

Eco-enzyme as the natural disinfectant: Increasing school community awareness on waste management

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Abstract: The increase of COVID-19 has influenced aspects of life in global including education. Recently, the Indonesian government has given allowance to schools for conducting offline teaching-learning processes. Preparation should be conducted to maintain the protection of the school environment, including teachers and students. Health protocols remain an important requirement. SD Muhammadiyah 08 Dau Malang was one of the schools that wanted to prepare for conducting the offline teaching-learning process. The preparation of this school was cleaning all the school areas and spraying disinfectant to prevent the contamination of bacteria and viruses. Yet, the principal of SD Muhammadiyah 08 Dau Malang is concerned about the students' and teachers' health considering the chemical substance in the disinfectant. Moreover, the cost of disinfectant is also the consideration of the principal for savings. The result of an interview with the principal and observation of the school environment, it needs an alternative disinfectant that contains a less chemical substance, is effective, and is inexpensive. The disinfectant should not cause respiratory infections and is not harmful to students who are children. Concerning the problems faced by SD Muhammadiyah 08 Dau Malang, the team of community service programs brings solutions by introducing eco-enzyme and its advantages for health and the environment. It can be used as a natural disinfectant made of fresh organic waste from the kitchen. It is not only the solution to environmental health and virus protection but also recycling and utilizing waste.

Keywords: eco-enzyme, fermentation, kitchen waste, natural disinfectant

1. Introduction

Recently, health issues, immunity, and hygiene are still the global concern of the world. The awareness has spread within the prevention of the outbreak of COVID-19. The pandemic has been worrying and being the influencing factor for the living aspects of society including economic, tourism, and education [1]–[4].

Health protocols are still being promoted to protect society from virus attacks, which are still engulfing the world community globally. The implementation can be simply conducted during the interaction with others, and it should be applied in a disciplined manner. People must wear a mask during the meeting or in a crowd. Moreover, they should take a distance of at least a meter or two where they are at the public or indoor meeting. Besides, washing hands with soap under running water is recommended to maintain the hygiene of our hands. When we have high mobility in doing activities, spray hand sanitizer or liquid disinfectant is suitable to protect us from bacteria and germs.

After around two years the outbreak of COVID-19 hit the world, the living sectors have gradually increased. Economic and tourism sectors come to their resurrection by continuing to implement the health protocols. The school has also been scheduled for the new academic year. The implementation of the teaching-learning process should have permission from the local government, the principal, and the school committee in the name of students' parents. The use of the classroom is determined to accommodate 50% of the capacity of students. Moreover, the

health protocols are maintained in discipline by wearing a mask, at least, body temperature checks, providing washing-hand facility, and hand sanitizer and disinfectant.

Considering the rules of preventing infection and the spread of the virus during the preparation of the offline teaching-learning process, SD Muhammadiyah 08 Dau Malang cleaned up the rooms at school. Furthermore, it was also the implementation of health protocols in preparing the school activities. The cleaning process was conducted by wiping up the window glass, brushing the furniture, and mopping the floor. In this cleaning process, the school needed a natural disinfectant or cleaning liquid that was safe for students, teachers, and the school staff.

Eco-enzyme is a natural cleaning liquid made of fresh organic waste from the kitchen. It can be used as a natural disinfectant or cleaning agent to clean the furniture or surfaces of the house. The use of eco-enzyme as a natural cleaning agent can help SD Muhammadiyah 08 Dau Malang to decrease the use of chemical substances for cleaning up the school environment.

Eco-enzyme is the result of fermentation of fresh organic waste, brown sugar, and water that is fermented for three months, at least [5], [6]. It is the research result of Dr. Rosukon Poompanvong for thirty years in her laboratory. The fermentation process of eco-enzyme used the anaerobe method where the air and oxygen cannot contaminate the eco-enzyme mixture during the fermentation process. It is to maintain the advantageous bacteria in eco-enzyme.

The advantages of eco-enzyme can be utilized to maintain a healthy environment, especially in the cleanliness [7], [8]. Although the fermentation process of eco-enzyme has a chemical reaction of the mixture, eco-enzyme contains no chemical substance. Therefore, it does not cause any damage to the environment. Eco-enzyme can be utilized as an anti-microbe and water purifier [9], [10].

