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Training on the Making of Eco-Enzyme Disinfectants as a Sustainable Strategy for Processing Organic Waste

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Abstract: The community in Habaring Hurung Urban Village, Bukit Batu District, Palangka Raya City, is grappling with the issue of accumulating household waste, primarily composed of organic waste. The prevalent practices of managing this waste, such as landfilling, burning, or haphazardly piling it around residential areas and roadsides, pose environmental and health risks. In response to this challenge, an initiative was undertaken to empower families in Habaring Hurung Urban Village through training sessions on creating disinfectants using eco enzymes derived from fermented organic waste. The method of implementing community service consists of the preparation stage, namely digging up information on training needs, and preparing materials and teaching aids; the implementation stage in the form of pre-final tests and training; and the last stage in the form of evaluation and reporting, took place on September 4, 2023, at the office hall of Habaring Hurung Urban Village. A total of 39 participants actively engaged in the training, displaying enthusiasm and a positive response. The results of the questionnaire also showed a fairly good level of satisfaction of all participants regarding the theme of the activity, the presentation was easy to understand, the participants' knowledge increased, and this activity should be continued by all participants where the percentage of participants who agreed showed a value of 56.4%. 51.3%, 66.7%, and 53% respectively. The ultimate goal of this initiative is to educate the local community on transforming organic waste into multifunction products for everyday use.
Keywords: disinfectant; eco enzyme; habaring hurung; organic waste

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INTRODUCTION

Habaring Hurung Urban Village is located in the Bukit Batu District, Palangka Raya City, Central Kalimantan (Agriana & Hujjatusnaini, 2022). The population in this location is reported to be around 857 individuals, with an area of approximately ±73.58 km^2 (BPS Kota Palangka Raya, 2022). Geographically, Habaring Hurung is crossed by the Kahayan River, as part of the Tjilik Riwut road and the Trans Kalimantan

road. Known for its fertile soil, this location is recognized as one of the vegetable, rubber, cashew, and local fruit-producing areas (Surjanto, 2017). The people are involved in various occupations according to their residence environment, such as agriculture, animal husbandry, entrepreneurship, etc.

One of the challenges faced by the community in Habaring Hurung is the current accumulation of household waste. Organic waste is the largest contributor to waste in Indonesia, around 60%. Organic waste comes from the remains of living creatures undergoing decomposition (Putri et al., 2023; Saputro et al., 2015). Due to the distance from the final disposal site, residents manage organic waste by burying, burning, or piling it up on the roadside and/or around their homes. Although organic waste decomposition is categorized as environmentally friendly, the process produces methane gas, contributing to greenhouse gas emissions (Anisa et al., 2022; Chanda et al., 2011) and reducing oxygen levels in the air (Yuliono et al., 2015). In addition, Septiani et al. (2021) reported that natural decomposition of organic waste generally takes a relatively long time.

Eco enzyme is a product that can be produced from organic waste (Putri et al., 2023; Sari et al., 2021; Septiani et al., 2021; Yuliono et al., 2021). The uniqueness of eco enzymes lies in their easy and simple preparation process, more economical operational costs, and great benefits in daily activities. Generally, eco enzymes are produced by fermenting organic waste (such as fruit peels and vegetable scraps) using a mixture of sugar and water (Kurniawati et al., 2022). During fermentation, glucose is converted into ethanol and acetic acid (Astuti et al., 2020). The high content of ethanol and acetic acid is what makes eco enzymes function as disinfectants, whereas ethanol and acetic acid are compounds that have antiseptic and disinfectant properties. Ethanol can kill bacteria, viruses, and fungi by damaging their cell membranes, while acetic acid can kill bacteria and fungi by lowering the pH of their environment (Yuliono et al., 2015).

Based on these considerations, a solution that can be proposed is to provide training on how to make disinfectants from eco enzymes produced from organic waste fermentation to the community, especially members of the Family Welfare Empowerment (PKK) in the Habaring Hurung Urban Village, Bukit Batu District, Palangka Raya City. This activity aims to provide knowledge and skills to PKK members in the Habaring Hurung Urban Village so that they can manage organic waste into valuable products, such as practical disinfectants for daily use.

