

APPLICATION OF THE CIRCULAR ECONOMY CONCEPT IN ORGANIC WASTE MANAGEMENT IN SCHOOLS

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ABSTRACT

Waste management is a serious problem in Indonesia. Many landfills, including those used by schools, have reached maximum capacity or very high environmental pollution burden. The key to effective waste management is fostering environmental awareness and promoting a culture of environmental care in schools. This makes waste management crucial at all stages (upstream and downstream). However, students at SMAN 29 Jakarta lack a clear understanding of recycling used items and the concept of a circular economy. Therefore, this training aims to educate students on the concept of the circular economy and its application through Takakura and eco-enzymes. The training method is mentoring, which includes socialization and explanation of materials related to the circular economy and its application. Implementation of the circular economy is achieved through demonstrations and hands-on practice. This activity aims to broaden students' understanding of their role as agents of change in their environment, both theoretically and practically.

Keywords: Waste Management, Eco-enzymes, Takakura, Circular Economy

1. INTRODUCTION

The high volume of waste transported to final disposal sites (TPA) is caused by population growth and a lack of management facilities. Over the past three years, waste production has increased. According to data collected from the National Waste Management Information System (SIPSN) of the Ministry of Environment and Forestry (KLHK) of the Republic of Indonesia, in 2024, the total waste generated was +29 million tons/year, with +11 million tons/year being unmanaged waste (KLHK, 2024). The existence of waste is increasingly difficult to avoid because the management system still relies on a downstream processing approach, or what is called end of pipe (Agung et al., 2004; Rahmawati, 2021). Therefore, a combination of source management and end management is needed to achieve 100% managed waste. According to SIPSN data from 2024, food waste accounts for 49.87% of the total waste composition in DKI Jakarta. Previous studies have shown that composting with Takakura is easy to do and the materials used are readily available. In addition, it does not require a large area of land (Harlis et al., 2019; Tamyiz et al., 2018).

The circular economy is an economic concept that focuses on minimizing waste and maximizing the use of resources. In a circular economy, products, materials, and resources are designed to be reused, recycled, or kept in the cycle of use for as long as possible so that they can be reused in the economic cycle (Purba et al., 2024).

Activities at SMAN 29 Jakarta, including eating nutritious food, produce waste in the form of fruit peels or leftover fruit and vegetable scraps that are unfit for consumption and thus become waste. In addition, the MBKM Learning Program implemented at the high school level requires students to be active and critical in addressing current issues in society. One of the MBKM programs implemented at SMA 29 is the creation of Appropriate Technology (TTG), which will culminate in an internal exhibition. This TTG program is being implemented for the first time at SMA 29, so there is a great need to introduce what TTG is, especially technology that is applicable, solution-oriented, and requires minimal capital. This is seen as one of the problems at SMA 29, namely the excessive use of battery energy in the TTG innovations carried out by SMA 29 students. In addition, the students' orientation is towards high technology that requires a sufficient amount of capital. Environmental issues have not been raised by students at SMA 29, even though this issue is the closest to the community. It is common to find organic waste being disposed of without further processing at final disposal sites (TPA), both in urban and rural areas. Organic waste is a type of waste consisting of organic compounds that can decompose naturally or can be easily decomposed with the help of living

organisms. Other organic waste comes from gardening or from trees and plants. Organic waste contains various types of microbes, including protozoa, fungi, bacteria, and viruses (Setiyono & Wahyono, 2022).

Waste management is a complex issue and requires different approaches to suit each environment. Age, gender, education level, income, length of stay, and other environmental factors must be considered in efforts to achieve sustainable waste management. Through Law No. 18 of 2008 concerning Waste Management and Government Regulation No. 81 of 2012 concerning Household Waste Management and Household-like Waste Management, the Indonesian government emphasizes the principle of reduce–reuse–recycle. More than 60% of household waste is organic waste that can be easily managed by applying the principles of a circular economy. More than 60% of household waste is organic waste that can be easily managed.

The transition to a circular economy requires preparation in several important aspects. Circular economic activities have the potential to be applied in various sectors, including agriculture and industry. The circular economy model can be an option in integrated agriculture by developing innovations to improve efficiency and effectiveness, optimizing resource use, and caring for environmental preservation to support sustainable development (Adziem et al., 2021). As Pandawara Group is popular for conducting cleanup activities in various places, it is hoped that source management with the involvement of the younger generation can have a significant impact so that the lifespan of landfills will be longer and the cost of waste processing at the end will be reduced.

