

# Socialization of the Use of Ecological Enzymes from Organic Waste of Horticultural Plants as Natural Bandages and Anti-Inflammatory Agents

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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 pineapple. 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 has experienced a wound at some point, whether it's a scratch, cut, puncture, burn or surgical incision. It takes time for

wounds 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. The location, type and severity of the wound also determine how quickly it heals. Add appropriate original references to the sentences/paragraphs taken from other media/sources.

### The stages of the wound healing process:

When a person is injured, the wound healing process involves several stages, including:

#### 1. The Haemostasis Stage (Blood Clotting)

The first stage of wound healing is blood clotting. Blood usually comes out when the skin is cut, scratched or punctured.

A few seconds or minutes after the wound is sustained, the blood clots to close the wound and prevent excessive blood loss. This blood clot then turns into a scab when it dries.

#### 2. Inflammatory Stage (Inflammation)

Once the bleeding has stopped, the blood vessels widen to allow fresh blood to flow to the injured area of the body. This fresh blood is needed to aid the healing process of the wound. This is why the wound may feel warm and swollen, ooze and turn red for a while.

During this stage, white blood cells destroy germs in the wound area. This is the body's natural mechanism to prevent infection. White blood cells also produce chemicals that can repair damaged tissue. Furthermore, new skin cells will grow and close the wound.

### **3. Proliferative Stage (Formation of New Tissue)**

This stage is marked by the formation of scar tissue on the wound. During this process, collagen production in the wound area increases. Collagen is a protein fibre that provides strength and elasticity to the skin.

The presence of collagen encourages the edges of the wound to shrink and close. Furthermore, small blood vessels, or capillaries, form in the wound to supply blood to the newly formed skin.

### **4. Stage of Tissue Maturation or Strengthening**

The final stage is strengthening. At this stage, although the wound is closed, the healing process continues. Tissue strengthening occurs during this stage, which can make the wound feel itchy, stretched or wrinkled.

Tissue maturation can take months or even years. This is why scars appear more faded with age. Once the damaged tissue has healed completely, the skin will be as strong as before the injury.

Scar tissue is made entirely of collagen because the skin cannot produce new elastin. The new skin that forms over scars is generally strong but less elastic than the surrounding skin.

Ecoenzyme is the result of fermenting organic waste in the form of vegetables or fruit. It was introduced by Dr Rosukon Poompanvong, a Thai researcher and environmentalist. This innovation has had a significant positive impact on the environment. Dr Rosukon is also the founder of the Organic Agriculture Association of Thailand, which collaborates with Thai and European farmers to produce high-quality, environmentally friendly agricultural products. Ecoenzyme products

are environmentally friendly, easy to use and multi-functional. They can be used to increase plant nutrients, clean the surrounding environment and the house, and for many other purposes. Anyone can easily make ecoenzyme. This is because it is made from simple, readily available ingredients that are cheap because they come from organic waste (Yulistia & Chimayati, 2021). EE production only requires water, brown sugar or molasses as a carbon source, and organic waste. Using brown sugar minimises the possibility of chemical bleaching compound residues and also has economic value (Retno & Ismawati, 2010). EE is derived from organic waste such as papaya, orange, pineapple and mango. The effectiveness of EE has been studied and it is widely used as an antibacterial agent and natural disinfectant (Rochyani et al., 2020 : Lubis et al., 2025).

Several studies have shown that EE can be used as a liquid organic fertilizer to increase shallot production (Gultom et al., 2022) and as a disinfectant (Hasanah, 2021). EE derived from papaya and pineapple waste has antibacterial properties against *Enterococcus faecalis* (Mavani et al., 2020).

### **Partner Issues**

Panca Budi College was established in 1961. Initially, only one level was managed by the college: the Senior High School of Agriculture (SPMA/SPP). Panca Budi College was established to meet the educational needs of the children of the Foundation's Chairman, Prof. DR. H. Kadirun Yahya, who regularly held religious activities (Zikrullah) at the Panca Budi Campus.

Since its inception in 1961, Panca Budi College has grown rapidly to become a leading educational institution in the city of Medan. It currently manages elementary and secondary education, with school units ranging from PG/TK to SD, SMP, SMA and SMK.

The history of the establishment of school units at Panca Budi College records that the SPMA/SPP was founded in 1961, the

kindergarten in 1967, the elementary school in 1966, the junior high school in 1967, the senior high school in 1976 with science and social studies majors, and the vocational school (SMK) in 1997 with IT, automotive and electronics majors, and the BM vocational school with secretary and accounting majors.

In order to continue to progress and develop in the face of future challenges, Panca Budi College has set the following vision: 'The realisation of a conducive learning environment and graduates who have Islamic character and global competence.'

Given Panca Budi College's consistent commitment to improving educational quality in line with changing times since its inception, it is clear that the college can collaborate effectively with the entire educational community to move forward together in building the world of education, producing future generations with Islamic values and global competence. To this end, students from Panca Budi Vocational School, who are teenagers after all, must be involved.

## **LITERATURE REVIEW**

Eco Enzyme (EE) is a complex organic compound produced by fermenting organic waste (fruit or vegetables), sugar (such as brown or cane sugar) and water. The concept of eco enzyme was first introduced by Dr. Rosukon Poompanvong, founder of the Thai Organic Farming Association. The idea initially emerged as a way of processing organic waste that we usually throw in the trash into useful enzymes (Lubis et al., 2022).

