Eduvest – Journal of Universal Studies
Volume 5 Number 1, January, 2025
p- ISSN 2775-3735- e-ISSN 2775-3727

REWASTE INNOVATION AT THE FRIENDSHIP CENTER GENERAL HOSPITAL

Nemi Muhaeminah
Rumah Sakit Umum Pusat Persahabatan, Jakarta, Indonesia
Email: nemimuhaeminah@gmail.com

ABSTRACT

This research aims to implement waste management innovations at the Central Friendship General Hospital through the development of compost, biopore infiltration holes, and reuse of plastic waste. The hospital produces around 10,000 tons of domestic waste per year, so a solution is needed to minimize this waste. This innovation involves making compost from organic waste such as leaves and vegetable scraps which are processed into organic fertilizer. Biopore infiltration holes are used to reduce organic waste and maximize water absorption, while broken plastic waste is reused as plant pots. The results of the study show that this innovation not only succeeds in significantly reducing waste, but also provides cost efficiency that has a positive impact on hospitals.

KEYWORDS *Innovation in waste, compost, biopore infiltration holes, plastic reuse, cost efficiency, RSUP Persahabatan*

INTRODUCTION

The most effective way to reduce waste is to not make it in the first place. Creating new/recycled products that work to inhibit greenhouse gases that contribute to climate change and require a lot of materials and energy – raw materials must be extracted from the earth, and products must be made then transported wherever they will be sold. As a result, reduction and reuse are the most effective ways to conserve natural resources, protect the environment, and save money (USEPA, 2023).

Recycling also conserves resources and protects the environment. Environmental benefits include reducing the amount of waste sent to landfills and incineration facilities; conserving natural resources, such as wood, water and minerals; and prevent pollution by reducing the need to collect new raw materials. Economic and societal benefits include improving economic security by utilizing domestic material sources, supporting American manufacturing and creating jobs in the recycling and manufacturing industries (USEPA, 2023).

Worldwide there is increasing attention to the harmful impacts of waste and environmental pollution. The United Nations has adopted the Sustainable

Development Goals (SDGs) to address this issue, specifically SDG12 on sustainable production and consumption. Dealing with waste and pollution can be considered very important for the mission of achieving a Circular Economy (Ma, Wenting et all, 2023).

Every year, worldwide, 1.3 billion tons of food are lost or wasted. in vain, says the United Nations Environment Programme (UNEP). Guidelines issued by UNEP and the Institute for Global Environmental Strategies (IGES) show that the practice of composting is one of the best options to manage organic waste while reducing environmental impact (UNEP, 2021).

Proper composting of the organic waste we produce in our daily lives – inedible or unusable foods – can reduce reliance on chemical fertilizers, help restore soil fertility, and improve water retention and nutrient delivery to plants (UNEP, 2021).

Data from the Minister of Environment and Forestry of the Republic of Indonesia in 2022 that the achievement of waste management performance is the achievement of reducing and handling household waste and household waste-like waste from the achievement data below is the result of data input carried out by 173 regencies/cities throughout Indonesia in 2022, namely waste heaps of 13,197,631.36 tons/year, waste reduction of 18.75%, waste handling 51.11%, managed waste 69.86% and unmanaged waste 30.14%. The composition of waste based on waste sources is 39.3% household waste, 21.2% from business centers, 16% from traditional markets, 7.2% from regions, 6.9% from public facilities and 6% from offices. Meanwhile, the composition of waste based on the type of waste is 40.9% from food waste, 18.5% from plastic, 13.3% from twigs, wood and leaves, 10.8% from paper, and the rest from glass, metal, cloth and rubber (Menlhk, 2023).

Composting is just one potential element of many elements in a functioning municipal solid waste management system. Composting from plants alone cannot solve the existing waste problem, and the decision to choose composting as the right technology must be made based on the integrated waste management plan in the respective city or country. The role of compost, an organic fertilizer derived from waste, has been overshadowed by the excessive use of pesticides and chemical fertilizers in agricultural practices. The lack of compost used in agricultural fields and the reliance on chemical fertilizers have a number of negative impacts, such as deteriorating soil conditions, deficiencies or excess nutrients, insect infestations, and hardened soils, to name a few. However, organic waste produced in daily life1 can help restore soil fertility if it is used to produce compost (Unep, 2020).

