the agricultural sector with the circular economy (Mangalisu et al., 2022).

Fertilizer is an essential additional nutrient for plant growth and development, serving as plant fertilizer, whether for ornamental plants or in agriculture or plantations. Liquid organic fertilizer is derived from plant residues and livestock waste that have undergone a decomposition or weathering process using renewable technology (Pareira & Naikofi, 2022). The process of making liquid organic fertilizer is carried out anaerobically (Mangalisu et al., 2022). The advantages of this liquid organic fertilizer are its environmental friendliness, ability to increase farmers' income, and capacity to enhance soil fertility by repairing physical damage to the soil due to excessive use of inorganic (chemical) fertilizers (Nabila, 2022). Therefore, there is a need for liquid organic fertilizer with advantages such as improving soil structure, quick absorption of nutrients by plants, enhancing soil biological life, containing microorganisms, ease of application, and addressing nutrient deficiencies (Antara & Istanti, 2022).

Ginger pulp, galangal, turmeric, and ginger still contain active substances, minerals, and simple sugars, as well as high levels of fiber (Redi Aryanta, 2019). This forms the basis for making liquid organic fertilizer from ginger pulp waste. The results of the decomposition of ingredients in liquid fertilizer are more easily absorbed by plants. The nutritional content varies and contains macro and micronutrients. Because liquid fertilizer is soluble, nutrients are absorbed more quickly, providing an advantage for farmers (Ngatirah & Dewi, 2020). It is hoped that this liquid organic fertilizer will not only address environmental problems but also overcome fertilizer scarcity at the farmer level. This liquid

organic fertilizer can also be well-designed to increase people's income through effective marketing (Wahyu & Dewi, 2020). The use of organic fertilizers is recommended to reduce problems caused by the use of chemical fertilizers that can pollute and damage the environment (Pareira & Naikofi, 2022). The liquid nature of the fertilizer can provide some essential elements for plant growth and represents a potential business opportunity in making liquid organic fertilizer, which is classified as very easy (Sukmawati & Sunaryo, 2022).

Materials that can be used for making liquid organic fertilizer include waste residues from production processes, both industrial and domestic, that have no economic value, such as vegetables, fruit, leftover rice, banana stems, and rice washing water (Pareira & Naikofi, 2022). Much of this waste is generated by the community for their daily needs, but it is not utilized properly. This is due to various factors such as limited knowledge and inadequate infrastructure for reusing this waste as raw material for liquid organic fertilizer, which is still low (Antara & Istanti, 2022). The various benefits explained regarding liquid organic fertilizer serve as a strong foundation for implementing community service concerning the processing of liquid organic fertilizer from ginger waste by AL Hidayah High School students in Dlanggu, Mojokerto.

## 5. CONCLUSION

The community service program has brought numerous benefits to both students and teachers at SMA AL Hidayah, such as enhancing their knowledge and understanding of producing liquid organic fertilizer. This is marked by the students' and teachers' ability to create this fertilizer using biorefinery technology from household organic materials and ginger waste. The availability of this liquid organic fertilizer fulfills the needs of the community, including farmers and gardeners, contributing to increased productivity in their agricultural endeavors. Furthermore, this initiative

enhances students' entrepreneurial skills. Looking ahead, we hope for further activities as there are still many possibilities at SMA AL Hidayah Dlanggu, which already boasts an exceptional product in the form of 'Hidayah' ginger.

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