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Community Empowerment In Processing Of Household Organic Waste Into Compost

Sri Wahyuni[1*], Triastuti Sulistyaningsih[1], Nuril Huda[1], Siti Herlina Dewi[1], M. Haris Baihaqi[1], Fika Maulydha Hardiyanti[1], Eka Siti Rinjani[1].

[1]Universitas Negeri Semarang, Indonesia
*Corresponding author: sriwahyunikimia@mail.unnes.ac.id

Abstract
Household waste, which is mostly in the form of food waste such as vegetables and fruits, is a source of waste accumulation. More than fifty percent of the waste accumulation in Banyudono village, Boyolali, Central Java is household waste. The accumulation of garbage causes environmental pollution problems that can result in a decrease in the quality of life of residents. Garbage accumulation occurs because residents only throw it into the surrounding environment or rely on garbage transport trucks to be disposed of in landfills. This is due to the lack of knowledge among of residents (the participant of the service activities) in waste processing. Proper waste management not only makes the environment clean and healthy, but also improves the community's economy through the creation of value-selling products. To overcome the partner's problem, namely the accumulation of waste, the service team provides solutions according to the partner's needs, namely the transfer of science and technology (IPTEK) to process household waste (organic) into organic fertilizer (compost). The transfer of science and technology to Banyudono Village residents take place in July 2023 and participants were given assistance to implement the science and technology to treat waste independently. The results were monitored 3 months later according to the known composting method. Composting is done using EM4 bioactivator so that the results can be harvested within 3 months of composting. Compost quality analysis is carried out after the compost is physical and chemical mature which confirmed by checking pH and levels of nitrogen, phosphorus, and potassium. The obtained compost was blackish with a smell like earth, and has a fine texture. The compost had a pH of 6.9 and the nitrogen, phosphorus, and potassium levels meets SNI standards. Through this activity, participants able to processing household waste independently.

Keywords: EM4, compost, household organic waste, community service, SNI

INTRODUCTION

Waste that accumulates is a significant issue that can damage the balance of environmental ecosystems. Based on Bappenas calculations, landfill in Indonesia amounted to 22.5 million tons and more than doubled in 2020 to 53.7 million tons (Suprapto et al., 2020). Fifty-eight percent of this waste consists of organic waste, followed by 14% of plastic waste (Zahra and Damanhuri, 2011). One of the main sources of waste is household waste, where 48% of household waste is organic waste and 33% is inert material (Sarmah et al., 2020). Banyudono Village, Banyudono District, Boyolali Regency, Central Java also faces the problem of stacking household waste, both non-organic waste and organic waste. This has an impact on the village environment, the environment becomes dirty and sometimes smells. Therefore, it is necessary to solve the problem immediately regarding to the household organic waste.

The main livelihoods of Banyudono villagers are agricultural labor and trading. A small percentage are farmer employees. Some areas of Banyudono village are still farms and plantations where farmers require fertilizer for the fertility of their crops. The fertilizers that have been used are factory-made chemical fertilizers such as urea and triple super phospat (TSP) which are sold at expensive prices and have a negative impact on the environment such as causing the eutofication process resulting in an explosion of weed populations (Darwis and Nurmanaf, 2004; Kariyasa et al., 2007). This is also experienced by Banyudono village farm workers, namely the amount of fertilizer needed is relatively large but the price is expensive. Therefore, residents in Banyudono Village, Boyolali need to be given knowledge and skills about alternative organic fertilizers that are more environmentally friendly to replace chemical fertilizers.

Organic waste has the potential to be processed into compost which is an environmentally friendly product (Handayani et al., 2021). This compost can be applied at the household level and can reduce the volume of organic waste significantly and can be an additional sector of economic income for residents if the fertilizer made is sold in the surrounding environment or used personally. Composting is one of the methods of processing organic waste (waste) which aims to change the composition of waste into useful products and enriched with nutrients such as nitrogen (N), phosphorus (P), and potassium (K) (Le Pera et al., 2022). Compost is generally made from organic waste such as household food waste, animal waste, and leaves that are incubated to produce fertilizer with balanced nitrogen (N) and carbon (C) levels. The composting process by utilizing EM-4 bacterial culture can accelerate the decomposition process and produce compost with an ideal C/N ratio (Yusuf et al., 2016). In addition to making compost from organic waste, Banyudono villagers are also given training to make eco-enzymes, which are a type of liquid organic fertilizer that can help plant fertility.