METHOD

The community service activity conducted in the Habaring Hurung Urban Village, Bukit Batu District, Palangka Raya City was carried out using an implementation method consisting of preparation stages, namely gathering information on training needs, preparing training materials and teaching aids; implementation stages in the form of socialization and demonstration; and the final stage consisting of evaluation and reporting through a series of steps that can be outlined as follows:

Preparation Stage

The preparation stage began with gathering information on the community's training needs, coordinating with the Village Head of Habaring Hurung to request permission for the empowerment activities, and discussing and planning the schedule for the activities. In addition, activity site surveys, participant registration, and activity topic delivery were also conducted at this stage.

Disinfectant Production Stage

The service team carried out this stage to prepare disinfectants using eco enzymes produced from the fermentation of organic waste such as fruit peels and vegetable scraps. The tools needed include knives, cutting boards, scales, measuring cups, containers with air-tight lids, strainers, and basins. Meanwhile, the materials used involve water, waste fruit, and vegetable peels (such as watermelon, pineapple, oranges, carrots, and cabbage), and molasses in a ratio of 10:3:1 (Harahap et al., 2021). The workflow for making eco enzymes can be seen in Figure 1.

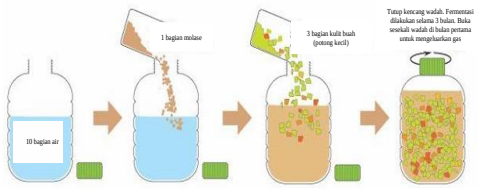

Figure 1 Eco enzyme production workflow

The disinfectant is produced by mixing fermented eco enzyme with water in a ratio of 1:400 (Parbuntari et al., 2023). After that, the produced product would be neatly packaged and then distributed to activity participants after the training session.

Implementation Stage of Training Activities

The training was held on September 4, 2023, at the Habaring Hurung Urban Village Hall. The number of participants present was 39, and one village official represented PKK members. Participant selection was carried out by considering the following criteria: (1) men or women aged 25-65 years; (2) have jobs as farmers, entrepreneurs, or housewives; and (3) have never received knowledge about organic waste management.

The method applied in the training involves socialization and demonstration. Two lecturers from the service team were the speakers delivering the socialization material. The topics discussed included organic waste and its impacts, the benefits of eco enzymes, techniques for making eco enzymes as disinfectants, product standards, and how to use them. Furthermore, a demonstration was conducted on the making and application of eco enzymes as disinfectants to participants, guided by three lecturers and two students from the service team.

Evaluation Stage of Activities

Activity evaluation was conducted after the training session to the participants. The participants were asked to complete a questionnaire to assess the implementation of the activities that have taken place. This questionnaire contains indicator questions designed to measure the success rate of the service activity with answers covering Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD), and Neutral (N). The indicator questions include 1) the suitability of the training theme with the participants' needs; 2) the level of ease of understanding the presented material; 3) the increase in knowledge of participants after attending the socialization and demonstration; 4) the implementation of the activity; 5) the benefits of the activity; 6) the continuity of the activity for participants. Analysis of questionnaire data uses a quantitative method using a Likert scale, which is the collection of respondent questionnaire data in the form of a number ranging from 1 to 5. Participant attendance and activity during the activity would also be considered.

RESULTS AND DISCUSSION

This community service activity was carried out using an implementation method consisting of preparation, implementation, and evaluation-reporting stages. The preparation stage began with gathering information on the community's training needs, where the

service team conducted surveys and discussions with members of the Family Welfare Empowerment in the Habaring Hurung Village. Based on the results of the discussion, information was obtained regarding the problem of household organic waste, which is only waste and has not been optimally utilized, as shown in Figure 2.

Figure 2 Discussion activity with members of the family welfare empowerment

Furthermore, it was found that many residents living in the area work as farmers and have plantation and agricultural land. Therefore, the service team initiated converting household organic waste into eco enzymes, which function as natural disinfectants, as a form of community service. After conducting the survey, the team then coordinated with the village head of Habaring to prepare for the implementation of the service, and the team prepared the materials and teaching aids.

The next stage is the implementation stage, which consists of socialization and training in the form of demonstrations for all training participants. Socialization was carried out through lectures to deliver the material, followed by a question and answer session to allow participants to ask questions, express opinions, and gather information after the material presentation as seen in Figure 3.

Figure 3 Socialization activity

Overall, the socialization results show that participants responded positively to the material presented. Participants were very enthusiastic during the material presentation and actively participated in the discussion. In fact, some participants hoped that similar activities could be carried out continuously.

