



# The Effect of Disposable Mask Waste on Environmental Pollution in the Pandemic Era in Surakarta City

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**Abstract** - The Covid-19 virus was recorded to have been found in Indonesia since March 2, 2020. This virus is a virus that is easily contagious, so it is one of the efforts to prevent transmission by using a mask. So that everyone is required to wear a medical or non-medical mask when doing activities outside the home. Of the two types of masks that are more often used, namely the type of medical masks that are used because they are considered safer and more comfortable than non-medical masks. However, after use, the mask turns into the garbage which is classified as B3 waste. Hazardous waste has different characteristics and properties from waste in general because it is unstable, reactive, explosive, flammable, and toxic. In this case, once the mask waste is immediately disposed of without processing, the environment can be explained. Therefore, this study was conducted with the aim of knowing the effect of disposable medical waste on environmental pollution during the pandemic era in Surakarta City. The method used in this study is a questionnaire method which was conducted through online media surveys targeting people aged 17-25 years and supported by data from indexed literature studies. The results of this study indicate that out of a total of 45 respondents, the community is very aware of B3 waste (80%), knows that B3 waste is harmful to health (100%), likes disposable medical masks (58%), and understands disposable medical waste including B3 waste. (82%). Meanwhile, for the management of disposable mask waste, it shows that people still store medical mask waste at home (93%), understand the proper disposal of disposable mask waste (78%), have not differentiated it from other waste (60%), have not implemented 3R (76%), cutting medical waste before disposal (78%), understanding that medical mask waste is harmful to the environment (100%).

**Keywords** – Covid-19, Medical Masks, Waste, B3 Waste, Pollution

**Doi:** <http://dx.doi.org/10.14710/wastech.10.1.43-49>

[How to cite this article: Matin, H.H.A., Ashila, J., Fatikha, L.A., Azizia, M.S., Armando, M.F., Putrayuda, M.R., Silaningtyas, N.W. (2022). The Effect of Disposable Mask Waste on Environmental Pollution in the Pandemic Era in Surakarta City. Waste Technology, 10(1), 43-49 doi: <http://dx.doi.org/10.14710/wastech.10.1.43-49>]

## 1. Introduction

Humans will not be separated from the environment. The status of environmental quality will greatly affect and pass on to human life. If the quality of the environment is good then people's lives will be good, otherwise, if the quality of the environment is bad then people's lives will be disrupted, therefore all human activities should not harm the environment. Environmentally friendly activities are all activities carried out to achieve human needs by taking into account the balance of the environment, not only paying attention to human needs but also the continuity of other environmental components. Among other things, human activities that are not harmful to the environment produce waste that is not managed properly and can cause various environmental problems. Waste is a proton concept and the result of human activities. In the scope of science, waste has many meanings, one of which is waste or the disposal of materials from sources produced by human and natural

activities, and these sources do not yet have economic value. Waste has the meaning of causing unpleasant odors and sources of disease. Waste has become a very important environmental issue, especially in urban areas. The increasing number and variety of sources of urban waste also contribute significantly to environmental damage.

The Law of the Republic of Indonesia Number 32 of 2009 concerning Environmental Protection and Management stipulates that waste is the remainder of a business and/or activity. Waste is an object that contains substances that are harmful or not harmful to humans, animals, and the environment, and are usually the result of human activities (including industrialization). The waste itself has a classification and characteristics of waste. Based on its economic value, waste is divided into waste that has economic value and waste that has no economic value. Economic value waste refers to waste that will provide added value through further processing. Non-economic

waste is a type of waste which after further processing will not provide added value, but can only facilitate the processing system. This type of waste often causes problems of pollution and environmental damage. According to its nature, industrial waste can be divided into three categories, namely liquid waste, solid waste, and gas waste. Solid waste is all forms of solid, useless, unused, or unwanted waste generated by human and animal activities, or can be defined as all heterogeneous materials discharged from human, commercial and industrial activities. Liquid waste is waste in the form of liquid from activity and nature (Ichtiakhiri dan Sudarmaji, 2015).