2. METHOD

Based on the issues described above and the agreement between the proposing team and its partners, the following approach can be used to implement the proposed solution to address the existing problems:

1. Socialization of knowledge and awareness among students at SMAN 29 Jakarta. This process involves providing information in simple language about the dangers of accumulating food waste and how it can be transformed into valuable products. 2. Introduction to the concept of the circular economy. Socialization techniques utilize digital media and teaching aids.
3. Training Process: Training is carried out through tutorials and practical training on how to manage food waste and turn it into compost using the Takakura Method.

The following steps were taken to implement this partnership method:

1. First stage: Collect data, facts, and information related to the community service issue.
2. Second stage: Develop a joint plan through discussion. The purpose of this discussion was to gain support and agree on a solution together.
3. The third stage involves implementing activities that have been planned and agreed upon with partners.
4. The fourth stage involves evaluation, monitoring, and reporting. At this stage, the results of the implementation are disseminated so that a comprehensive evaluation can be conducted. Partner participation in this PKM involves allocating time for activities, providing venues for them, and jointly processing food waste into compost using the Takakura method, which motivates them to continue. The implementation of the education-related program is evaluated through pre- and post-tests.

3. RESULTS AND DISCUSSION

The material on circular economy begins with facts about waste in Indonesia and the value of goods (Figure 1). Next, the concept of 3R is explained, whereby goods that are thought to be unusable can actually be reused to process new products. Examples from the Setaria Farmer Group in Sangasanga District and the Masdarling Pokdarwis in West Bontang District, East Kalimantan, have implemented integrated farming with a circular resource utilization model as an adaptation to reduce production costs, while ensuring the health impact of products and preserving the environment. This creates long-term sustainability (Adziem et al., 2021).

In addition, an explanation was given regarding the relationship between the circular economy and eco-enzymes. One method of managing organic waste using used items is to turn it into eco-enzymes, where participants were given an in-depth understanding of the importance of organic waste management. Reusing production waste to minimize

unused waste is a circular economy concept that demonstrates the sustainability principle of a product (Manik, 2022). The circular economy is not only good for the environment but also for economic growth because it increases resource use efficiency by reducing waste and maintaining material value in the economic cycle. Organic waste processing is good for reducing environmental impact, and the reuse of bottles and sugar residues are examples of the circular economy that increase resource use efficiency. The implementation of circular economy activities will help raise students' awareness and behavior in protecting the environment because they will think creatively to utilize the waste they produce (Purba et al., 2024). Processing organic waste using used bottles and other used items can create new products that can be utilized by schools.

The material was presented using PowerPoint. Fifty percent of the participants in the waste management training were students. They were 11th grade high school students, aged 17 or 18. The training continued with socialization, demonstrations, and hands-on waste management practices using the Takakura method, as well as an introduction to eco enzymes. This community service activity targets organic waste management at the source. It is hoped that waste management at the source will reduce the burden on landfills. The Takakura composting method has advantages over other methods. First, it is practical for households without much land. The baskets can be placed anywhere according to the available space. Second, it is easy because it only requires daily waste disposal. No additional treatment is needed, such as adding water or other materials. Third, the process is odorless because it involves fermentation, not decay (Rezagama & Samudro, 2015). Koji Takakura introduced this composting method in Japan in 2004. It only uses a container, such as a basket, for the composting process. The necessary materials, such as husks, cardboard layers, and ready-made fertilizer, are easy to obtain. There are several stages to putting the materials into the Takakura basket (Figure 2). Composting using the Takakura method has advantages beyond being practical for household use; it is also fast and inexpensive (Kartini et al., 2021). This method uses additional microorganisms. The addition of EM4 to the composting process accelerates it compared to conventional methods and is believed to improve the quality of the compost (Saad et al., 2013; Haryanti et al., 2017; Ekawandani et al., 2019; Dewilda et al.).



Picture 1. Presentation and Discussion Session

The session concluded with a question and answer session on the importance of managing organic waste through the application of a circular economy and environmental sustainability. Questions were asked about the organic waste produced every day, how it is collected, and how it is sorted. Large pieces of organic waste suitable for making eco enzymes are separated and shredded once a week. One of the activities to achieve this goal was an evaluation through the distribution of pre-test sheets before the activity began and post-test sheets after the activity was completed. The distribution of evaluation sheets aimed to measure the participants' level of understanding before and after the training. The participants gained an understanding of the concept and benefits of the circular economy and its application in organic waste management. The hope is that participants can replicate this at school or at home and use it in their daily lives.

