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Evaluation of Shorting Facility Toward Archived Sustainable Waste Recovery in Talang Gulo landfill, Jambi City

Andra Puput Marya Ani[1], Mega Mutiara Sari[1*], Iva Yenis Septiariva[2], I Wayan Koko Suryawan[1]

[1]Faculty of Infrastructure Planning, Department of Environmental Engineering, Universitas Pertamina
Jl. Teuku Nyak Arief, RT.7/RW.8, Simprug, Jakarta Selatan, Daerah Khusus Ibukota Jakarta 12220
[2]Study Program of Civil Engineering, Faculty of Engineering, Universitas Sebelas Maret,
JL. Ir. Sutami 36A Surakarta, Jawa Tengah 57126, Indonesia
Email: mega.ms@universitaspertamina.ac.id

Abstract

Talang Gulo landfill has now been converted into a sanitary landfill system. In the management system, the incoming waste is sorted first. The purpose of this study was to evaluate the process of shorting waste at the Talang Gulo landfill to reduce the waste generation that is the reduction in landfills. This research was conducted by direct observation and using secondary data. The decrease in the number of waste reductions in Jambi City from 2019 to 2020 (9.52% to 1.77%). Data collection during June 2021 shows that the average generation that goes into landfills is 312.44 kg/day. The amount of waste that can be recovered from the shorting process is 2.4% of the total that goes to the shorting facility. The types of waste that are shorted consist of polyethene terephthalate (PET), high-density polyethene (HDPE), polypropylene (PP), low-density polyethene (LDPE), aluminium, and glass. Where in the shorting process consists of two types of processes, namely mechanical and manual. The shorting with the mechanical and manual process obtained the highest PET waste with values, 38.82% and 56.8% respectively. The composition of the recovered waste in the Talang Gulo TPA Shorting Area is as follows LDPE Plastic 10.20%; aluminium 5.21%; Glass 1.30%; PET Plastic 38.83%; HDPE Plastic 24.3% and PP Plastic 20.17%.

Keywords : *landfill, waste, shorting, waste reduction*

INTRODUCTION

The Ministry of Public Works and Public Housing (PUPR) has developed the Talang Gulo Final Processing Site in Jambi City, which originally used an open dumping system to become a sanitary landfill system (Kementerian PUPR, 2021). A sanitary landfill system to minimize environmental impacts, both water, soil, and air so that it is more environmentally friendly (Helene et al., 2020). The development of the Talang Gulo landfill is a collaboration between the Government of Indonesia through the Directorate General of Human Settlements of the Ministry of PUPR and the German Government in the 'Emission Reduction in Cities (ERiC) Solid Waste Management in Jambi' program (Kementerian PUPR, 2021). The Talang Gulo landfill was built in 1997 with an overloaded condition, so it can no longer accommodate the waste that is generated every day. If the landfill operation is not good and the landfill has exceeded the capacity it is feared that it can cause landslides, greenhouse gas emissions and the spread of leachate that is not controlled (Septiariva & Suryawan, 2021; Yodi et al., 2020). The new landfill is projected to be able to process waste with the concept of going green and environmentally friendly.

With this concept, the impact of poor waste management such as a decrease in aesthetic, health, ethical aspects to economic and environmental losses that lead to natural disasters

*)Correponding author
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can be suppressed (Setyono, 2015). The alternative in overcoming the waste problem is the handling of a good waste management system and the application of waste technology through the concept of Reuse, Reduce and Recycle (3R) which is expected to minimize the waste to be processed in the landfill. The waste management paradigm of collect-transport-dispose will only add to the burden of the landfill. For this reason, it is necessary to develop technology for separating types of waste. In addition to spurring government programs in reducing landfill loads through waste type separation technology. Waste reduction with the 3R mechanism is a top priority where the success of this concept requires the commitment of the local government, especially the authorized agencies, accompanied by integration with the overall waste management system.

The stages of waste management include the process of collecting, sorting waste material, and processing waste material (Fatimah et al., 2020; Tallentire & Steubing, 2020). The most important process of recycling management is the process of sorting waste material. This is due to the material processing process. The material to be processed must be following the processing process. There are several types of waste sorting based on the nature of the material, the first is plastic and nonplastic, the second is magnetic and non-magnetic. The purpose of this study is to evaluate the waste separation system to reduce waste generation at Talang Gulo Landfill, Jambi City.

METHOD

The data used in this study was secondary data obtained directly from the Talang Gulo TPA and the national solid waste information system. In addition, direct observations were also made on the generation of waste and the process of separating waste. Observations were made during June 2021.