Hazardous and toxic materials (B3) are substances, energy, and/or other components that directly or indirectly pollute and/or damage the living environment and/or harm the environment due to their nature, concentration, and/or quantity. Health, and survival of humans and other creatures. Then B3 waste is defined as the remaining part of the business and/or activity containing B3 (Kurniawan, 2019). According to Government Regulation Number 74 of 2001 concerning Management of Hazardous and Toxic Materials, B3 waste is the residue of the results of businesses and/or activities containing hazardous and/or toxic materials due to their nature and/or concentration and/or quantity, which can directly or indirectly pollute and/or damage the environment, and/or may endanger the environment, health, and survival of humans and other organisms. In addition, B3 waste can also be defined as solid waste or a combination of solid waste, because its quantity, concentration, physical, chemical, or infectious, rarely causes death and incurable disease, and its substances can endanger human health or the environment due to improper management. Improper storage, transportation, and disposal (Ichtiakhiri and Sudarmaji, 2015). If B3 waste is directly discharged into the environment, it will cause environmental damage and affect public health and other organisms. In addition, B3 waste has different characteristics and properties from waste in general, mainly because it is unstable, reactive, explosive, flammable, and toxic (Purwanti, 2018).

It is known that almost two months have passed since the Indonesian government first announced the first case of Coronavirus Disease (Covid-19) on March 2, 2020. Carefully recorded statistical data on the number of deaths due to being positive for this virus, as well as various other processed data provided on various portals. Official central and local government. However, there are some things that sometimes escape our collective attention, namely the amount of medical waste that is processed during the Covid-19 period (Prasetiawan, 2020). Indonesia is one of the countries affected by the Covid-19 virus. As we all know, the Covid-19 virus was determined by the World Health Organization (WHO) on March 11, 2020. The Covid-19 disease was first discovered in Wuhan, Hubei Province, China. The disease is believed to be caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is still part of the coronavirus family (Kriswibowo, et al.,

2021). The current Covid-19 pandemic is due to the mutation process of the SARS-CoV virus becoming highly contagious, so it becomes a challenge for the community because patients who are in the incubation period and are declared negative can transmit the virus. Governments around the world have issued policies related to various efforts to prevent transmission. One of the efforts agreed upon by the world is the use of masks throughout the community (Atmojo et al., 2020). COVID-19 will increase the amount of medical waste that will burden health facilities (Yolarita and Kusuma, 2020).

Coronavirus (Covid-19) is a new type of virus that is now taking the world by storm. The problem is, this virus has infected millions of people around the world in a short time. Even if humans don't show symptoms of coronavirus infection, they can pass it on to other people. The spread and number of infections are expected to increase, so the public is encouraged to adopt a new healthy lifestyle in accordance with hygiene procedures during the coronavirus pandemic. One form of this protocol is to maintain cleanliness and not to make direct contact with patients who are positive for the coronavirus. Then, use a protective mask when traveling or leaving the house. Next, maintain cleanliness by washing your hands or using hand sanitizer. Finally, social distancing is applied by maintaining a distance of 1 meter and covering the mouth with hands when coughing or sneezing. Masks are a form of personal protection during the coronavirus pandemic. The World Health Organization also reinforces this statement with interim guidance on mask recommendations published on April 6, 2020. The use of masks is very important because they cannot only act as protection but also prevent the spread of coronavirus infection. Through the use of protective masks, the spread of the coronavirus can also be controlled (Pinasti, 2020). The spread of COVID-19 not only disrupts the economic and health sectors but also disrupts environmental health due to the increasing amount of waste produced by the Indonesian people. The spread of this virus also exacerbates the waste problem, especially medical waste. Medical waste can be in the form of face masks and PPE (Personal Protective Equipment), including mask waste used by medical and non-medical personnel or the public. The Ministry of Environment and Forestry noted that during the COVID-19 pandemic in Indonesia, medical waste increased by 30%-50% (Ameridya et al., 2021).