More than 35 million tons of plastic were produced in the United States in 2018 and only 8.7 percent was recycled. Some types of plastic are not accepted in community recycling programs. Check with your local recycling program to find out what type of plastic they accept. If possible, buy products made from recycled plastic materials. Can plastic containers, cups, and utensils be recycled? It depends on what type of plastic containers and cups are made of and whether your local program accepts them. Items with food scraps cannot be recycled. Plastic utensils are also not recyclable (US EPA, 2022).

RSUP Persahabatan is a vertical hospital with a total of 433 beds. The total land area at RSUP Persahabatan is 13.45 hectares with an area of vacant land and a

park totaling 89.5 m3. RSUP Persahabatan produces domestic solid waste with an average of 10,000 tons/year. If accumulated in a few years, it will fill the Waste Disposal Site in Bantar Gebang. In order to minimize waste and implement reduce, reuse and recycle waste and waste at the Friendship Hospital, these efforts are needed. Based on the reasons mentioned above, the author is interested in making an essay entitled "Rewaste Innovation at the Friendship Hospital"

The objectives of this study are: 1. Providing compost making innovations at the Friendship Hospital. 2. Monitoring biopore infiltration hole innovation in the context of composting in the Friendship Hospital environment. 3. Providing innovation *to reuse* waste from damaged plastic bins used as plant pots in order to reduce waste.

RESEARCH METHOD

This study uses a qualitative descriptive method that aims to explore waste management innovations at the Central General Hospital (RSUP) Persahabatan. Data collection was carried out through direct observation in the field, interviews with hospital staff involved in waste management, as well as the study of documents related to waste management policies in hospitals. Observations include domestic waste management and the implementation of biopore infiltration hole technology, composting, and reuse of plastic waste. The interview was conducted to gain a deeper understanding of the application of this waste management technology and its impact on cost efficiency and environmental impact. The data obtained is then analyzed qualitatively by describing the findings based on the results of observations and interviews.

RESULT AND DISCUSSION

Composting Innovation

Based on research conducted by Chitsan Lin et al in 2022, Composting is a biological process of self-heating that has been used for centuries as an organic waste management solution. In addition to managing organic waste, composting products can be used as soil amendments and organic fertilizers. Composting research has made great progress over the years, especially in shortening the composting process and improving the quality of compost.

The average domestic waste produced at the Friendship Hospital is 10,000 tons/year. One of the components of domestic waste is leaves, leaves, plants, and leftovers from the Nutrition Installation. In order to reduce the quantity of domestic waste/waste, it is used as composting.

The location for making compost fertilizer is located in the WWTP park using a 300-liter drum with the current number of 10 drums available. The organic materials used come from leaf waste and vegetable residues from the Nutrition Installation to make composters into organic fertilizers. The organic fertilizer is used to fertilize plants in the Friendship Hospital.

How to Make Compost at Persahabatan Hospital

1. Collect raw materials in this case organic waste consisting of leaf waste and vegetable residues from the Nutrition Installation into the tub

At this early stage, the composting raw materials should not contain contaminants such as biodegradable and hazardous waste, as they negatively affect the final quality of the compost. The initial inclusion of non-organic components such as plastic and glass in the waste collected as organic waste determines the impurity content at the end of the composting process (Kosuke Kawai et al, 2020).

2. After being collected and somewhat dried, the waste is shredded using an organic waste shredder into a smaller size of organic waste.

Smaller particles have a larger surface area that allows for effective degradation to occur. They also improve the homogeneous mixing of the starting material. However, small particles can also inhibit the penetration of air and water within the mixture leading to the anaerobic zone. Conversely, larger particle sizes can lead to excessive ventilation, decreased water-holding capacity, and slower degradation (Chitsan Lin et al, 2022)

3. After chopping into smaller sizes it is put into the composter drum.

The decomposter drum at RSUP Persahabatan is made of a drum with a capacity of 300 liters with holes along the side of the drum. In this process, it is necessary to pay attention to the moisture content of the compost mixture, which is an important factor because it provides a medium to transport dissolved nutrients necessary for the metabolic and physiological activities of microorganisms. To activate aerobic bacteria, the moisture content of the raw material must be kept above 40%, while the higher moisture content prevents air from blowing into the raw material. Food waste has a high moisture content of around 70% to 80%. To maintain aerobics. For this reason, it is necessary to reduce the moisture content by adding organic additives such as sawdust (Kosuke Kawai et al, 2020).

