

# The Implementation of Waste Reduction in Supit Urang Malang

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**Abstract.** This paper aims to determine the effect of waste management on the implementation of waste reduction in the Supit Urang landfill. This study uses weighbridge and quartering methods to determine waste generation and composition. The study is conducted at the sorting and composting facilities in the Supit Urang Landfill under the Emission Reduction in City-Solid Waste Management (ERiC-SWM) program, each facilities having a capacity of 35.000 kg/day for the sorting facility and 15.000 kg/day for the composting facility. The waste reduction at Supit Urang Landfill through the ERiC-SWM program is still relatively low, with a total waste reduction of 1.561,78 kg/day or 2,54 %. The composition of the reduced waste consists of three types of waste at the sorting facility: paper waste at 6,29%, plastic waste at 38,95%, and metal waste at 0,64%. Meanwhile, at the composting facility, only organic waste is reduced, accounting for 10,56 %.

## 1 Introduction

Waste is a national issue that requires a holistic management approach from inception to disposal [1]. The issue of waste stems from the lack of organization in the waste management system. Waste management can be defined as a discipline related to the control of generation, storage, collection, transportation, processing, and disposal of waste [2]. Waste management involves various stages, starting from containment, collection, transfer, processing, transportation, to final disposal of waste [3]. Malang, as the second largest city in East Java, has a population of 846.126 people and covers an area of 110.056 km<sup>2</sup>. The city is divided into five districts, namely Sukun, Kedungkandang, Lowokwaru, Klojen, and Blimbing, with 57 sub-districts [4]. The waste generation rate in Malang reaches 0,64 kg/person/day, and the amount of waste entering the Final Processing Site (TPA) is 523,82 tons/day [5].

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That efforts to reduce waste can extend the lifespan of the TPA [6]. The reduction of waste entering the TPA can be achieved through sorting facilities and composting facilities in the TPA, under the Emission Reduction in City-Solid Waste Management (ERiC-SWM) program. The sorting facility has a capacity of 35.000 kg/day, while the composting facility has a capacity of 15.000 kg/day [5].

## 2 Method

### 2.1 Scope

The scope of the research revolves around the implementation of waste reduction at Supit Urang Landfill located in Mulyorejo Village, Sukun District, Malang City. The management of Supit Urang Landfill encompasses several waste processing facilities, namely composting installation, sorting, and leachate treatment.

### 2.2 Sampling Technique and Data Collection

The research was conducted over 8 days at the landfill to obtain data on waste generation, composition, and waste reduction the sorting and composting facilities. Waste generation measurements were facilitated by the weighbridge, where all waste-carrying vehicles entering the landfill passed through the weighbridge to measure the weight of the waste entering the landfill. A sample of waste, totaling 100 kg, was collected to calculate the waste composition entering the ERiC-SWM facilities based on the number of vehicles entering the facilities. The equations for calculating waste density and composition percentage can be observed in Equations 1 and 2.

$$\text{Waste Composition (\%)} = [\text{Type of Waste (kg)} / \text{Weight Waste (kg)}] \times 100 \% \quad (1)$$

$$\text{Waste Reduction (\%)} = [\text{Manage Waste (kg)} / \text{Waste Generation (kg)}] \times 100 \% \quad (2)$$

### 2.3 Waste Reduction from the Sorting and Composting Facilities at Supit Urang Landfill

Waste reduction at the landfill is determined by the quantity and composition of waste entering specific facilities over a given time period, measured in kg/day. The sorting facility contributes to waste reduction with a sorting capacity of 35.000 kg/day, segregating three types of waste: paper, plastic, and metal. The composting facility also aids in reducing organic waste with a capacity of 15.000 kg/day. Waste entering the sorting facility originates from four collection points: Dinoyo Collection Point, Sutami Dam Collection Point, Brawijaya University Collection Point, and Malang State University Collection Point, as well as waste from Lavalette Hospital. Waste from the Gadang Malang Wholesale Market and waste from Malang City Parks enters the composting facility.

### 3 Result and Discussion

#### 3.1 Waste Composition

The waste composition was determined by segregating the waste generated at the ERiC-SWM sorting and composting facilities. Waste sorting was conducted based on several types of waste, including organic, paper, wood, textile, rubber/leather, plastic, metal, glass, hazardous waste, and others. The waste composition is expressed as a percentage of each waste type divided by the total waste. The composition results from the sorting facility are presented in the **Table 1**.