There are several types of protective masks, namely medical masks and respirators. Medical masks are disposable masks with a maximum usage time of  $\pm$  4 hours and cannot be reused when wet (Lepelletier et al., 2020). Medical masks have a particle penetration rate of 44%, so they can protect themselves from viruses and are not at risk of other diseases (Szarpak et al., 2020). A respiratory mask (Respirator) is a filter media in the form of a mask. Respiratory masks can be used as protective equipment for health workers who are exposed to the virus (Ippolito et al., 2020). Masks are currently the main item to protect personal and public health. Many countries have made the

use of masks mandatory, especially in Asia, where it is reported that these countries have achieved satisfactory results in slowing the spread of infection in Hong Kong and Singapore (Atmojo et al., 2020). The use of masks is highly recommended for all people when traveling. The recommendation given for the use of masks in the Covid-19 pandemic is medical masks. The use of these medical masks is the most important part of the prevention and control measures to limit the propagation of the Covid-19 virus. Medical masks are well used for healthy people and people exposed to the Covid-19 virus to protect themselves. A medical mask is a 3-layer mask that has a tight fold on the head with a strap that goes around the ear or head or both. The use of masks is continuously used as an obligation for all the general public in every activity. With the aim of preventing infected communities or communities from spreading the virus to others and also providing protection for the wider community (Kriswibowo, et al., 2021). Common signs and symptoms of Covid-19 infection include symptoms of acute respiratory distress, such as fever, cough, and difficulty breathing. The average incubation period is 5 to 6 days with an incubation period of fever, cough, and difficulty breathing (Putri, 2020).

Waste management, especially masks, is an activity that remains a local and global problem. Most people still don't know the meaning and types of B3 waste, especially the Covid-19 B3 residue. People still eliminate all types of waste without classifying the type of waste. Minimum information to the public regarding waste management is also one of the obstacles. In addition, there are other issues related to the disproportionate lack of medical waste disposal facilities with significant medical residue during the pandemic. Guidelines on the management of community mask residues have also been issued by the government through the Indonesian Ministry of Health. However, many people have not implemented it on the household scale (Maimunawaro, 2021). Disposable mask waste which is in daily use by the public is generally an issue because many masks are disposed of in a careless way so that they can pollute the environment (Juwono, et al., 2021). In line with the Covid-19 pandemic and the increasing use of disposable medical masks that are currently of public concern, this study was conducted with the aim of knowing the effect of disposable medical mask waste on environmental pollution in this pandemic era, considering that masks must be used every day. When you leave the room, there must be an increase in the waste of disposable masks at this time.

## 2. Materials and Methods

### 2.1 Research Time

The research was conducted for 1 month from October 2021 to November 2021 which included preparation, implementation, and preparation activities. The research preparation stage includes the activities of preparing the title and preparing questions for the google form questionnaire as well as searching for appropriate

literature studies. The research implementation phase includes distributing online questionnaires and deepening the study of the literature. While the research preparation stage includes the process of compiling the data obtained into a journal about the effect of disposable masks on environmental pollution during the pandemic.

### 2.2 Research Location

The research was carried out in Surakarta City, which is located between Surakarta City, which is located between 110° 45' 15" - 110° 45' 35" East Longitude and 70° 36' - 70° 56" South Latitude and is bordered by Karanganyar Regency and Boyolali Regency in the north, Karanganyar and Sukoharjo regencies in the east and west, and Sukoharjo regencies in the south. The reason for choosing the city of Surakarta as the research location is because the city of Surakarta is included in the red zone where the spread of the Covid-19 virus is high, so the use of masks is also increasing.