In the composting process depending on the quality of the raw materials, composting usually includes the following processes:adjusting the moisture content, fermentation, and mechanical separation, in addition to the separate collection of raw materials at the source (Kosuke Kawai et al, 2020). This is in line with Chitsan Lin et al's 2022 research that key parameters that affect the process and also include optimal conditions for effective composting if needed include moisture content, C/N ratio, particle size, and in some cases pH, initially controlled to provide microorganisms with a suitable environment to thrive.

Moisture content is an important parameter in the composting process because microorganisms need enough moisture to survive. Water is necessary for nutrient transport, making it accessible to microbes. Humidity affects air penetration, nutrients, oxygen uptake, and temperature. Higher moisture content (usually >70%) during the composting process forms puddles that cause anaerobic conditions. Lower moisture content is usually. Since composting raw materials generally have a high moisture content, sawdust and rice husks are often added to absorb and regulate moisture content. Furthermore, the raw materials are biologically decomposed in the fermentation process through aerobic fermentation, a more common type of fermentation (Chitsan Lin et al, 2022).

4. Compost Making Process

The following is the process of making compost, including:

1) Mix 10 g of sugar, 20 ml of EM-4, and, 1,000 ml of clean water into a tightly closed jerry can, shake evenly and then ferment for 24 hours.

2) Next, add the EM-4 solution and stir evenly until the moisture content in the mixture is about 30%.
3) Take a handful of compost, if when squeezed there is no water dripping it means it is correct.
4) Put the compost into the decomposter drum and close
5) Make sure that every 2 days the decomposter drum is checked, if the temperature is less than 50 0C, the compost mound must be dismantled and aerated immediately. After cooling, make the compost mound again, cover it with a burlap sack. And if the compost mound is too dry, add EM-4 solution.
6) After 3 weeks have passed, you can disassemble the decomposer.
7) It needs to be filtered using a 2 cm gauze filter.
8) Materials that do not pass the filter can be recomposted.
9) Compost is ready for use

Figure 1. Flow of Composting at Friendship Hospital

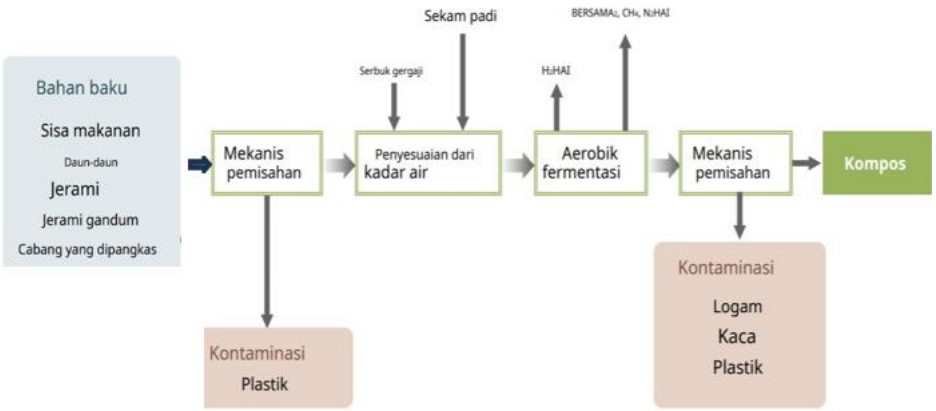

Figure 2. Composting Flow (UNEP, 2020)

Cost Efficiency

Currently, RSUP Persahabatan can produce 30,000 liters of compost in a year. The estimated calculation is obtained from the number of drums as a composter place totaling 10 with a capacity of 300 liters.