The next activity was a demonstration accompanied by the distribution of sample products (provided in Figure 4). The process of making eco enzyme as a natural disinfectant begins with mixing water, fruit peel waste, and molasses in a ratio of 10:3:1 to produce an eco enzyme solution. This mixture was then placed in a closed container for 3 months to ferment, where glucose in the fruit peel waste is transformed into pyruvic acid. Next, pyruvic acid was broken down by pyruvate decarboxylase into ethanol and carbon dioxide under anaerobic conditions. The ethanol produced was then broken down into acetaldehyde and water, which were then converted into acetic acid (Astuti et al., 2020; Lubis, & Maulina, 2020; Soviyah et al., 2019). During the 3-month fermentation process, the container was opened several times to release the gas produced. In the final stage, the mixture was then filtered, and the filtrate obtained was a concentrated eco enzyme solution as shown in Figure 4.

Figure 4 Demonstration and product distribution activity

The ethanol and acetic acid content from this fermentation result in eco enzyme being effective as a disinfectant to clean floors, walls, household appliances, and the surrounding air from microorganisms (Mavani et al., 2020; Parbuntari et al., 2023; Yuliono et al., 2021). The disinfectant is then made by mixing the eco enzyme solution and water in a ratio of 1:400. The eco enzyme solution used in the demonstration is the result of fermentation for 3 months prepared by the service team beforehand. The eco enzyme solution has a pH of 4, a dark brown color, and a fresh, acidic aroma. The production of eco enzyme resulted in an ethanol content of 4.56% in 1-month fermentation. The ethanol content obtained is influenced by the carbon source (sucrose) from the type of sugar used. The longer the fermentation time, the cloudier the color of the solution, the higher the alcohol content, and the more acidic the pH of the eco enzyme (Munir et al., 2020; Suprayogi et al., 2022). This indicates that the fermentation process has successfully produced an eco-enzyme solution. The workflow for making eco enzymes is shown in Figure 5.

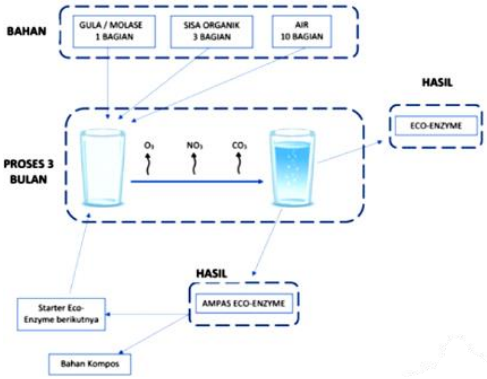

Figure 5 Workflow of eco enzyme production

The results of the eco enzyme product that can be used as a disinfectant were prepared beforehand by the service team and distributed to the participants after the training session was completed. The distribution of this product was done with the aim that the participants could personally experience the benefits provided by the produced disinfectant.

The participants were asked to fill out a questionnaire prepared by the community service team to assess the activities' implementation. The data presented in Table 1 shows that participants agreed (56.4%) and strongly agreed (43.6%) that the activity theme was suitable to their needs. This indicates that the selection of the activity theme was appropriate and in line with the local community's needs, which is to manage organic waste wisely and with environmental sustainability in mind (Sayali et al., 2019). The presented material was also acknowledged for its clarity. This is evident from the questionnaire results, where 51.3% agreed and 46.2% strongly agreed that the material presented was easy to understand. However, one participant (2.6%) disagreed with this statement due to hearing limitations (elderly), making

it difficult to understand the material during the presentation.

Two students assisted in implementing the service during the demonstration, where they had received previous training to make eco enzymes. The questionnaire results also revealed that 66.7% of participants agreed and 33.3% strongly agreed that their knowledge increased after participating in this service activity. During the material presentation, participants were also given knowledge regarding other uses of eco enzyme besides as a disinfectant, such as for laundry, dishwashing, removing pesticide residues on fruits and vegetables, natural pesticides, air purifiers, water clarifiers, plant fertilizers, and others (Mauidatul & Rosariawari, 2022; Ramadani et al., 2019: Rini et al., 2017; Rini, 2016; Supriyani et al., 2020).

