

BIODEGRADABLE MATERIAL IN COMPOSTING: GREEN INITIATIVES IN NORTHERN MALAYSIA AND INDONESIA

Nurul Azita Salleh¹, Aviasti Anwar², Mohamad Satori³, Pao Ter Teo⁴, A. Shah⁵, Zakirah Othman⁶, Faisal Zulhumadi⁷

^{1,6,7}School of Technology Management and Logistics, Universiti Utara Malaysia, 06010 Sintok Kedah, Malaysia

^{2,3}Fakultas Teknik, Universitas Islam Bandung,

⁴Faculty of Bioengineering and Technology, Universiti Malaysia Kelantan,

⁵Faculty of Technical and Vocational, Universiti Perguruan Sultan Idris

E-mail: nurulazyta@gmail.com

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Abstract

Composting is an aerobic or anaerobic organic waste decomposition process that is biologically produced. It is a method in managing solid waste, more specifically organic waste, that consists of food and agricultural waste. Disposal of food waste on a daily basis has led to the launching of several studies through a programme conducted to raise awareness and provide information to the public regarding the benefits of managing food waste. In Malaysia, a Taka kura based composting programme was held in Village A, a rural township in the state of Kedah, in the northern part of Peninsular Malaysia. Meanwhile in Indonesia, an overlay brick composting programme was held at RW22 to look at the level of knowledge and practice of residents about composting activities before and after the composting programme was implemented. The results of programmes in both countries showed that the level of knowledge and awareness of the population about food waste management has risen to a higher level than before the implementation of the programme, which was based on briefings and demonstrations given and shown to the public on solid waste management by composting. In fact, the villagers also adopted these composting activities after the programme.

Keywords--- Green Initiatives, Composting, Biodegradable, Malaysia, Indonesia

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INTRODUCTION

Composting is one method, under the management of waste or solid waste, implemented in addition to recycling and the usual waste disposal methods. This method is a biologically aerobic or anaerobic decomposition process involving carbon, nitrogen, humidity, pH, and oxygen aspects (Argun, Karacali, Calisir & Kilinc, 2017). According to Mohamad Satori, Endang Prastyaningsih, Yanti Srirejeki, Tani Hikmah Nur Ulfah, Nika Rika Nurmalsari, and Iik Nuralam (2018), in the new paradigm of today, waste is not just seen as waste material that requires disposal, but rather it is viewed as having the potential to become a (useful) resource.

Composting has become a reliable waste management practice due to its obvious economic and environmental benefits, such as reduction in waste, destruction of any pathogens, decomposition of stink compounds, increase in biodiversity and microbial population activity in the soil including reduction of grass growth, and commercial fertilizer use in agriculture (Inceca, Ozbayrama, Akyolb, Inceca, & Inceca, 2015).

Typically, composting can be carried out in urban, as well as rural areas where they are less equipped in terms of solid waste disposal facilities (NurulAzita, Fadhilah, Zakirah, Noor Hidayah, Aviasti, Rushanim, MohdNasrun, 2020).

In fact, home composting is also good practice among residents providing sustainable environmental solutions in rural areas that can improve the quality of compost and agricultural land productivity with reduced impact on the environment, while incorporating bio-based economies within the rural areas (Mihai & Ingraio, 2016). Indeed, it is a good method for recycling biodegradable waste into compost (MohdDinie & Mashitah, 2013), namely bio-fertilizer or energy (biogas) (Mohamad Satori et al., 2018).

Basic Materials in Composting

Generally, composting involves organic waste (Argun et al., 2017) which consists of kitchen or food waste, as well as plant waste. However, in principle, among the ingredients that can be used for composting purposes include all compostable solid organic matter such as domestic organic and market-type organic waste (fish, vegetables, and fruits) or other related substances from urban areas (including paper), waste from livestock and agro-industrial areas, and waste from orchards and farms (including fruit, vegetables and sugar, as well as other organic materials such as hair/fur, bones, and horns). Ardiningtyas (2013) also stated that organic waste is made up of kitchen waste, food, fruit peels, and garden waste that is easily destroyed and decomposed.

Method of Composting

Composting can be divided into two methods, namely aerobic and anaerobic. Aerobic decomposition occurs biologically in the chemical structure or organic matter with the presence of oxygen through the role of several bacteria, such as *psychrophilic*, *mesophilic*, and *thermophilic* bacteria, where these microorganisms take water and oxygen from the air, while food is derived from aerobic organic matter decomposition. As for the anaerobic composting process, it occurs biologically on the chemical structure and organic matter without the presence of oxygen, where it does not undergo any temperature changes such as in the aerobic processes (Samekto, 2006; Argun et al., 2017).

