Socialization of Ecoenzymes Utilization from Organic Waste of Horticultural Plants as a Nature Wound Dressing and Anti-Inflammatory

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Abstract
The purpose of this community service activity (PKM) is to convey the socialization of the use of various organic waste materials for the production of wound dressing solutions based on ecoenzymes (EE) fermented for 100 days. The organic waste used comes from various agricultural waste from horticultural crops of oranges and pineapples. The service method is starting from a location survey, discussion with the principal of SMK Panca Budi, Medan, when the service will be carried out, lectures, direct practice, and evaluation of PKM results. This activity begins by explaining the process at the ecoenzyme (EE) synthesis stage, then continues with the technique of making wound healing solutions with a ratio of 1:10 (EE: water). The results of the service will be seen whether the community has absorbed knowledge related to organic waste from orange and pineapple plants that can treat wounds such as knife cuts (shallow), and as an antibacterial.

Keywords: *Ecoenzyme, Organic Waste, Wound Dressing, Antibacterial*

Introduction

Everyone must have experienced a wound, whether in the form of a scratch, cut, puncture, burn, or surgical stitches. Wounds require time and process to heal and return to normal. The length of time required depends on the size of the wound.

The smaller the wound, the faster it heals. The larger and deeper the wound, the longer it takes to heal. In addition, the location, type of wound, and its severity also determine how fast or slow the wound healing process is.

SMK Panca Budi is a private vocational high school located on Jl. Jend. Gatot Subroto Km 4,5, Simpang Tanjung Village, Medan Sunggal District, Medan City, North Sumatra. This school offers various majors, including Computer and Network Engineering (TKJ). With A accreditation and ISO 9001:2008 certification, SMK Panca Budi is committed to high educational standardsStages of Wound Healing Process.When injured, there are several stages in the wound healing process, including: Hemostasis stage (blood clotting), **Inflammatory stage (inflammation),** Proliferative stage (formation of new tissue), and **Stage of tissue maturation or strengthening.** The first stage in the wound healing process is the blood clotting stage. Blood usually comes out when the skin is cut, scratched, or punctured. A few seconds or minutes after the wound occurs, the blood will clot to close the wound and prevent the body from losing too much blood. This blood clot will then turn into a scab when it dries. After the bleeding stops, the blood vessels will widen to flow fresh blood to the injured area of the body. Fresh blood is needed to help the wound healing process. This is the reason why the wound can feel warm, swollen, oozing and become reddish for some time. The third stage is Proliferative stage, during the process, collagen production in the wound area will increase. Collagen s a protein fiber that provides strength and elastic texture to the skin. The final stage is the strengthening stage. At this stage, the wound is closed but the healing process continues. In it, tissue strengthening occurs so that the wound often feels itchy, stretched, or wrinkled [1].

Ecoenzyme is a fermentation result of organic waste in the form of vegetables or fruits [2], which was introduced by Dr. Rosukon Poompanvong, a researcher and environmental observer from Thailand [3]. The type of waste that is underutilized is fruit and vegetable waste. Fruit waste is a waste material that is usually disposed of by *open dumping* (waste is simply dumped in a final disposal site without any treatment) without further management so that it can cause environmental disturbances and unpleasant odors. Fruit waste has a lower nutritional content, namely crude protein of 1-15% and crude fiber of 5-38%. One of the potentials that can be seen from fruit waste is in the manufacture of ecoenzymes that can be used as wound dressing solutions with certain concentrations. Physically, vegetable waste rots easily because it has a high waters content, so it becomes a problem for the environment where every day it increases and it is increasingly difficult to find a place to dispose of it. One way that can be done to utilize vegetable waste is to process it into something useful, for example by processing it into a wound healing and anti-inflammatory solution [4]. With the history and existence of SMK Panca Budi from its inception until now which remains consistent in building the quality of education according to the dynamics of the times, it increasingly shows that SMK Panca Budi can work together with the entire educational community to move forward together in building the world of education in an effort to produce future generations with Islamic character and global competence. For that, students from Panca Budi Vocational School, who are in fact teenagers, must be involved in overcoming environmental problems by making ecoenzymes from organic agricultural waste that have utility as antibacterials such as the cause of acne in teenage girls, or as an alternative anti-inflammatory (anti-inflammatory) and environmentally friendly wound healer. Based on the description above, devotion is required, namely**:** "Socialization of the Ecoenzymes utilization from Organic Waste of Horticultural Plants as Wound dressing and Anti-Inflammatory at SMK Panca Budi, Medan City".

Literature Review

Eco enzyme (EE) is a complex organic compound solution produced from the fermentation process of organic waste (fruits or vegetables), sugar (brown sugar, brown sugar or cane sugar), and water. *Eco Enzyme* was first introduced by Dr. Rosukon Poompanvong who is the founder of the Thai Organic Farming Association. Initially, this idea emerged for the processing of organic waste that we usually throw in the trash, into more useful organic waste enzymes.