The waste produced by the people of Jambi City have been sent to the Talang Gulo TPA every day. The waste transportation to the TPA was carried out using cleaning vehicles belonging to the Jambi City Environmental Service, namely pick up cars, dump trucks, armrolls, compactors, and fuso. Each type of vehicle had a different number of rites, for 36 units of the fleet of dump trucks, 4 rites were carried out every day, 13 units of the armroll fleet were 3 rites per day, 3 units of the compactor fleet were 2 rites per day, 8 units of the pick-up fleet and 1 fuso fleet transports 1 rite of garbage every day. After entering the landfill gate, the waste vehicle have passed through the weighbridge to be weighed and confirm the type of waste. Tree felling waste and market waste have been directed to the compost area, household waste from certain locations was directed to the sorting area, and waste that cannot be sorted have been directed directly to landfills including sorting and composting residues. After that, the empty vehicle have been weighed again to determine the difference between the weight of the loaded vehicle and the empty weight (w/w). The results of observations at the weighbridge have been produced data on waste generation. In addition, observations were also made in the shorting area to determine the amount of waste that could be recovered every day.

Data analysis in this study was carried out in a qualitative way and by doing a description of the data that had been obtained. In addition, to support the statement, a literature review was also carried out to compare with ideal conditions or other conditions from waste management data.

RESULT AND DISCUSSION

The amount of waste that goes to the Talang Gulo TPA varies. From Monday to Friday, the amount of waste that enters is more due to the large number of people who carry out activities that can produce waste. Furthermore, the garbage will be piled up and leveled withusing excavators. Landfill is carried out when the waste has reached a height of 1-2 meters (Figure 1).

The unpacked waste will be put into the Opener to be transported to the sorting process. Garbage that enters the tub Opener will be channeled with a conveyor to the screen for filtering the size of the waste. Garbage with a size of more than or equal to 80 mm is directed to a large conveyor for manual sorting (Figure 2).

The results of sorting HDPE types of waste can be seen in Figure 3. The waste data that enters the Talang Gulo TPA can be seen in Figure 4. The

average produced reaches 312.44 kg/day with a maximum value of 358.9 kg/day and a minimum of 281.94 kg/day. Overall waste generation in Jambi City increased from 2019 to 2020 with a value of 154,557.83 tons/year to 156.103.35 tons/year. This shows that the Covid-19 pandemic has caused public consumption in Jambi City to continue to increase. Several studies in Indonesia also show changes in public consumption due to the pandemic (Ruslinda et al., 2020; Suryawan, Rahman, et al., 2021). Although the waste handled in Jambi City has not changed much (75.23-75.24%), there has been a drastic change in the percentage of waste reduction from 9.52% in 2019 to 1.77% in 2020 (Table 1). This also affected the amount of managed waste which decreased from 84.75% in 2019 to 77.01% in 2020 (Table 2). On the other hand, the waste recycling rate in Jambi City has increased from 1.11 to 1.77 (SIPSN, 2021). This shows that the processing capacity has been carried out optimally, besides that there has also been an increase in the waste generation that occurred from 2019 to 2020.

Figure 1. Landfill treatment process with Excavator

Figure 2. Manual Waste Sorting Process

Figure 3. HDPE Type Plastic Waste Sorting Results

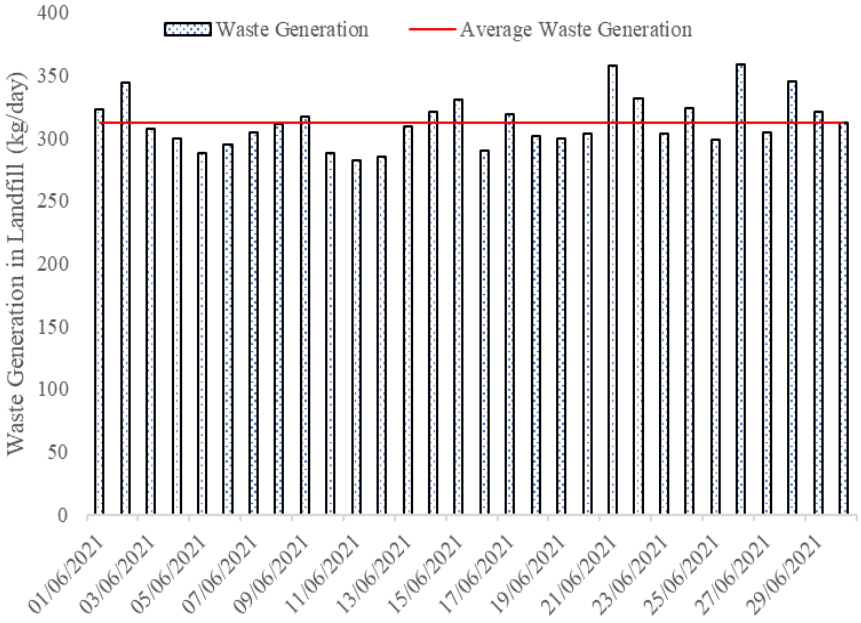

Figure 4. Amount of Waste Transported to the Talang Gulo Landfill Weighbridge, Jambi City