Table 1. Results of Pretest and Posttest

Questions	Pretest		Posttest	
	% Yes	% No	% Yes	% No
Do you know what the circular economy is?	10	90	96	4
Are you familiar with its benefits?	6	94	96	4
Are you familiar with the principles of the circular economy?	3	96	100	0
What is organic waste?	90	10	100	0
Are you aware of the negative impacts of organic waste on personal health and the environment?	81	19	100	0
Do you know how to manage or utilize organic waste?	68	32	100	0
Are you familiar with Takakura and eco-enzymes?	35	65	100	0
Are you familiar with the connection between the circular economy, Takakura, and eco-enzymes?	6	94	96	4
Did you know that organic waste management is an application of the circular economy?	13	87	96	4
Do you know how to make Takakura and eco-enzymes?	26	74	100	0

The pre-test results (Table 1) show that more than 90% of participants were not familiar with the circular economy (definition, benefits, and principles). Between 70-90% of participants knew about organic waste, its impact, and its utilization. This was because they had already been equipped with knowledge about organic waste and various methods of organic waste management. Between 70-90% of participants did not have in-depth knowledge about the application of the circular economy through the production of takakura or eco enzymes.

The post-test results after the activity was carried out showed an increase in participants' understanding of more than 90% regarding organic waste, organic waste management, circular economy, and the application of circular economy. The training activity also increased the enthusiasm of the participants to apply the principles of circular economy through the production of takakura and eco enzymes at school. The participants were also enthusiastic in participating in the training activities and were satisfied with the material, explanations from the speakers, and the implementation.

5. CONCLUSION

Students at SMAN 29 Jakarta understand the importance of the circular economy. They are also aware of the importance of applying the circular economy in organic waste management. The training activities improve their understanding of organic waste management using Takakura and eco enzymes. This training activity also provides them with the skills needed to make Takakura and learn about eco enzymes. The ability to apply the circular economy in environmental management also motivates them to consistently practice environmental culture at school.

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6. REFERENCES

Adziem, A., Hamdir, W., & Nurhasanah, Y. (2021). Inisiasi Lokal Model Ekonomi Sirkular Melalui Pertanian Terpadu Sebagai Adaptasi Petani Di Kalimantan Timur Selama Pandemi COVID-19. *Learning Society: Jurnal CSR, Pendidikan dan Pemberdayaan Masyarakat*, 2(1), 88–100.

- Purba, B., Kaban, N. S. B., Hutahaean, R. P. L., Zandroto, T. R., & Dirham, I. N. (2024). Konsep Ekonomi Sirkular Model Circular Bisnis Circular dan Ekonomi Karbon Sirkular. *Economic Reviews Journal*, 3(3). <https://doi.org/10.56709/mrj.v3i3.305>
- Fadlilla, T., Budiastuti, Mt. S., & Rosariastuti, M. R. (2023). Potential of Fruit and Vegetable Waste as Eco-enzyme Fertilizer for Plants. *Jurnal Penelitian Pendidikan IPA*, 9(4), 2191–2200. <https://doi.org/10.29303/jppipa.v9i4.3010>
- Jelita, R. (2022). Produksi *Eco enzyme* dengan Pemanfaatan Limbah Rumah Tangga untuk Menjaga Kesehatan Masyarakat di Era New Normal. *Jurnal Maitreyawira*, 3(1), 28–35.
- MAHARANI, M. D. D., RACHMANI, N. R., & FEBRINA, L. (2024). Perbandingan Efektivitas Penurunan Beban Pencemar Air Limbah Domestik dengan Penambahan *Eco enzyme*. *Jurnal Reka Lingkungan*, 12(1), 93–103.
- Manik, Y. M. (2022). Ekonomi Sirkular, Pola Berfikir dan Pendidikan untuk Keberlanjutan Ekonomi. *JURNAL PROMOSI Jurnal Pendidikan Ekonomi UM Metro*, 10(1), 115–128.
- Romdaniyah, S. W. (2023). Produk Ekoenzim Pemanfaatan Sampah Organik Untuk Peningkatan Kepedulian Lingkungan Adiwiyata Siswa Kelas Vii Smp Negeri 1 Batu. *Jurnal Pendidikan Taman Widya Humaniora (JPTWH)*, 2(3), 68–87. <https://jurnal.widyahumaniora.org/>
- Rukmini, P., & Astuti Herawati, D. (2023). Eco-enzyme from Organik Waste (Fruit and Rhizome Waste) Fermentation. *JURNAL KIMIA DAN REKAYASA*, 4(1). <http://kireka.setiabudi.ac.id>
- Setiyono, & Wahyono, S. (2022). Sistem Pengelolaan Sampah Kota Di Kabupaten Bekasi-Jawa Barat. *Jurnal Teknologi Lingkungan*, 2(2), 194–198.
- Zultaqawa, Z., Nurahman Firdaus, I., & Donie Aulia, M. (2023). Manfaat *Eco enzyme* Pada Lingkungan. *CRANE : Civil Engineering Research Journal*, 4(2), 2775–4588. <https://ojs.unikom.ac.id/index.php/craneZeisetal./CRANE/2023>