Eco-enzyme products are environmentally friendly products that are easy to use and easy to make. Making eco-enzymes only requires water, sugar as a carbon source, and organic vegetable and fruit waste. The use of eco-enzymes can be done to reduce the amount of household waste, especially organic waste whose composition is still high.

In its manufacture, eco-enzyme requires a container made of plastic, the use of materials made of glass is highly avoided because it can cause the container to break due to the activity of fermentation microbes. Eco enzyme does not require a large area for the fermentation process as in making compost and does not require a composter tub with certain specifications.

Eco enzyme has many ways to help the natural cycle such as facilitating plant growth (as a fertilizer), treating soil and also cleaning polluted water. This enzyme cleaner is 100% natural and free from chemicals, biodegradable and gentle on hands and the environment.

Ecoenzyme products are environmentally friendly, easy to use, and easy to make, as well as multi-functional, can be used to increase plant nutrients, to clean the surrounding environment, clean the house, and other functions. Every individual can make EE easily. It is said to be easy because it is made from simple ingredients because it is waste, easy to get, and cheap because it comes from organic waste [5] Making EE only requires water, brown sugar/molasses as a carbon source, and organic waste/waste. The use of brown sugar can minimize the possibility of chemical bleaching compound residues, in addition brown sugar also has economic value

EE is derived from organic waste such as papaya, orange, pineapple, mango, etc. The effectiveness of EE has been studied, which has been widely used as an antibacterial and as a natural disinfectant [6].

Several research results show that EE as a fertilizer is included in the group of liquid organic fertilizers that can increase the production of shallots [7] and as a disinfectant (Hasanah, 2021), EE from papaya and pineapple waste has the ability as an antibacterial against *Enterococcus faecalis* [8].

Utilization of organic waste to make eco enzyme can reduce household waste because household organic waste occupies the largest proportion of total waste production. The average composition of waste in several major cities in Indonesia is organic (25%), paper (10%), plastic (18%), wood (12%), metal (11%), cloth (11%), glass (11%), others (12%) (Balitbang, 2009).

The problem of waste is not only the responsibility of the government, but also the responsibility of all of us, including teenagers. so that education needs to be carried out at the youth level starting from schools, to college/university levels. No exception for SMK Panca Budi Vocational School. Waste from organic waste around us can have economic value and be more useful if it becomes an ecoenzyme and becomes an antibacterial and anti-inflammatory solution.

Ecoenzymes from agricultural waste have the potential to be an alternative component of wound dressings due to several of their beneficial biological properties. A recent study by Rahman et al. (2022) revealed that ecoenzymes contain various organic acids such as lactic acid, acetic acid, citric acid, and malic acid which work synergistically in inhibiting the growth of pathogenic microorganisms in wounds. In addition, ecoenzymes contain polyphenolic compounds such as flavonoids and tannins which function as strong antioxidants and natural anti-inflammatories [9].

Research Methodology

The community service method used is Participation Action Research (PAR) through certain stages (Muhtarom, 2019). The stages of implementing community service activities consist of: 1) Focus Group Discussion (FGD). FGD is carried out at the beginning of the activity between the community service team and vocational high school students. This is done to provide a more detailed explanation regarding the activities to be carried out and to make a time contract for the implementation of the activity. 2) Socialization of community service activities to community groups, vocational high school students, and In this socialization activity, the team provides an explanation to community groups, vocational high school students, about the technical and schedule of activities to be carried out in the implementation of community service. The media used in this socialization activity is power point (ppt). 3) Education and practice on community empowerment, waste management, and motivation. The work procedures carried out include: Preparation Stage. The team coordinated regarding the implementation plan of the community service regarding the schedule and place of the activity. The activity was planned in an inorganic waste-free area at SMK Panca Budi, Medan.

Procedures

A. Preparation Stage

The team coordinates regarding the implementation plan for community service regarding the schedule and location for implementing the activity.

Based on focus group discussions (FGD) conducted with the school (principal, teachers, and student representatives), several needs and expectations from this community service program were identified:

1. Improving students' knowledge and practical skills in the utilization of agricultural waste.
2. Development of innovative products that have economic and social value
3. Entrepreneurship opportunities for students through the production and marketing of ecoenzyme-based wound dressing products.
4. Sustainable transfer of technology and knowledge
5. Development of learning modules that can be integrated into the school curriculum.

The school also expressed its commitment to supporting the sustainability of the program through allocation of time, place, and facilitation of follow-up activities.

B. Implementation stage

The implementation of the activity is carried out in stages:

1. Preparation of EE modules/materials
2. Lecture and discussion on the manufacture of Ecoenzymes
   Previously, it was explained what and how to technically make ecoenzymes, namely with the BIO principle of 1: 3:10 (1 part sugar/carbohydrate: 3 parts organic material: 10 parts water).
   The waste used is waste from pineapple, papaya and mango in the form of fruit skins (Figure 1), which is put into a container in the form of a 15 L capacity plastic barrel, then added to water that has been dissolved in molasses/brown sugar.
3. Making EE solution (1:10) as a wound healing and anti-inflammatory solution.
   Lecture materials (presentations) are given to participants in the form of EE training modules, then continued with discussions (questions and answers) and direct practice in the field.
   a) Lecture on What is meant by Enzymes and Ecoenzymes
   b) Lecture on the Procedure for Making Ecoenzymes

Partners participate in providing the necessary materials and equipment and providing participants from SMK Panca Budi, Medan.