Table 1 Results of the activity evaluation questionnaire filled out by 39 participants

No	Question	Response				
		SA	A	FA	D	SD
1	The theme of the service activity is in accordance with the needs of the participants	43.6%	56.4%	-	-	-
2	The material presented is easy to understand by the participants	46.2%	51.3%	-	2.6%	-
3	The knowledge of the participants increased after participating in the service activity	33.3%	66.7%	-	-	-
4	The implementation of the service activity has been carried out well	23.1%	76.9%	-	-	-
5	The service activity is considered beneficial	46.2%	53.8%	-	-	-
6	The service activity that has been implemented can be continued by the participants	66.7%	33.3%	-	-	-

Information: SA, Strongly Agree; A, Agree; FA, Fairly agree; D, Disagree; SD, Strongly Disagree

Data in Table 1 also reveals that participants chose to agree (76.9%) and strongly agree (23.1%) that the implementation of the activity ran smoothly and was considered very beneficial. Most participants plan to continue using the eco enzyme distributed as an environmentally friendly household disinfectant. This confirms the success of the service activity carried out.

CONCLUSION

The participants who attended the training session showed positive reactions to the training conducted. This is evident from the involvement and active participation of the participants during the training. The questionnaire results show that most participants agree, even strongly agree, that the selected activity theme is suitable for the community's needs, the presented material is easy to understand, the participants' understanding has increased, and the activity will be continued by the participants with percentages of agreement of 56.4%, 51.3%, 66.7%, and 53%, respectively. This indicates the success of the service in Habaring Hurung, which effectively equipped participants with the knowledge and skills to transform organic waste into practical products in daily life.

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REFERENCES

Agriana, B. M., & Hujjatusnaini, N. (2022). Pendampingan permainan playdough dari tepung untuk meningkatkan kreativitas anak sekolah dasar di kelurahan habaring hurung 1. *Abdimas Mandiri – Jurnal Pengabdian Pada Masyarakat*, *2*(1), 60–66.

Anisa, D. N., Utami, G. N., Eka, D., & Laelatul, S. (2022). Pembuatan eco enzyme sebagai hand sanitizer dalam upaya pencegahan covid-19 bagi warga SMPN 2 Sekampung. *Jurnal Pengabdian Kepada Masyarakat Tabikpun*, *3*(1), 61–68.

Astuti, A. P., Tri, E., & Maharani, W. (2020). Pengaruh variasi gula terhadap produksi ekoenzim menggunakan limbah buah dan sayur. *Seminar Nasional Edusainstek FMIPA UNIMUS 2020*, 470–479.

BPS Kota Palangka Raya. (2022). BPS Kota Palangka Raya.

Chanda, S., Kalpna, R., & Rathis, N. (2011). Antimicrobial activity of terminalia catappa l . leaf extracts against some clinically important pathogenic microbial strains. *Chinese Medicine*, *2*(2), 171–177.

Harahap, R. G., Dianiswara, A., Putri, D. L., Kelautan, T., & Joang, K. (2021). Pelatihan pembuatan eco-enzyme sebagai alternatif disinfektanalami di masa pandemi covid-19 bagi warga km.15 Kelurahan Karang Joang. *Sinar Sang Surya (Jurnal Pusat Pengabdian Kepada Masyarakat)*, *5*(1), 67–73.

Kurniawati, R., Wiwik, D., Edy, J. T., Mustamina, M., Fadliah, F., Faldo, M. (2022). Pelatihan pembuatan eco-enzyme sebagai alternatif hand sanitizer pada masa pandemi covid-19 bagi masyarakat Desa Mekarsari. *Abdimas Universal 4*, *4*(2), 268–273.

Lubis, A. W., & Maulina, J. (2020). Pemanfaatan Ekstrak Kulit Nanas (Ananas comosus L.) Dalam pembuatan hand wash sebagai antibakteri (1). *Best Journal (Biology Education Science & Technology)*, *3*(1), 70–75.

Mauidatul, A., & Rosariawari, F. (2022). Efektivitas eco–enzyme dalam menurunkan tss, tds, surfaktan pada limbah domestik dengan variasi proses anaerob dan koagulasi - flokulasi. *Esec Proceeding*, *3*(1), 43–50.

Mavani, H. A. K., Tew, I. M., Wong, L., Yew, H. Z., Mahyuddin, A., Ghazali, R. A., & Pow, E. H. N. (2020). Antimicrobial efficacy of fruit peels eco-enzyme against enterococcus faecalis: an in vitro study. *International Journal of Environmental Research and Public Health*, *17*(14), 1–12.

Munir, N. F. S. M. N. H. (2020). Karakteristik fisikokimia ekoenzim limbah kulit jeruk pamelo (citrus maxima (burm.) merr.) dengan variasi gula. *Seminar Nasional Politeknik Pertanian Negeri Pangkajene Kepulauan "Sustainability and Environmentally of Agricultural System for Safety, Healthy and Security Human Life,"* 631–637.