**Table 1.** Waste Composition in ERiC-SWM Facility

<b>Waste Composition</b>	<b>Persentase (%)</b>
<b>Sorting Facility</b>	
Organic	61,68
Paper	9,4
Wood	1,65
Fabric/Textile	1,84
Rubber/Leather	0,5
Plastic	16,16
Metal	0,54
Glass	0,52
Hazardous Waste	0,2
Other	7,51
<b>Composting Facility</b>	
Organic	100

The most prevalent type of waste generated is organic waste. Plastic and paper waste have the second and third-largest percentages, while metal waste is relatively small, below 1%. This suggests that the community has not fully utilized organic, paper, plastic, and metal waste at the source. The composting facility has a composition of 100 % organic waste originating from the Gadang Malang Wholesale Market and city park waste.

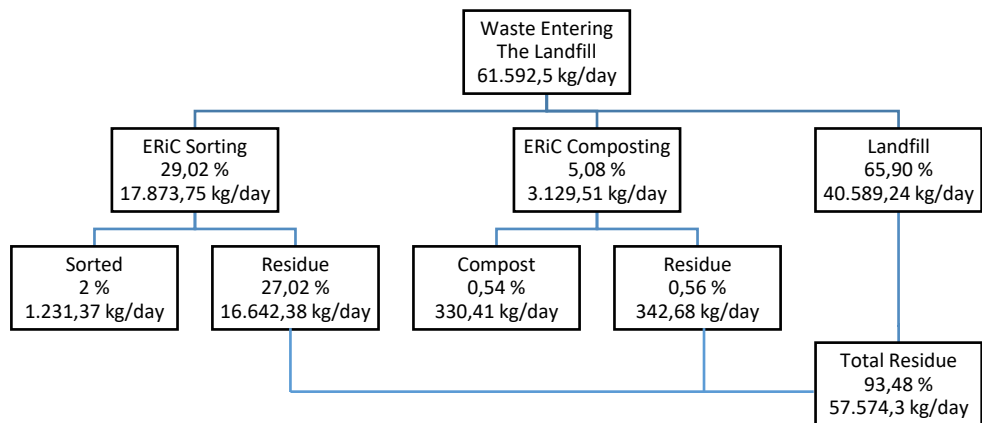
#### 3.2 Waste Reduction

Waste reduction at Supit Urang Landfill is carried out by sorting personnel who segregate three types of waste paper, plastic, and metal at the sorting facility. All other waste types are collected in one containment bin and then buried in the landfill. Waste reduction from the composting facility is also disposed of in the TPA landfill. The reduction from the sorting and composting facilities can be seen in the **Table 2**.

**Table 2.** Waste Reduction at The ERiC-SWM Facility

No	Types of Waste at Source	Types of Waste	Composition (%)	Waste generation (kg/day)	Reduction of Existing Waste (kg/day)	RF Eksisiting (%)
<b>Sorting</b>						
1	Organic	-	61,68	11.024,53	-	-
2	Paper	Recycling	9,4	1.680,13	105,76	6,29
3	Wood	-	1,65	294,92	-	-
4	Fabric/Textile	-	1,84	328,88	-	-
5	Rubber/Leather	-	0,5	89,37	-	-
6	Plastic	Recycling	16,16	2.888,40	1.124,99	38,95
7	Metal	Recycling	0,54	96,52	0,62	0,64
8	Glass	-	0,52	92,94	-	-
9	Hazardous Waste	-	0,2	35,75	-	-
10	Other	-	7,51	1.342,32	-	-
<b>Total</b>			<b>100</b>	<b>17.873,75</b>	<b>1.231,37</b>	<b>-</b>
<b>Composting</b>						
1	Organic	Composted	100	3.129,51	330,41	10,56
<b>Total</b>			<b>100</b>	<b>3.129,51</b>	<b>330,41</b>	<b>-</b>

According to the table data, the total waste generation entering the sorting facility is 17.873,75 kg/day, with a successful reduction of 1.231,37 kg/day or 6,89 %. The achieved reduction is 16.642,4 kg/day or 93,11 %. The resulting residue is substantial, indicating the need for efforts to enhance waste reduction. The composting facility manages to reduce organic waste into compost by 330,41 kg/day or 0,54 %, resulting in a reduction of 342,68 kg/day or 0,56 %. The mass balance existing of waste entering the landfill can be seen in the **Figure 1**.