Waste Separation System

The segregation of waste in the Talang Gulo landfill is an effort to reduce waste that will be disposed of in landfills. Waste that is directed to the sorting area is not more than 35 tons/day. The results of monitoring the incoming waste, which is recovered, and become residues can be seen in Figure 5. The waste sorting process at the Talang Gulo landfill is divided into two, manual sorting and special technology sorting. Manual sorting is carried out directly in the landfill area by landfill daily workers while sorting with the help of machines is carried out in the sorting area. The machine used in the sorting process is an innovative technology, where there is a combination of a belt conveyor and magnetic separator. This technology has a positive impact on accelerating the processing of large amounts of waste. The mass balance of the separation process as a whole can be seen in Figure 6. Where the average recovery rate is 2.4% with a generation rate of 0.48 tons/day.

The waste sorting process at the Talamg Gulo landfill has only been operating for 5 months, but equipment breakdowns often occur. The damage occurs because, during the sorting process, the Belt Conveyor accommodates a variety of materials including sharp objects, objects containing vegetable oil, and chemicals found in domestic household waste that can tear and damage the rubber belt. Every day the machine operator has carried out equipment maintenance by cleaning the dirt stuck to the belt. However, because the capacity of the garbage accommodated is quite a lot, the rubber belt is torn and cannot operate. Belt replacement is carried out by the operator and mechanic within two weeks. During the belt replacement process, waste sorting is still carried out by daily workers manually at the waste collection location which is right in front of the entrance to the sorting area.

During the manual sorting process, daily workers find medical waste carried by the cleaning vehicle and dumped into the sorting area. The medical waste comes from several health care facilities. Medical waste that is taken to landfills can cause serious problems in the spread of unwanted viruses (Chi et al., 2020; Suryawan, Sarwono, et al., 2021). Therefore, decisive action is needed by the government on this problem. In addition, this medical waste should be treated by incineration and a secure landfill (Sangkham, 2020).

The loading and unloading of garbage trucks in the sorting area starts at 06:30 WIB, the unloaded waste can only be stored for 2 days. The garbage collection location is right in front of the entrance to the sorting area. The sorting process starts at 08:00 WIB and ends at 12:00 WIB. The unpacked waste will be put into the Opener to be transported to the sorting process. Garbage that enters the tub Opener will be channelled with a conveyor to the screen for filtering the size of the waste. Screening is divided into 2, namely less than 80 mm and more or equal to 80 mm which is automatically carried out by Screen. Garbage that is less than 80 mm in size will be directed to the magnetic separator.

Composition of Recovery Waste Composition

In this process, metals will be attracted by magnets while other than metal waste will be put into containers to be disposed of in landfills. Garbage with a size of more than or equal to 80 mm is directed to a large conveyor for manual sorting. The sorting is divided into several types, namely paper waste (magazines, newspapers, and chalk paper), cardboard waste, plastic waste (LDPE, PP, PET, and HDPE), can waste, and glass waste. The composition of the sorted waste can be seen in Figure 7.

Table 1. Annual Managed Waste in Talang Gulo Landfill (SIPSN, 2021)

Year	Annual Waste Generation (tonnes/year) (A)	Annual Waste Reduction (tonnes/year) (B)	% Waste Reduction (B/A)	Annual Waste Management (tonnes/year) (C)	%Waste Handling (C/A)	Annual Managed Waste (tonnes/y) (B+C)
2019	154,557.83	14,707.03	9.52	116,281.70	75.24	130,988.72
2020	156,103.35	2,766.83	1.77	117,442.40	75.23	120,209.24

Table 2. Annual Recycling Rate in Talang Gulo Landfill (SIPSN, 2021)

Year	Annual Managed Waste (tonnes/year)(B+C)	%Managed Waste(B+C)/A	Annual Waste Recycling (tonnes/year)(D)	Raw Materials Waste Annual (tonnes/year)(E)	Recycling Rate(D+E)/A
2019	130,988.72	84.75	1,708.14	0	1.11
2020	120,209.24	77.01	2,766.83	0	1.77