When compared to the Cooperation Contract Agreement with SPK number: KN.01.04/2.5.1-PPK/15/2023.BLU regarding the implementation of cleaning service procurement services where in the contract there are procurement items for Urea and NPK fertilizers with a nominal amount of IDR 657,120,000,-.

Table 1. Efficient Estimation of Compost Production Costs

Produksi Kompos						Pembelian Pupuk Tahunan				
No	Keterangan	Volume	Satuan	Harga Satuan	Jmlh Harga	Keterangan	Vol	Satuan	Harga Satuan	Jmlh Harga
1	Kompos Organik	36000	liter	Rp 700,00	Rp 25.200.000	Urea	5	kg	Rp 95.238.000	Rp 476.190.000
						NPK	5	kg	Rp 36.186.000	Rp 180.930.000
						Pengurangan Retribusi Pembuangan Sampah				
										Rp 657.120.000
						Sumber : SPK KN.01.04/2.5.1-PPK/15/2023.BLU				
						Effisiensi	3,83%			

Based on table 1 above, the estimated cost efficiency of compost production at the small-scale Friendship Hospital is 3.83% which will greatly affect the *cash flow of* the hospital.

Biopore Infiltration Hole Innovation in the Context of Composting

Biopore Infiltration Hole Innovation

Biopore Infiltration Hole is an appropriate and environmentally friendly technology that is able to permeate water through the hole. Water that enters the hole does not directly enter the sewer. In addition, Biopore Infiltration Holes can convert waste into compost and become a source of food for organisms in the soil (Anri Noor Annisa Ramadan et al., 2020).

Biopore infiltration holes are cylindrical holes made into the soil with a diameter of 10-30 cm, with a depth of about 100 cm or do not exceed the depth of the groundwater table. The hole is then filled with organic waste so that biopores are formed from the activity of soil organisms and plant roots. Organic waste needs to always be added to the pit whose contents have shrunk due to the weathering

process. Because of its small diameter, these holes are able to reduce the infiltration load, so that the rate of water infiltration can be maintained. The manufacture of biopore infiltration holes is quite simple, cheap and does not require a large amount of land. The tool is relatively simple in the form of a modified drill (PermenLH No.12/2009).

The percentage of plants and buildings at Persahabata Hospital is 60% planting and 40% of buildings with an area of 13.45 hectares so that it will produce a lot of leaf waste. In order to reduce leaf waste in the environment of the Friendship Hospital, composting is made through the biopore infiltration hole. The amount of compost in the biopore infiltration hole will be monitored if it has begun to shrink, then the leaf waste is put into the biopore infiltration hole. In this case, the use of biopores will convert organic waste into compost.

Benefits of Applying Biopore Infiltration Holes

Theoretically, the benefits of the application of infiltration wells are (Ratna Safitri et al., 2019) as follows:

1) Converting organic waste into compost
2) Increasing the amount of water entering the soil
3) Maintaining the hydrological balance of groundwater so that it can prevent seawater intrusion
4) Reducing the drainage network dimension can be up to zero if needed
5) Lowering the concentration of groundwater pollution
6) Questioning the height of groundwater table
7) Reduce surface runoff so that it can prevent flooding
8) Prevent land subsidence.

How to Make Biopore Infiltration Holes (LRB)

Here's how to make a Biopore Infiltration Hole (PermenLH No.12/2019):

1) Make a cylindrical hole into the soil with a diameter of 10 cm, a depth of 100 cm or not exceeding the depth of groundwater. The distance between making biopore infiltration holes is between 50 – 100 cm
2) Strengthen the mouth or base of the hole by using:
   a. Paralon with a diameter of 10 cm, a minimum length of 10 cm
   b. Mix cement 2 – 3 cm wide, 2 cm thick around the mouth of the hole
3) Fill the LRB pit with organic waste from leaves, lawn clippings or kitchen waste
4) Closing the biopore infiltration hole with a sieve wire