**Figure 1.** The Mass Balance Existing of Waste Entering the Landfill

The waste generation data entering the landfill from the weighbridge is 61.592,5 kg/day, significantly lower, which reported waste generation entering the landfill at 532,280 kg/day [5]. The low amount of waste entering the landfill is attributed to the lack of adherence to waste transport truck regulations, especially in passing through the weighbridge (non-compliance with applicable SOPs). According to the figure, the waste reduced by the sorting

facility is 1.231,37 kg/day or 2 %, and the composting facility reduces 330,41 kg/day or 0,54 %. The obtained data is then compared with the Recovery Factor (RF %) data from previous studies, aiming to identify the ideal RF % to determine the potential reduction that can be achieved by the ERiC-SWM facility. The comparison of RF % values can be seen in the **Table 3**.

**Table 3.** Comparison of %RF Values

No	Types of Waste at Source	RF Existing ERiC-SWM (%)	RF 1 (%) <sup>[2]</sup>	RF 2 (%) <sup>[7]</sup>	RF 3 (%) <sup>[8]</sup>	RF Ideal Used (%)
1	Organic	10,56 %	90 %	85,37 %	80 %	90 %
2	Plastic	6,29 %	50 %	74,40 %	50 %	74,40 %
3	Paper	38,95 %	50 %	82,54 %	50 %	82,54 %
4	Metal	0,64 %	90 %	100 %	80 %	100 %

The determination of the ideal RF % is carried out by selecting the highest percentage value for each type of waste based on the results of previous studies. The results of the recovery factor calculations at the ERiC-SWM sorting and composting facilities at Supit Urang Landfill can be observed in **Table 4** and **Table 5**.

**Table 4.** Results Recovery Calculation at the ERiC-SWM Sorting Facility

No	Types of Waste at Source	Waste generation at the ERiC-SWM Sorting Facility (kg/day)	Waste Reduction (kg/day)	RF Ideal (%)
1	Plastic	2.888,40	2.148,97	74,40 %
2	Paper	1.680,13	1.386,78	82,54%
3	Metal	96,52	96,52	100 %
<b>Waste Reduction (kg/day)</b>				<b>3.632,27</b>
<b>Residue (kg/day)</b>				<b>1.032,78</b>
<b>%RF Ideal</b>				<b>77,86 %</b>

Based on the above data, it is known that the potential waste reduction is 3.632,27 kg/day or 20,32% of the total waste generation entering the ERiC-SWM sorting facility, which is 17.873,75 kg/day. The comparison between the existing waste reduction and the ideal waste reduction is significant, amounting to 18% of waste reduction.

**Table 5.** Results Recovery Calculation at the ERiC-SWM Composting Facility

No	Types of Waste at Source	Waste generation at the ERiC-SWM Composting Facility (kg/day)	Waste Reduction (kg/day)	%RF Ideal
1	Organic	3.129,51	2.816,56	90 %
<b>Waste Reduction (kg/day)</b>				<b>3.129,51</b>
<b>Residue (kg/day)</b>				<b>312,95</b>
<b>%RF Ideal</b>				<b>90 %</b>

Based on the above data, it is known that the potential waste reduction is 2.816,56 kg/day or 90% of the total waste generation entering the ERiC-SWM composting facility, which is 3.129,51 kg/day. The comparison between the existing waste reduction and the ideal waste reduction is significant, with 79,44 % of the waste being reduced to compost. The sorting facility has a capacity of 35.000 kg/day but is currently utilized at 17.873,75 kg/day. Similarly, the composting facility, with a capacity of 15.000 kg/day, is currently utilized at only 3.129,51 kg/day. Based on the obtained data, waste reduction in the sorting and composting processes can still be improved to reduce the resulting residue. The

implementation of waste reduction at Supit Urang Landfill is still low, at 2,54 %. The resulting impact is a reduction in the amount of waste successfully reduced at each facility and a significant amount of residue being generated in the landfill area.

## 4 Conclusion

Implementing waste reduction at Supit Urang Landfill through the Emission Reduction in City-Solid Waste Management (ERiC-SWM) program remains at a low level. The total amount of waste successfully reduced by the program is 1.561,78 kg/day, equivalent to 2,54 %. The composition of the reduced waste consists of three types of waste at the sorting facility: paper waste at 6,29 %, plastic waste at 38,95 %, and metal waste at 0,64 %. Meanwhile, at the composting facility, only organic waste is reduced, accounting for 10,56 %.

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