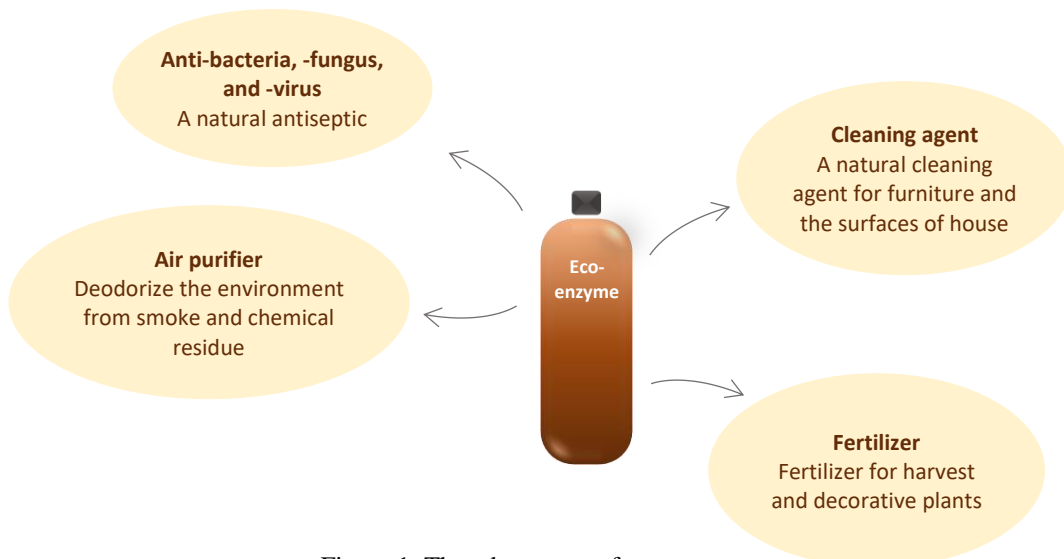


Figure 1. The advantages of eco-enzyme

Reviewing the advantages of eco-enzyme, the community service program aimed to introduce the eco-enzyme to SD Muhammadiyah 08 Dau Malang. It is to support their needs in a natural cleaning agent for the school environment. Preparing the offline class, the school needs to prepare the rooms cleanliness for school activities and teaching-learning process.

2. Method

The application of eco-enzyme in SD Muhammadiyah 08 Dau Malang, as the implementation of community service program, was first conducted by interviewing the principal and teachers at this school to find out the problems. This school wants to prepare the classrooms for the teaching-learning process when the government states the allowance to conduct offline classes during the outbreak of the pandemic. They want to spray disinfectant in the classrooms as an effort to prevent the spread of the COVID-19 virus in addition to implementing other health protocols. Considering the expensive cost of commercial disinfectants at the stores and the compositions are mostly chemical substances, SD Muhammadiyah 08 Dau Malang wants a solution to the cost savings and avoids chemicals substance of the disinfectant because it will be implemented in the classrooms where the students study. The observation was conducted by calculating the need for disinfectants for the classrooms. Moreover, the right kind of disinfectant for students who are children is also considered.

The use of disinfectants helps to eradicate viruses and microorganisms that cause diseases. However, chemical disinfectants have side effects on the environment and health [11]–[13]. Therefore, SD Muhammadiyah 08 Dau Malang needs natural and eco-friendly disinfectants to protect the school, teachers, and students from viruses and avoid diseases.

Offering the solutions for school problems in the use of natural and eco-friendly disinfectants, the community services program introduces eco-enzyme that is made of organic waste of the households. It is the result of fermentation of fresh wastes from the kitchen that is recently researched as a beneficial liquid for agricultural fertilizer and environmental health [14], [15].

Moreover, the community service conducted in SD Muhammadiyah 08 Dau Malang introduced the eco-enzyme and its advantage as the natural disinfectant. The teachers were invited to participate in the workshop and training of eco-enzyme. The evaluation was also conducted to find out the advances of beneficial prospects after this program was conducted.

3. Result and Discussion

In the production of eco-enzyme, three steps should be conducted. The first step of preparing eco-enzyme is collecting the fresh waste including the fruit peels and the unused parts of vegetables. In the fermentation process, those will be submerged in the water added with the brown sugar. The mixture of the waste, water, and brown sugar is determined in 3:10:1 ratio. Afterward, the appropriate storage for the mixture is prepared for the fermentation process. The storage for the fermentation process needs to be elastic and pressure resistant. In this process, the plastic bottle is used because it has flexible characteristics to restrain the gas pressure during fermentation.