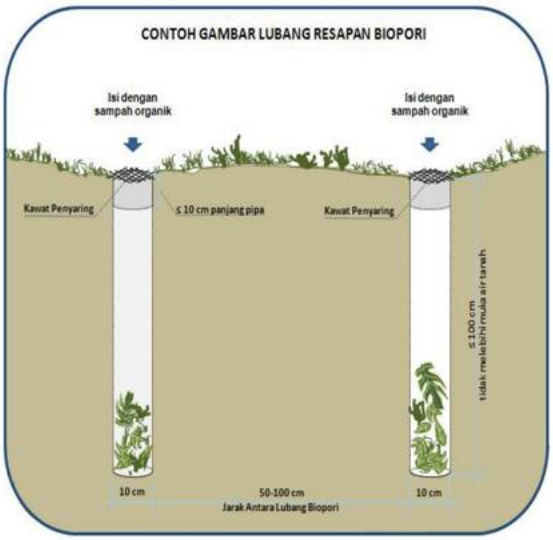

Figure 3. Example of Making Biopore Infiltration Holes (PermenLH No.12/2019)

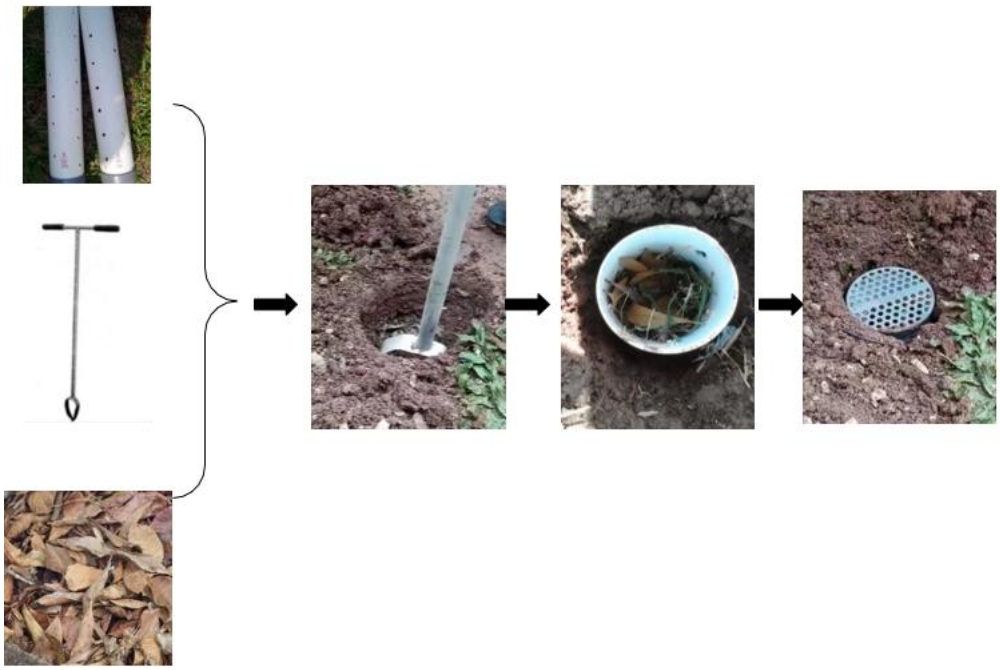

Figure 4. Flow of Making Biopore Infiltration Lubanr

Innovation *to Reuse* Damaged Plastic Waste Used as Plant Pots

Trash Can Reuse Innovation

The procurement of garbage cans is one of the waste management efforts at the Friendship Hospital. Damaged trash cans are reused into plant pots as one of the efforts to prevent environmental pollution.

Benefits of Reuse

The benefits of *reusing* garbage/waste are as follows (USEPA, 2023):

1) Reducing greenhouse gas emissions that contribute to climate change.

2) Prevent pollution caused by the reduction of the need to harvest new raw materials.
3) Saves energy.
4) Reducing greenhouse gas emissions that contribute to global climate change.
5) Helping to preserve the environment for future generations.
6) Reduce the amount of waste that needs to be recycled or sent to landfills and incinerators.
7) Allows the product to be used to the fullest.
8) Save money.

The innovation of reuse trash cans has a great influence on cost efficiency in hospitals. If you buy plant pots or polybags to plant plants or plant nurseries, it will cost money. By recycling, the trash can will not incur costs and reduce environmental pollution.