In conclusion, composting refers to the process of compost produced by organic matter after a natural nutrient-rich decomposition process. The decomposed compost is recycled as fertilizer for the main ingredient in organic farming. Basically, composting requires only the heaping of waste outdoors and time for the pile to decompose. However, modern composting

methods use a number of steps and processes through which water, air, and other materials rich in carbon and nitrogen are carefully monitored and administered accordingly. This composting process is facilitated by incorporating additional plant material, as well as water mixing and suitable ventilation by periodically blending the mixture. Subsequently, worms, microbes, and fungi will act to decompose the material in an appropriate environment for high quality composting (Ardiningtyas, 2013; Argun et al., 2017).

Benefits of Composting

According to Kebede, Gan, and Kaguchi (2016), composting can be a potential source of income and can improve the quality of life and economy of the rural community. Additionally, this composting method is also very effective in preventing the disposal of any unnecessary domestic organic, agricultural, livestock, and food waste which can create an unwanted waste and increased waste at landfills. It was found that almost 40% of organic domestic waste produced from a household on a daily basis is made up of vegetables and food waste, which is usually thrown into plastic bags along with other inorganic wastes.

In addition, composting can produce compost in the form of fertilizers where this organic fertilizer has many benefits in increasing soil moisture resistance and it is used as agricultural and landscaping soil in municipal, garden, and residential areas, including for use in greenhouses. In fact, these composting products have also been used as natural fillers to cover and rehabilitate abandoned waste disposal areas, land reclamation, and even as animal feed, as well as used as additives to fertilizers, fuels, and building materials.

As such, home composting is arguably the most appropriate early treatment option in playing a major role in rural areas to remove biological waste from being dumped in wild forest areas or open garbage collection sites (Colón, Martínez-Blanco, Gabarrell, Artola, Sánchez, Rieradevall, & Font, 2010).

Green Initiative: Composting Program in Malaysia

In Malaysia, food waste is a major contributor to solid waste composition with 44.5% (Survey on Solid Waste Composition, Characteristics and Existing of Solid Waste Recycling in Malaysia Final Report, 2012). It is paramount that proper waste material management needs to be implemented so that waste does not significantly degrade the environment, as well as becoming excess dumps at the landfills. Therefore the education and delivery of information in related programs are necessary to give the public informational exposure on how to properly manage waste, including more specifically on the managing of organic food waste.

From the aspect composting methods in solid waste management, the public's awareness of this is still relatively low. Thus, this article presents the results from the composting program conducted in a village in the northern part of Peninsular Malaysia, specifically in a rural area in Kedah, to look at the level of knowledge and practices of villagers regarding composting activities before and after the program has been run. The program was conducted in Village A with a solid waste agency representative acting as speakers, lecturers, and co-supervisors involving 55 respondents. This exercise was carried out quantitatively which involved observations on the composted produce (NurulAzita, et al., 2020).

Implementation of Composting Program in Village A Before Program Implementation

1. A community program planning meeting was organized under Social Innovation Research at the government agency office involving area agency officials, solid waste agencies, and researchers from Universiti Utara Malaysia.
2. A visit was made to the programme location in Village A.

3. A brief meeting with researchers, government agency officials, and village representatives on the implementation of the program was performed.
4. Site and equipment preparation before the day of the program was carried out.

During Program

1. Community members fill out a questionnaire (pre-test).
2. The related agency gives briefing to participants on solid waste management.
3. Implementation of composting activities using Taka kura method by participants was performed.
4. Community members fill out a questionnaire (post-test).

After Program Implementation

1. The first observation was made after one week since the commencement of the program with representatives of the related agencies, in the development of composting fertilizers produced by participants in 10 groups. The results of the observation showed that the production of fluids for compost materials was successful for all groups. However, only one group managed to produce compost soil. Most groups fail due to excess water usage. In addition, there were also groups that had problems with water shortage and their compost materials had been damaged by ants. As a result, improvements to compost soil had been made related to the previous failures.
2. The second observation was made three days after the previous observation with the related agency representatives. The results showed that three groups were able to reproduce the microbes (fungi), while the other groups failed because the soil was too dry due to close proximity to windows and over exposure to sunlight. In addition, insect activity, such as foraging ants, also resulted in the failure to reproduce the necessary microbes. For successful groups, the microbial reproduction process was continued by inserting a handful of excess kitchen waste every two days.
3. Subsequent observations were made to inspect at the development of compost fertilizer where it was found that the excess kitchen waste had decomposed. This indicated that the composting process was working well.

A preliminary inspection of the data gathered found that 74.5% (41) of the respondents do not practice composting, as 72.7% (40) of them stated that they are unaware of composting waste management. However, the villagers have undertaken composting activities after receiving an abundance of information from the briefings made during the program.

Table 1. Mean score comparison of the community's level of knowledge about composting (NurulAzita, et al., 2020)

No.	Items	Mean	
		Pre	Post
1.	I know about solid waste management through composting	3.3	4.2
2.	I know about the benefits of waste composting	1.9	4.3
3.	I know about waste composting programmes	1.8	4.0
4.	I am well informed about waste composting	2.4	4.0
5.	I know about the types of waste for composting	2.0	4.3
6.	I know how to do waste composting	1.8	4.2
7.	I know about the respective parties/ agencies that organize waste composting programmes	1.8	4.1

Table 1 above shows the results of the mean values on the level of knowledge of rural communities in Kedah, before and after the program on composting solid waste management. The results of the study on the level of knowledge of composting in solid waste management recorded a mean value of 3.3 before and increased to 4.2 after the program.