Eco-enzyme products are environmentally friendly and easy to use and make. To make eco-enzymes, you only need water, sugar as a carbon source, and organic vegetable and fruit waste. Using eco-enzymes can help to reduce household waste, especially organic waste, which still makes up a large proportion of our rubbish (Wasito, 2023).

During the manufacturing process, plastic containers are used to avoid the risk of breakage due to fermentation microbes.

Unlike composting, the fermentation process for eco-enzymes does not require a large area or a composter tub with certain specifications.

Eco-enzyme can be used in many ways to support the natural cycle, such as facilitating plant growth (as a fertiliser), such as fertilizer for shallot plants (Gultom et al., 2022), treating soil and cleaning polluted water, or as natural disinfectant (Suwarsono et al., 2023) This 100% natural, chemical-free, biodegradable cleaner is gentle on hands and the environment (Mavani et al., 2020). Using organic waste to make eco enzyme can reduce household waste, as household organic waste makes up the largest proportion of total waste production (Lubis et al., 2024). National data from the Indonesian Ministry of Environment and Forestry (2021) indicates that waste composition includes 27.84% food waste, 15.57% plastic, 12.27% wood, 12.23% paper, 7.13% metal, 6.77% textile, 6.71% glass, and 7.92% other.

Waste management is not only the responsibility of the government, but also of us all, including teenagers, so education needs to be carried out at all levels, from school to university. This includes Panca Budi Vocational School.

Organic waste around us can have economic value and be put to good use if it is made into ecoenzymes, which are antibacterial and anti-inflammatory solutions.

## **MATERIALS & METHODS**

### **Approach Methods Offered**

Agricultural waste is a big problem, but it can be turned into something useful. One way is by making ecoenzymes, which are liquids made from fermenting organic waste with sugar and water. Ecoenzymes contain enzymes, organic acids, and natural compounds that have many benefits (Hasanah, 2021). Research shows they have antimicrobial, antioxidant, and anti-inflammatory properties, which makes them useful in health, especially for wound care.

Conventional wound dressings are often expensive and hard to access in rural areas.

Ecoenzymes can be a cheaper, natural alternative because they:

- Contain organic acids (lactic, acetic, citric, malic) that kill harmful bacteria.
- Have antioxidants like flavonoids and tannins that reduce inflammation.
- Support wound healing by helping fibroblast growth and collagen production.

Studies in animals and cell cultures show ecoenzymes can:

Reduce inflammation by blocking enzymes (COX, LOX), inflammatory cytokines (TNF- $\alpha$ , IL-1 $\beta$ , IL-6), and NF- $\kappa$ B activation. Lower oxidative stress.

Speed up wound closure and tissue regeneration.

At SMK Panca Budi Vocational High School in Medan, students have a great chance to learn how to turn agricultural waste into ecoenzymes and use them for wound dressings. This program teaches students practical skills, reduces waste, and supports the circular economy.

The program uses the Participation Action Research (PAR) method with these steps:

- FGD (Focus Group Discussion): To explain the program and set the schedule.
- Socialization: Sharing the plan with students and community groups using presentations.
- Education & Practice: Hands-on training in making ecoenzymes, waste management, and motivation activities.

Activities will be held in an inorganic waste-free area at SMK Panca Budi, creating both skills and awareness about sustainable innovation.

## PROCEDURES

### Preparation Stage

The team prepared the plan for the program (schedule and location) together with the school.

From the Focus Group Discussion (FGD) with the principal, teachers, and students, the following needs were identified:

- Improve students' knowledge and skills in using agricultural waste.
- Develop innovative products with social and economic value.
- Create entrepreneurship opportunities through ecoenzyme-based wound dressings.
- Ensure sustainable transfer of technology and knowledge.

Develop learning modules to be included in the school curriculum.

The school also committed to supporting the program by providing time, space, and facilities.

### Implementation Stage

The program was carried out in steps:

- Preparation of ecoenzyme (EE) modules/materials.
- Lectures and discussions on how to make ecoenzymes.

The process follows the BIO principle 1:3:10  $\rightarrow$  1 part sugar, 3 parts organic material, 10 parts water.

Waste used: pineapple, papaya, and mango peels.

Materials are placed in a 15 L plastic barrel, with water mixed with molasses/brown sugar.

a)



b)



Figure 1. Materials for Making Ecoenzymes; a) Fruit Pulp, b) Plastic Container for Fermentation

Then the container is tightly closed, for the anaerobic fermentation Process.

- 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.

- Lecture on What is meant by Enzymes and Ecoenzymes
- Lecture on the Procedure for Making Ecoenzymes

### Activity Plan

The activity is planned in collaboration with partners, namely the University of Malaysia Perlis (UNIMAP) in the inorganic waste-free area at SMK Panca Budi, Medan City in February 2024.

### Partner Participation Description

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

### Description of Evaluation of Community Service Program Implementation

This evaluation was carried out by emphasizing the focus of the results of this evaluation, namely that this activity is very useful for solving organic waste problems in the vocational school environment.

## RESULT

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-PB school students and the community around the school.

The series of events for this community service activity includes:

- 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. 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 (Hasanah, 2021).



Figure 2. 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.

- 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 a waited 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 (Figure 3).



**Figure 3. Ecoenzyme Application as a Wound Dressing**

- Continued with Discussion (Question and Answer)



**Figure 4. Discussion with Participants**

## 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. 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, cleaning yourself, 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 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.

In addition to being a wound dressing, as a multifunctional liquid, Ekoenzyme 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.

Community service activities can be carried out at other school locations, not only in the Panca Budi environment.

### *Declaration by Authors*

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