How to Make a Tanama Pot at Persahabat Hospital

Figure 5. The Process *of Reusing* Plastic Waste into Plant Pots

Cost Efficiency

The author made an estimate of the cost efficiency calculation compared to purchasing plant pots of the same size as reuse plant pots from plastic waste with a size of 50 liters.

Table 2. Estimation of Calculation of Plant *Pot Reuse* Cost Efficiency

Reduce Tempat Sampah						Pembelian Pot Tanaman				
No	Keterangan	Volume	Satuan	Harga Satuan	Jmlh Harga	Keterangan	Vol	Satuan	Harga Satuan	Jmlh Harga
1	Reduce Limbah Plastik	10	buah	-	-	Ukuran 50 liter	10	buah	Rp 15.000	Rp 150.000
										Rp 150.000
						Sumber : SPK KN.01.04/2.5.1-PPK/15/2023.BLU				

Based on table 2 above, utilizing plastic waste, in this case, damaged trash cans will be more cost-effective and reduce plastic waste and reuse plastic waste.

CONCLUSION

The conclusion of this study are 1. Compost innovation as an organic fertilizer is very useful in minimizing the amount of domestic waste and has proven to be significant for cost efficiency. 2. Biopore Infiltration Hole Innovation at Persahabat Hospital converts organic waste into organic compost which directly becomes compost in biopore land areas and minimizes organic waste. 3. The innovation of *reusing* damaged plastic waste bins is used as plant pots is useful in reducing environmental pollution and reducing hospital spending.

REFERENCES

Anri Noor Annisa Ramadan, Agi Rivi Hendardi, 2020. Pemanfaatan Lubang Resapan Biopori di RW 03 Keluharan Sambongjaya Kecamatan Mangkubumi, Kota Taksimalaya. Jurnal Pengabdian kepada Masyarakat. Vol. 6, No. 4, Desember 2020, Page. 267–273. DOI: http://doi.org/ 10.22146/jpkm.54253

Chitsan Lin, Nicholas Kiprotich Cheruiyot, Xuan-Thanh Bui & Huu Hao Ngo (2022) *Composting and its application in bioremediation of organic contaminants, Bioengineered*, 13:1, 1073-1089, DOI: 10.1080/21655979.2021.2017624

Environment Program, 2021. *How composting can reduce our impact on the planet*. Kenya :United Nations Avenue. Gigiri Nairobi.

Kementerian Lingkungan Hidup dan Kehutanan Republik Indonesia. 2023. Capaian KInerja Pengelolaan Sampah. Kementerian Lingkungan Hidup dan Kehutanan RI

Kosuke Kawai et al, 2020. CCET guideline series on intermediate municipal solid waste treatment technologies: Composting. United Nations Environment Programme

Ma, Wenting, Martin de Jong, Filippos Zisopoulos, Thomas. 2023. *Classification Framework To Urban Waste Policy: Analysis Of Sixteen Zero-Waste Cities In China*. Waste Management 165 (2023) 94–107. https://doi.org/10.1016/j.wasman.2023.04.012

Peraturan Menteri Lingkungan Hidup No.12 tahun 2009 tentang Pemanfaatan Air Hujan

Perjanjian Kontrak Kerjasama dengan nomor SPK : KN.01.04/2.5.1-PPK/15/2023.BLU tentang pelaksanaan jasa pengadaan cleaning service.

Ratna Safitri dkk, 2019. Pembuatan Biopori dan Sumur Resapan untuk Mengatasi Kekurangan Air Tanah di Perumahan Villa Mutiara, Tangerang Selatan. Jurnal Ilmiah Pengabdian kepada Masyarakat. Maret 2019, Vol 5 (1): 39□47. ISSN 2460-8572, EISSN 2461-095X

United Nations Environment Programme, 2020. *CCET (Centre Collaborating with UNEP on Environmental Technologies) guideline series on intermediate municipal solid waste . treatment technologies*: Composting. Kyoto University

US EPA, 2023. *Reduce, Reuse, Recycle*. Washington DC
US EPA, 2023. *Recyclying Economic Information (REI) Report.* Washington DC