Parbuntari, H., Pangestuti, A. D., Etika, S. B., Farma, S. A., Syolendra, D. F., & Mahmud, M. (2023). Pelatihan pembuatan eco-enzyme sebagai disinfektan alami. *Abdi: Jurnal Pengabdian Dan Pemberdayaan Masyarakat*, *5*(1), 17–22.

Putri, R.T.H., Aisa, A., Taubah, Miftachul., Arrokhman, R. Y., Abdillah, M. A., & Fitriyah, I. N.

(2023). Sosialisasi dan pelatihan pemanfaatan sampah organik sebagai pupuk alami eco-enzyme di Desa Sidomulyo. *Pertanian: Jurnal Pengabdian Masyarakat*, *4*(1), 1–5.

Ramadani, A. H., Rosalina, R., & Ningrum, R. S. (2019). *Pengolahan Limbah Organik Kulit Nanas Sebagai Pupuk Cair Eco-Enzim*. *September*.

Rini, A. R. S. (2016). Pemanfaatan ekstrak kulit buah nanas (Ananas comosus L. Merr.) untuk sediaan gel hand sanitizer sebagai antibakteri Staphylococcus aureus dan Escherichia coli. *Skripsi, Universitas Negeri Semarang*, 1–40.

Rini, R., Supartono, S., & Wijayati, N. (2017). Hand sanitizer ekstrak kulit nanas sebagai antibakteri staphylococcus aureus dan escherichia coli. *Indonesian Journal of Chemical Science*, *6*(1), 61–66.

Safitri, I., Yuliono, A., Sofiana, M. S. J., Helena, S., Kushadiwijayanto, A. A., & Warsidah, W. (2021). Peningkatan kesehatan masyarakat teluk batang secara mandiri melalui pembuatan handsanitizer dan disinfektanberbasis eco-enzyme dari limbah sayuran dan buah. *Journal of Community Engagement in Health*, *4*(2), 371–377.

Sari, V. I., Susi, N., & Rizal, M. (2021). Pelatihan pemanfaatan sampah organik sebagai bahan eco- enzym untuk pembuatan pupuk cair , disinfektan dan hand. *COMSEP: Jurnal Pengabdian Kepada Masyarakat*, *2*(3), 323–330.

Sayali, J. D., Shruti, S. C., Shweta, S. S., Sudarshan, P. E., Akash, D. H., Shrikant, P. T., & Students, D. (2019). Use of eco enzymes in domestic waste water treatment. *International Journal of Innovative Science and Research Technology*, *4*(2), 568–570. www.ijisrt.com568

Septiani, U., Oktavia, R., Dahlan, A., Tim, K. C., & Selatan, K. T. (2021). Eco enzyme : pengolahan sampah rumah tangga menjadi produk serbaguna di yayasan khazanah kebajikan. *Seminar Nasional Pengabdian Masyarakat LPPM UMJ*, 1–7.

Soviyah, S., Lamondjong, A., & Kuswandari, R. A, M. (2019). Program pemberdayaan masyarakat dalam pemanfaatan sampah dalam rangka menuju bantul bersih sampah 2019 pangan dan juga menanam serta mengolah tanaman perkebunan . bantul . selain untuk mengurangi volume sampah yang ada , program pemberdayaan pengelolaan. *Jurnal Pemberdayaan: Publikasi Hasil Pengabdian Kepada Masyarakat*, *2*(3), 525–534.

Suprayogi, D., Asra, R., & Mahdalia, R. (2022). *Analisis produk eco enzyme dari kulit buah nanas (Ananas comosus L.) dan jeruk berastagi (Citrus X sinensis L .)*. *7*, 19–27.

Supriyani, Astuti, A. P., & Maharani, E. T. W. (2020). Pengaruh variasi gula terhadap produksi ekoenzim menggunakan limbah buah dan sayur. *Seminar Nasional Edusainstek*, 470–479.

Surjanto, D. (2017). Revitalisasi budaya dan ekosistem lokal dalam pengembangan pertanian berkelanjutan : pembelajaran dari proyek menuju penghidupan berkelanjutan tahun 1999-2004. *Agrisilvika*, *1*(1), 23–28.

Yuliono, A., Sofiana, M. G. S., Safitri, I., Warsidah, A. A.,& Kushadiwijayanto, S. H. (2015). Pengelolaan sampah berbasis masyarakat melalui bank sampah. *Indonesian Journal of Conservation*, *04*(1), 83–94.