

## FACE MASK WASTE: NEW ENVIRONMENTAL PROBLEM DURING COVID-19 PANDEMIC

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### Abstract.

Wearing mask is very essential in doing activities during COVID-19 pandemic. Many studies have revealed that wearing mask could prevent infection of COVID-19. However, single use face mask created new problem, which is discarded mask waste. This study aims to identify discarded mask quantity and public knowledge in mask waste management, particularly in Sumber Jaya Village, Bekasi District. The majority of resident in mentioned location are industrial and retail sector workers. The study was performed by distributing questionnaire concerning the quantity of discarded waste daily, mask waste disposal method, and knowledge of mask waste disposal. Selected respondents were workers who actively worked outside the house every day. Commonly used mask types were KN-95, KF 94, duckbill, medical mask, and fabric mask. Based on this study result, mask waste quantity based on the type were 0.16 kg/day for KN-95, 0.19 kg/day for KF94, 0.09 kg/day for duckbill waste, and 0.29 kg/day for 3-ply medical waste. Most of the respondents (92%) did not know that mask waste should be disposed in dedicated waste container. Majority of respondents (93%) have not known that mask waste should be disinfected prior to disposal. Mask waste was commonly disposed of without being destroyed first. Considering that the quantity of mask waste is increasing and knowledge in mask waste management is still low, many efforts shall be conducted to prevent negative impact to the environment.

**Keywords:** *Face mask, Waste, COVID-19, Management, Disposal*

### Introduction

COVID-19 pandemic has changed people's daily routine all over the world. Face mask, disposable gloves, personal protective equipment, and hand sanitizer become mandatory. Face mask is essential to reduce the risk of COVID-19 infection from droplets. During COVID-19 pandemic, there is also significant increase of waste quantity, which was caused by the use of disposable face mask, gloves, plastic packaging, etc. in Jakarta, the amount of medical waste was expected to increase to 212,000 kg/day (Tripathi et al., 2020). Disposable face mask is commonly made of polypropylene, high density polyethylene, and other polymers (Prata et al., 2021). It has been reported that face mask waste was disposed incorrectly causing plastic pollution worldwide (Prata et al., 2021). Face mask, which mainly derived from petrochemical polymers, is not easily decomposed in open environment (Silva et al., 2021). Such materials will cause problems to wildlife, such as disruption in food intake, reproduction, and furthermore will cause death (Selvaranjan et al., 2021). If only 1% of face mask wastes are disposed directly to the environment, it would result in 40,000 kg plastic waste per month in nature (WWF, 2020).

In Indonesia, infectious waste has increased by 30% during COVID-19 pandemic (Ministry of Environment and Forestry, 2020). Face mask waste has become problems in many cities in Indonesia. Bekasi is an urban area in Indonesia, where many people works for industrial sector. Due to pandemic condition, it is compulsory to wear mask during work to avoid COVID-19 infection. The study was performed in Sumber Jaya village, Bekasi Region where 87,147 people resides and most of the resident work for industrial and retail sector.

This study aims to identify the quantity of face mask waste generated from daily activities, especially in area where most of the residents were active workers. The study also involved face mask waste management during COVID-19 pandemic.

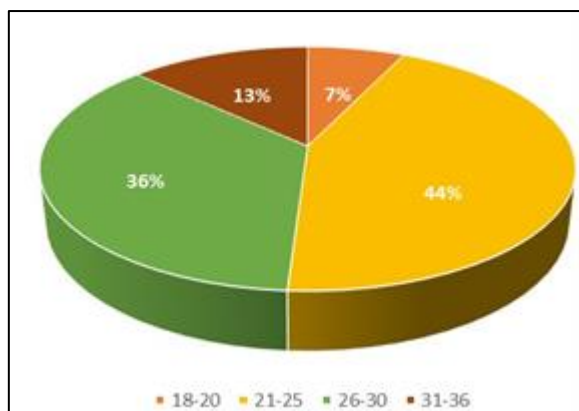
### Methods

Data was collected through online survey to maintain physical distancing during COVID-19 pandemic. Simple random sampling was used as sampling technique. The number of respondents for this research was 135 people. All of respondents were active workers who work daily and wear face mask during work. The survey was conducted to identify the type of mask that were used, the number of masks used per day, how people disposed of face mask waste, and their knowledge concerning face mask waste management.