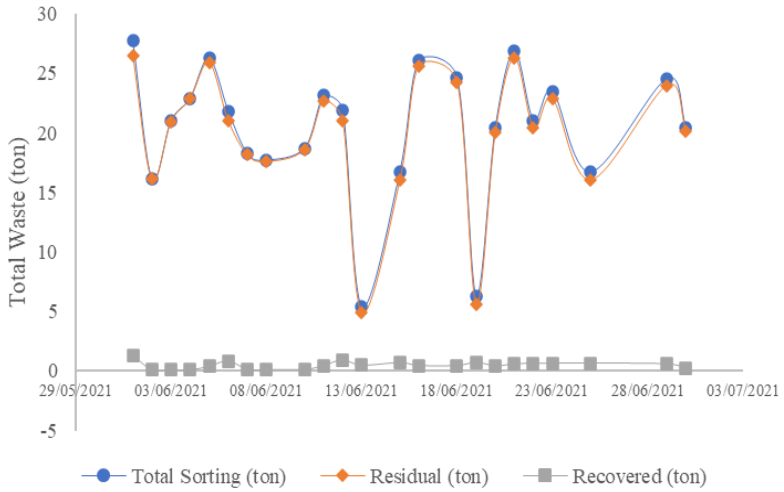

Figure 5. Amount of Waste Shorted to the Talang Gulo Landfill Shorting Area, Jambi City

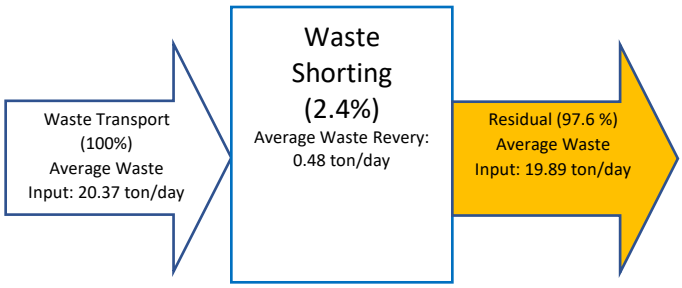

Figure 6. Mass balance of Shorting Area at Talang Gulo Landfill Shorting Area, Jambi City

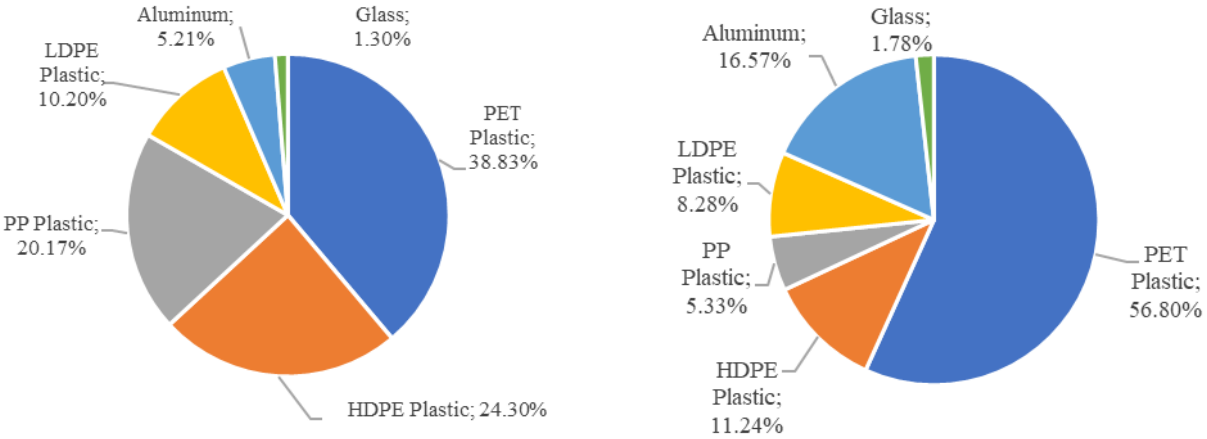

Figure 7. Composition of Recovered Waste in Shorting Area Talang Gulo Landfill

After sorting, the sorting results will be compacted using a baler and the residue from the sorting will be disposed of in a landfill. The amount of residue to be disposed of is often greater than the waste that enters the sorting area, this happens because there are vehicles that should be directed to the landfill but disposed of in the sorting area. The overall sorting results are stored and will be distributed to the Recycling Market.

Most of the plastic is waste that can be recycled into plastic ore. In addition, plastic also

has a high calorific value so that it is possible to recover energy from this type of waste (Qonitan et al., 2021; Sarwono et al., 2021). The opportunity to use waste into energy is also greater because of the sorting process before it is recycled further. This utilization can also be sustainable by utilizing technology such as gasification that produces fuel or electricity as has been applied in several locations in Indonesia (Fithri & Fitriani, 2020; Hendrawan et al., 2020; Legino et al., 2019; Wijaya et al., 2021).

CONLUSION

The percentage of waste reduction in Jambi City from 2019 to 2020 decreased from 9.52% to 1.77%. However, it can be seen that the current waste reduction is only 0.48 tons/day or around 2.4% of the waste sorting capacity at the Talang Gulo TPA. It is necessary to optimize the waste selection system that can increase capacity at the Talang Gulo TPA such as increasing the participation of the community and government.

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