Effective Microorganisms 4 (EM4) is one specific isolate products that has been marketed as a bioactivator agent in composting to accelerate microbial proliferation (Triwibowo et al., 2015). EM4 solution contains fermentor microorganisms consisting of about 80 genera including photosynthetic bacteria, Lactobacillus sp, Streptomyces sp, yeast (yeast), Actinomycetes sp. and selected those that can work effectively in the fermentation of organic matter (Aristotle et al., 2021; Suwatanti and Widiyaningrum, 2017). But on the other hand, residents of Banyudono Village, Boyolali still lack the skills to manage household organic waste into organic compost and there are limited facilities and infrastructure. Therefore, in this service, training was held to increase the capacity of household organic waste processing skills into organic fertilizer products, namely compost that can be used by residents and can be sold to increase the economic capacity of residents. The resulting compost is recommended to be used for some residents who are agricultural laborers, while residents who work as traders can use it to sell directly to people in need. This aims to increase the independence of the community in Banyudono village, Banyudono District, Boyolali Regency.

METHOD

The materials for making compost and eco-enzymes are organic waste in the form of food waste, fruit peels and vegetable waste obtained and collected by residents of Banyudono Village, molasses or Javanese sugar, EM-4 liquid, and water. The tools used in making compost are compost bags, blenders, and glassware.

Composting and *eco-enzymes*

Household organic waste that has been collected is then shredded into small sizes, the smaller the size of the shredded waste, the faster the composting will take place. On a small scale, approximately 1 kg of garbage (fruits, vegetables, and dried leaves) that have been chopped is put into a composting bag and added a certain amount of water to make the garbage slightly moist. Next, the diluted EM-4 liquid is added to the composting bag and stirred to make it homogeneous. Afterward, the compost bag is tightly sealed (temperature ≤ 50°C). After 2 weeks can be stirred periodically. Then

the pulp is dried by aeration. Following that the pulp is sifted, weighed, pH tested, and then packaged. Meanwhile, making eco-enzymes is done by utilizing fresh fruit skin waste materials. The skin of the fruit is weighed and mixed with water in a ratio of 1: 10. Then added molasses or low quality java sugar that is no longer consumed in a ratio of 1: 1 (fruit skin weight: sugar weight). Next, the mixture is left to stand for approximately 3 months to get eco-enzymes that are ready to be harvested for use as liquid fertilizer.

Compost quality test

Laboratory tests of the produced compost are carried out to guarantee its quality. Compost products are analyzed for chemical properties which include analysis of Nitrogen, Passport, and Potassium content. The analysis was conducted at the Integrated Laboratory of Diponegoro University.

pH Test

The pH test on compost is analyzed using a universal pH indicator. Ten grams of compost were dissolved in 100 mL of aquades and confirmed the pH with a universal pH indicator.

RESULTS AND DISCUSSION

The rapid development of the times is directly proportional to the increase in population and the increase in consumptive power in society. This results in an increase in the amount of household waste produced, especially organic waste such as vegetable and fruit residues which are the cause of the source of waste accumulation. The accumulation of garbage that occurs causes pollution and causes unpleasant odors in the area around residents' homes. This problem occurs because residents (participants of the service activities) have no knowledge in treating waste other than burning waste and disposing it directly into rivers or temporary garbage shelters, potentially causing environmental pollution if left continuously. The service team provides education on the causes of waste accumulation and how to respond to it. The service team equips villagers about processing organic waste into fertilizer, namely compost. The compost produced, in addition to being able to be used by residents themselves, can also be packaged and sold to farmers and communities around the environment and outside the environment. The educational stage is shown in Figure 1.

Figure 1. Education Stage of Banyudono Villagers, Boyolali

Compost organic fertilizer is a type of fertilizer that functions as a supplier of soil nutrients so that it can be used to improve soil properties physically, chemically, and biologically (Bachtiar and Ahmad, 2019). Composting is one of the various methods of processing organic waste that aims to change the composition of waste into products that are more useful and can be utilized by residents. In principle, the development of waste treatment with composting technology is based on the process

of decomposition of naturally occurring organic matter. The decomposition process can be optimized with the aim that composting can run faster and efficiently. Composting optimization can be done with the help of composting bacteria such as Promi, Orga Dec, Super Dec, BioPos, EM-4 and so on (Nur et al., 2016). According to Sidabalok et al. (2014), organic waste can be used as organic fertilizer by utilizing fermentation from decomposing bacteria, such as Rhodopsuedomonas spp, Lactobacillus spp, Saccaromyces spp and Actinomycetes.