### Result and Discussion

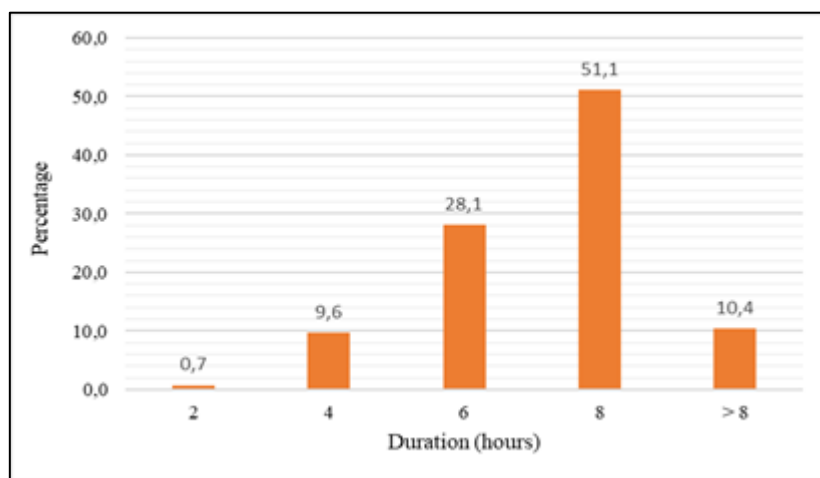
Online survey result indicated that the range of respondents' age were between 18-36 years old, detail percentage of each age group is shown in Figure 1. The respondents wear mask every day when they went to work. The type of face mask that the respondents used daily were 3-ply mask, duckbill mask, KN-95, and KF-94. The most commonly used type pf face masks were 3-ply mask and duckbill mask.

A study in several countries (Australia, America, UK, Singapore, Sri Lanka, and India) shown that 40% of people used surgical mask, 9% of people used N95 mask, and 15% of people used both surgical and N95 mask (Selvaranjan et al., 2021). Surgical mask or 3-ply mask are frequently used as they provide protection against droplet and are cheaper than N95 mask.



*Figure 1. Age group of online survey respondents*

Duration for wearing a piece of face mask was ranged from 2 to more than 8 hours. Most of the respondents (51%) used face mask for 8 hours, as detailed in figure 2. A study about the use of face mask in Poland also revealed that the most common duration of mask used per day is more than 5 hours (Matusiak et al., 2020).



*Figure 2. Duration of wearing face mask*

Based on the survey, the number of face mask waste generated from 135 people on daily basis was 231 pieces. The quantity of each type of face mask waste is described in Table 1. Total face mask waste quantity from 135 respondents was 0.735 kg/day or 0.005 kg/person/day.

*Table 1. The quantity of face mask waste*

Type of Mask	Number of Used Mask (pieces/day)	Face Mask Waste Weight (kg/day)
KN95	31	0.155
KF94	40	0.192
Duckbill	47	0.094
3-ply Face Mask	113	0.2938

According to regulation (Ministry of Environment and Forestry, 2021), infectious waste and COVID-19 related waste shall be managed as follows:

1. They shall not be mixed with other domestic waste
2. Face mask waste shall be destroyed (by cutting or tearing) prior to disposal
3. Face mask waste shall be disinfected
4. The waste shall be stored in closed and safely fastened trash bag

The majority of respondents (92%) stated that face mask waste was disposed of in the regular trash bin and mixed with other waste. Survey in another city in Indonesia, i.e. Surabaya, also revealed that 83,6% of respondents did not segregate infectious waste and domestic waste (Juwono & Diyanah, 2021). Many people were still not aware of the importance of segregating COVID-19 related waste from other domestic waste. COVID-19 related waste is required to be segregated to allow specific treatment, i.e. thermal treatment, and avoid pathogen contamination (Prata et al., 2021). There were also people who just throw away face mask waste due to lack of knowledge. Significant increase of face mask waste was found in two rivers in Jakarta Bay during COVID-19 pandemic which raised health and environmental concerns (Cordova et al., 2021).

This study also indicated that 72% of respondents destroyed face mask waste by cutting or tearing but 93% of respondents did not disinfect face mask waste prior to disposal. Many people are knowledgeable to destroy waste face mask but still unaware to disinfect the waste. It is compulsory that COVID-19 related waste is disinfected and segregated from other waste prior before being discarded to waste disposal facilities (Amuah et al., 2022). Destruction and disinfection of face mask waste are required to avoid reuse of face mask waste and prevent the spread of the virus (Tripathi et al., 2020).

The significant quantity of face mask waste and lack of knowledge in COVID-19 related waste management generate health and environmental problems. Tons of disposable face mask accumulated in natural environment with the potential to cause disruption in ecosystem. Proper containment, collection, and thermal destruction for COVID-19 related waste are needed to avoid waste contamination to the environment. Information dissemination and education program related to the proper mask disposal shall be performed to resolve the current condition.

## Conclusion

There is significant change in waste quantity during COVID-19, particularly face mask and PPE waste. Based on this study, face mask waste generation rate from active workers was 0.005 kg/person/day. Face mask waste from active workers in Indonesia may reach up to 720,000 kg/day. Most of COVID-19 related waste was still mixed with other waste and discarded directly to the environment. This practice shall be resolved to prevent further problems to the environment. Management of COVID-19 related waste shall be improved and public awareness shall be promoted.

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