The second step in the production of eco-enzyme is fermentation. It is conducted at least 90 days to obtain the eco-enzyme. Harvesting is the last step of eco-enzyme production. It is filtering the mixture up to resulting only the liquid without the residue. Even though only the liquid is used for the cleaning and anti-pathogenic agents, the residue of the fermentation can be utilized in the agricultural fields. It can be used as fertilizer.

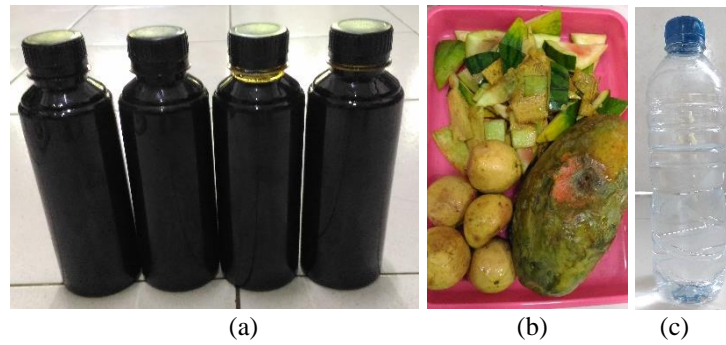


Figure 2. The ingredients of eco-enzyme. (a) Brown sugar, (b) organic waste, (c) water



Figure 3. Weighing and preparing eco-enzyme



Figure 4. The mixture of eco-enzyme prepared for fermentation

In the beginning process of fermentation, the bottle cap was opened twice a day to decrease the gas of the fermentation process. The gas is released to reduce the pressure during the fermentation process and to avoid the bottle from breaking. In the second week, the fungus had started to grow on the surface. It is the result of decomposition and the ripening process of eco-enzyme. The fungus has

characteristics of cotton-like fiber and is white. It was thicker in the longer fermentation process and the liquid color is darker.

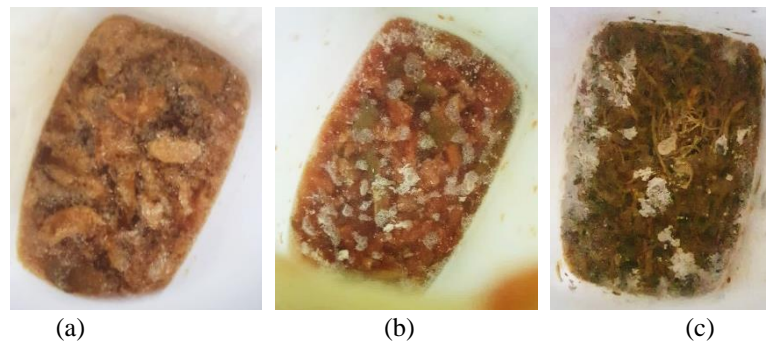


Figure 5. Fungus in the fermentation of eco-enzyme as the result of decomposition. (a) The growing fungus in two weeks of fermentation process; (b) The growing fungus in four weeks of fermentation process; (c) The eco-enzyme is darker after four weeks of the fermentation process.