In addition to providing education and counseling on the waste management process through processing organic waste into compost and eco-enzymes, the service team also provides assistance and training on the process of making compost. The processing of organic waste into compost is carried out by fermentation method using the help of effective microogenism 4 (EM4). Effective microorganism 4 (EM4) contains about 80 genera of fermented microorganisms, including photosynthetic bacteria, Lactobacillus sp., Streptomyces sp., Actinomycetes sp. and yeast (Aristotle et al., 2021). This bioactivator is applied as an inoculant to increase the diversity and population of microorganisms in the soil and plants which can further increase fertility and plant growth. With increasing fertility, the quality and quantity of crop production will also increase, especially for household scale (Suwatanti and Widiyaningrum, 2017). The EM4 bioactivator used can be seen in Figure 2.

Figure 2. EM4 bioactivator used

In this composting training, as the main source of materials is household waste in the form of food waste, vegetables, and fruits. These materials serve as a source of nitrogen (N). In addition, fallen leaves from trees around houses and the village environment where you live, paper, cardboard, and tissue waste were also used as carbon reservoirs (C). Waste as a source of carbon and nitrogen is then mixed with EM4 bioactivator to help the decay process to become compost faster. The estimated time needed for this process from preparation to compost ready for use is estimated to take approximately 3 months or less if the raw material shredding process is better. Compost produced in this way is environmentally friendly and contains substances that are not owned by ordinary chemical fertilizers (inorganic) whose manufacture comes from chemicals.

The processing of organic waste into compost and eco-enzyme is relatively very easy to do so that trainees can follow and practice it at home. This convenience makes participants moved to make their own after training. The process of making organic compost during training is presented in Figure 3.

Figure 3. The practice of making Compost in Banyudono Village, Boyolali

The resulting compost was measured pH with universal indicators and obtained a pH value of 7. This is in accordance with SNI 19-7030-2004 (SNI, 2004). The results of the analysis of Nitogen, Passport, and Potassium levels in the organic compost produced also meet SNI standards. In addition to making efforts to improve the skills of residents, the service team also makes efforts to increase the economic capacity of the community by conducting packaging training and selling products online.

Evaluation of activities is carried out by observing partner skills and filling out questionnaires to determine the improvement of partner knowledge and skills as well as product analysis to determine product quality before being marketed. Some of the questions asked in the questionnaire included the experience of residents in participating in counseling on making compost from household organic waste, residents' opinions about the importance of knowledge of making compost from household organic waste, knowledge about the benefits of compost, residents' plans after gaining the knowledge and skills that have been given, the results of residents' practices, the desire of residents to practice again in the future, The feasibility of compost to be sold according to residents, and the need for re-counseling.

Based on the activities that have been carried out, residents of Banyudono Village, Boyolali Regency responded well during the activity. The service team hopes that with this activity, the knowledge and skills of the residents of Banyudono, Boyolali village will increase and increasingly understand the need for knowledge about waste management as a whole to suppress the increasing accumulation of waste from time to time. Residents understand the causes of garbage accumulation, and how efforts can be made to overcome it. Residents also understand that by mastering skills about organic waste processing, it can help the village government in managing waste accumulation. Residents also benefit through the use of fertilizers made independently for the benefit of the village, especially in terms of increasing garden or agricultural output.

The improvement of residents' ability to make organic compost was also assessed in this activity. Residents of Banyudono village, Boyolali have only received counseling on composting once, previously residents had received waste management training but specifically on dry waste, especially plastic. However, this time the service was different because the service team provided training and explanation on organic waste management (wet waste from daily household activities) and introduced the use of EM-4 in processing the waste. Residents stated that they need to have the ability and knowledge in making organic compost, because many components of waste are not used and pollute the environment. Through this activity, residents' knowledge in managing organic waste increases, and they will practice independently using the facilities provided by the service team.

CONCLUSION

Based on the results of the program implementation, it can be concluded that the community began to understand the importance of independent waste management and the need for simple but basic knowledge to contribute to waste management in their respective neighborhoods. Increasing knowledge and skills in making compost based on household waste can be an alternative effort to overcome the problem of waste accumulation in the village environment, especially the accumulation of waste caused by household waste.

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