The response by the participants regarding the level of knowledge of composting benefits was low (1.9) pre-program implementation, which then increased to a mean value of 4.3 after the program. Similarly, the results of the study on composting information were initially observed lower at a mean of 2.4 and increased to 4.0, before and after the program respectively. In fact, residents' knowledge of the types of waste that can be composted was initially limited (mean = 2.0), but increased considerably (mean = 4.3) after being briefed in the program. Likewise, the level of knowledge of the residents about the way waste was composted recorded a low mean (1.8) and increased to 4.2 after the program. Also, residents' knowledge of composting programs was observed to be low in the early stages where it recorded a mean value of 1.8 and increased to a mean of 4.0 after the program. Similarly, the awareness of agencies or bodies that promote and implement composting programs increased from a mean value of 1.8 to 4.1.

Green Initiative: Composting Program in di Bandung, Indonesia

In Indonesia, organic waste is known as household waste where it comprises the largest composition of waste of about 60%-70% and has the potential to become good compost for crops (Mohamad Satori, 2018). On the other hand, Indonesia's organic waste composition can be said that approximately 78%-80% of it can be reused. Solid waste management in Indonesia is governed by the Law 18 of 2008 related to waste management. Thus, through the study of Mohamad Satori et al. (2018), it was found that only 38% of rural people in Indonesia do not practice sustainable solid waste management. This means that rural people in Indonesia understand and have adopted solid waste management practices well.

There are various solid waste management methods implemented in Indonesia including composting of organic waste, or kitchen and garden waste. However, the public's understanding of composting through urban farming programs is still seen as low and requires the public to be informed. One of these is through the brick composting bin method. This overlay brick technology is a method of composting organic waste using aerobic principles. It is made of red bricks arranged without a layer of cement at a certain distance where the function of the hole that is formed is intended for ventilation for assisting the aerobic bacteria.

This composting program using the overlay brick bin method was implemented in RW22, which included Tanimulya Village, Ngamprah District, and West Bandung Regency in Puri Cipageran Indah 2, consisting of five RTs with a population of 800 residents. All participants from these locations were quantitatively measured to see their level of knowledge, attitudes, and practices regarding solid waste management, specifically composting. According to Mohamad Satori et al. (2018), the organic residues in RW22 is approximately 0.29 tonnes per day or 8.64 tonnes per month, out of which 60% of it can result in composted organic output. The program conducted by Mohamad Satori et al. (2018) included:

1. Early visits with the participants
2. Implementation
 - Integration
 - Adaptation
 - Gathering of problems and issues
 - Solving problems and issues

- Action taken
- Evaluation (before and after the program)
- Reflection

The study found that the level of knowledge of the participants about the method of composting using overlay brick bins increased from before and after the program from 81% to 100%. Their knowledge of organic waste from kitchen waste increased (from before to after the program) from 95% to 100% and their knowledge of organic waste that can be converted into compost was 100% after the program. In fact, the participant attitude toward waste segregation had also increased from 43% to 100% and the population attitude toward managing organic waste using brick bins has increased (from before to after the program) from 33% to 60%.

DISCUSSION

Based on this study conducted in northern Malaysia and Indonesia, it was found that the attitude and level of knowledge of the people in both countries regarding the management of solid waste by composting has increased through the implementation of the respective programs.

Therefore according to Tamby Subahan, Lilia, and Thiagarajan (2010), an increase in knowledge, attitude, and practices related to this technique should be formal and informal in a continuous teaching and learning environment. In fact, Asmawati, Nor Ba'yah, and Fatimah (2012) explained that these educational factors and levels of knowledge can influence individuals' attitudes and practices toward preserving environmental sustainability. Therefore, the programs conducted by the authorities in these communities are crucial for fostering and enhancing their practice and knowledge, both directly and indirectly. This is because the community needs to be equipped with knowledge and skills related to solid waste management as well as having a positive attitude toward the practice since it can be said that one's attitude influences one's practice (SitiKhatijah&Noraziah, 2014).

CONCLUSION

In conclusion, it was discovered that the knowledge level of community in village A is still at low and medium levels before the briefings were given in the program. However, the knowledge of the population has increased to a great extent when briefings and demonstrations had been presented on the management of solid waste by composting. In Indonesia, the level of knowledge of RW22 residents about the management of organic waste using brick overlay bins has increased where 100% of them understand the information presented and 60% of them have practised it after the program. This shows that this composting technique has been well accepted by the communities in both countries. Therefore, support from all parties involved in financing, information, organizational planning, education, and composting facilities is essential for this composting technique to have a significant impact on the environment and economy of the local community.

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