Results

This community service activity was carried out on February 12, 2025, at Panca Budi Vocational High School (SMK-PB), Medan City. The event was attended by around 30 (thirty) participants. Participants consisted of SMK Panca Budi school students and the community around the school.

The series of events for this community service activity includes:

1. Lecture and discussion (question and answer)
   The event began with the Distribution of Modules on Ecoenzyme Making, followed by a lecture (presentation) on what and how to make ecoenzymes (EE), where the making of EE follows the BIO ratio of 1: 3: 10 (**Figure 1**). EE is made using household organic waste (3 kg); molasses (1 kg); and mineral water (10 L). The water used can also be well water, only for beginners to ensure the EE fermentation process is more guaranteed, mineral water (refill) is used. All ingredients are put into a container in the form of a used paint bucket and tightly closed for the anaerobic fermentation process (does not require air).
   The fermentation results will be completed after 100 days from the date of manufacture, then the harvesting process is carried out. EE harvesting is done by filtering pure EE from the dregs. Pure EE that has been filtered is then stored in another dry container, and used only as needed. The use of EE is adjusted to its intended use. The EE used should be mixed with water first in a certain ratio. It is not recommended to use EE for human consumption. Pure ecoenzyme can only be used for certain uses, because it is acidic, with a pH <4 [10].

Figure 1. Presentation and discussion

When used for plants, you can use the ratio EE: water = 1:300; for bathing 1:300; for drinks mixed with livestock drinks, you can use the ratio 1:1000; and so on.

2. Hands-on practice
   In this activity, direct practice is carried out to make EE solution as a wound dressing using EE derived from organic waste from households such as pineapple skin, mango skin, papaya. The waste that has been weighed as much as 3 kg, is put into a used paint barrel container (made of plastic) that has been cleaned previously, then filled with 10 L of water about 60% of the container. After that, add molasses/brown sugar, mix it into the container, and stir until evenly mixed/homogeneous. Furthermore, the container is tightly closed and isolated with duct tape until tight, and the fermentation time is awaited for up to 100 (one hundred) days, which is calculated from the date of making EE. EE harvest will be carried out after the 100th day, more than that date is allowed, but not less than the harvest date.
   Direct practice of making Ecoenzyme wound dressing solution
   - Prepare the finished Ecoenzyme and mineral water for dilution.
   - Make a solution with a concentration of 1:10 (EE:water) by adding 100 mL of water into a container, then adding 10 mL of EE to the container containing the water.

- 1:10 ecoenzyme solution into a container/spray bottle for application.

3. Continued with discussion (question and answer)
   The activity continued with a question and answer session regarding the anti-inflammatory power of ecoenzymes.

In this session, the experience of the research team or implementing team in using EE was explained/shared, namely to treat scars (wound dressing) of one of the vocational high school students. In addition to preventing the wound from causing infection because EE is antibacterial and antifungal [11].

Discussion

Waste management is very necessary in people's lives, both organic and inorganic waste. Inorganic waste requires special treatment, such as providing a final disposal site, where waste or garbage will be sorted or grouped, whether it can be recycled or not. For organic waste produced by the community can be organic waste from agricultural products, or household waste [12]. Household waste can be in the form of fruit peels, or vegetable waste such as unused vegetable stems, in being managed by making it into a multi-function liquid commonly referred to as ecoenzyme (EE). EE can be used in various fields, such as fertilizing the soil [13], cleaning yourself, for livestock pen sanitation [14], as an antimicrobial [15], and air purifiers. In addition to agriculture, EE can also be used for animal husbandry, cleanliness, and overcoming cleanliness (sanitation) and environmental pollution in rivers, lakes, or others.

In addition to being a wound dressing, as a multifunctional liquid, Ecoenzyme can also reduce the smell of corpses in the house, unpleasant odors in the bathroom, for washing hands, bathing. Also conveyed the benefits of EE to increase production in shallots, soybeans, edamame soybeans whose production increased with the provision of EE. Also shared experiences in terms of using pure EE (not mixed with water) for health, for example to cover wounds caused by knife cuts to stop blood, stop the activity of leeches attached to the feet, and close surgical wounds. EE that reopens. Pure Ekoenzyme can be used as a cover for minor wounds in some of the examples above, so it can be used as a first aid material for minor accidents that are not intentional.

From several examples of events (experiences) above, it is highly recommended that people immediately make their own EE, because it is not freely sold in stores. It can also be carried when traveling with a small bottle.

The results of implementing this activity are documented in the form of photos and reports of community service activities.

Conclusion

Ecoenzyme with a ratio of 1:10 is effective as an antibacterial and antifungal, so it can be used as a wound dressing. Ecoenzymes as wound dressings are easy to make and easy to apply.

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