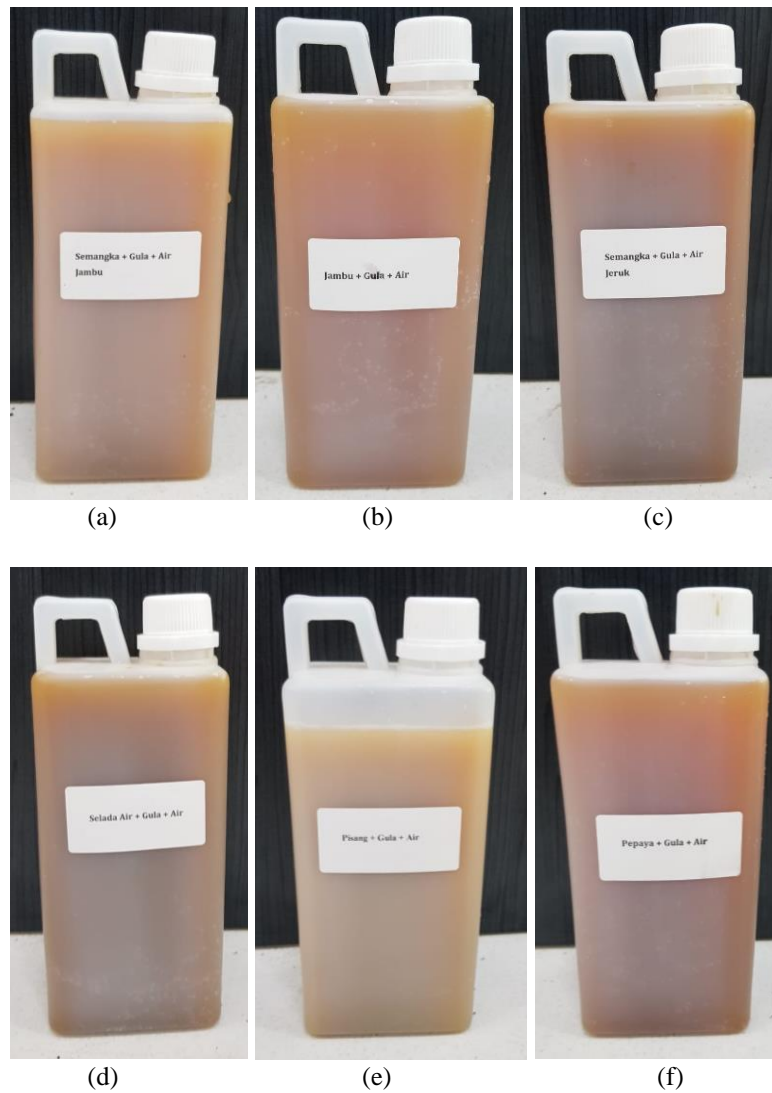


Figure 6. Harvested eco-enzyme. (a) Watermelon and guava-based eco-enzyme, (b) guava-based eco-enzyme, (c) watermelon and orange-based eco-enzyme, (d) watercress-based eco-enzyme, (e) banana-based eco-enzyme, (f) papaya-based eco-enzyme

After harvesting eco-enzyme, the workshop was conducted in SD Muhammadiyah 08 Dau Malang. The teachers as the participants of this workshop were introduced to eco-enzyme as the natural disinfectant. They were introduced with the ingredients of eco-enzyme, the composition, and the period to produce the substance.



Figure 4. The teachers of SD Muhammadiyah 08 Dau Malang in the Eco-enzyme workshop

Eco-enzyme is a multipurpose liquid that can be used for house cleaning [16]. It gives benefits as a natural disinfectant. It can be used to mop the floor and clean the furniture. It is also effective to wash the carpet. It is because eco-enzyme has anti-fungus and anti-bacterial characteristics. Moreover, it is also suitable to flush the toilet and wipe the glass. Although the composition of eco-enzyme consists of waste, it does not have an annoying odor. It tends to smell sweet because of the sugar and is a fruity fragrance. The application of eco-enzyme as the cleaning agent and disinfectant needs water as the dissolvent. The composition of water and eco-enzyme varies for different purposes.

Table 1. The composition of water and eco-enzyme [17], [18]

Purposes	Composition (ml)	
	Eco-enzyme	Water
Disinfectant	100	500
Mopping the floor	100	1000
Cleaning the furniture	100	1000
Washing the carpet (anti-fungus)	100	1000
Flush the toilet/waterways	250	-
Wiping the glass	60	40

Most of the teachers were enthusiastic about the introduction of eco-enzyme and the benefits for the house applications. In their opinion, the environment can be protected from bacteria, germs, and viruses with household wastes, eco-enzyme. It is an effort to protect self, surrounding, and the environment in the outbreak of COVID-19 in addition to continuing to carry out the health protocols. Furthermore, the ingredients of the liquid enzyme are abundant at home. On the other hand, the teachers' enthusiasm came up because of the advantages of eco-enzyme and the simple method of producing it.

4. Conclusion

The implementation of a community service program in SD Muhammadiyah 08 Dau Malang brought enthusiasm among the teachers. They were interested in the advantages of eco-enzyme in many fields; agricultural, health protection, and

household applications. Furthermore, the teachers were fascinated by the utilization of the kitchen waste and the simple method of producing the beneficial eco-enzyme. Many advantages of eco-enzyme for cleaning and the natural disinfectant made it effective for mopping the school floor and cleaning the furniture. It also can be the solution to protect the school member of SD Muhammadiyah 08 Dau Malang from virus contamination, especially COVID-19.

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