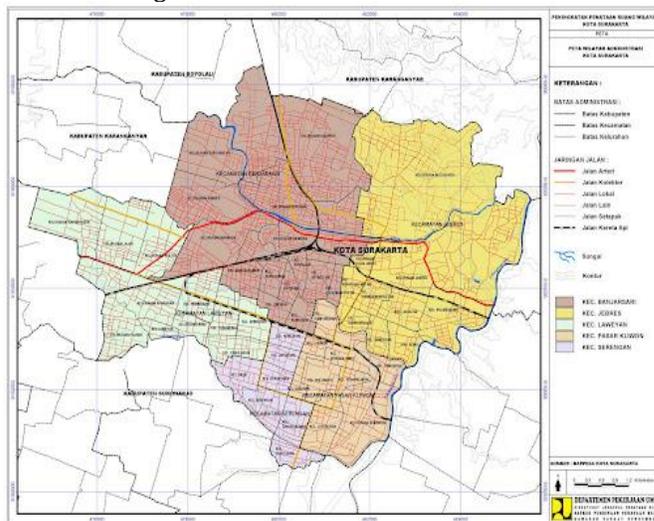


Figure 1. Surakarta City Administration Map

### 2.3 Data Collection and Analysis

This research is included in analytical descriptive research because it aims to describe or provide an overview of the object under study through the data or samples that have been collected. In an effort to achieve the objectives of the research required data in the form of primary data and secondary data. To obtain these data, we used two methods, namely the questionnaire method and the literature study. The questionnaire method is a research method in the form of a series of questions that aim to collect information from respondents. The questionnaire method in this study contained several questions related to the understanding and behavior of the community about the hazardous waste of disposable masks. We will use the results of this method as primary data. The object of this research is people who use disposable masks during the COVID-19 pandemic with the target respondent being 45 people from the city of Surakarta in the age range of 17-25 years. In getting respondents, we used google

forms to make online surveys and distribute them through various online media, such as WhatsApp and Instagram. After getting respondents who match the target, the data is processed, categorized, and given a value according to the results of the data that has been obtained. While the literature study method is used as a theory that supports the research. The data obtained comes from various trusted sources, such as indexed national and international books and journals. Data from the literature study will be used as secondary data.

### 3. Results and Discussion

According to research, during the COVID-19 pandemic, people always used masks when working outside the home, but only a few understand how to dispose of mask waste and how to monitor it. Table 1 shows the average survey results of the 45 respondents we surveyed. People are very aware of B3 waste (80%), know that B3 waste is dangerous to health (100%), really like disposable medical masks (58%), and very understand that disposable medical mask waste includes B3 waste (82%). Many people still store medical mask waste at home (93%), understand very well the proper disposal of medical mask waste (78%), some people do not understand how to separate medical mask waste from other waste (60%), some people have not implemented 3R to waste medical masks (76%), more likely to cut their waste medical masks before discharge (78%), it is understood that the waste of medical masks are harmful to the environment because it is difficult to decompose and cause infection (100%).

Table 1. Average Survey Respondents

Survey	Frequency	Percentage
very understand B3 waste	36	80%
Know that B3 waste is harmful to health	45	100%
Really like disposable medical masks	26	58%
Very understand that waste medical masks are disposable including B3 waste	37	82%
Many people still store medical mask waste at home	42	93%
Very understand the proper disposal of medical mask waste	35	78%
Some people do not understand how to separate medical mask waste from other waste	27	60%
Some people have not implemented 3R on medical mask waste	34	76%
Strongly understands that medical mask waste is harmful to the environment because it is difficult to decompose and causes infection	45	100%

Based on data analysis findings and the distribution of the survey, it was determined that the community already understood what B3 waste was and many were using disposable medical masks. This is closely related to the increasing amount of environmental medical mask waste. According to the community, B3 waste is a substance, energy, and/or other components that directly or indirectly pollute and/or damage the living environment and/or harm the environment due to its nature, concentration, and/or amount. There were 45 respondents who stated that the public knew very well that B3 waste was dangerous to health and the environment, in this case, medical mask waste. A total of 26 respondents stated that the majority of the community liked disposable medical masks. The average use of medical masks in a week is between 3-14 pieces. Then as many as 37 respondents stated that the majority of the community understood medical mask waste, including B3 waste. Then as many as 42 respondents stated that many people still store medical mask waste at home. After that, as many as 35 respondents stated that the community understood the proper disposal of medical mask waste. When people do not understand how to process medical mask waste, this causes environmental damage due to pollution caused by mask waste that has not been handled safely and correctly. A total of 27 respondents have not been able to sort out medical mask waste from other waste. Then, as many as 34 respondents have not implemented 3R on medical mask waste. And lastly, respondents are aware and understand that medical mask waste is dangerous for the environment because mask waste is difficult to decompose and can cause infection. People still don't care about the environment due to the accumulation of medical mask waste.

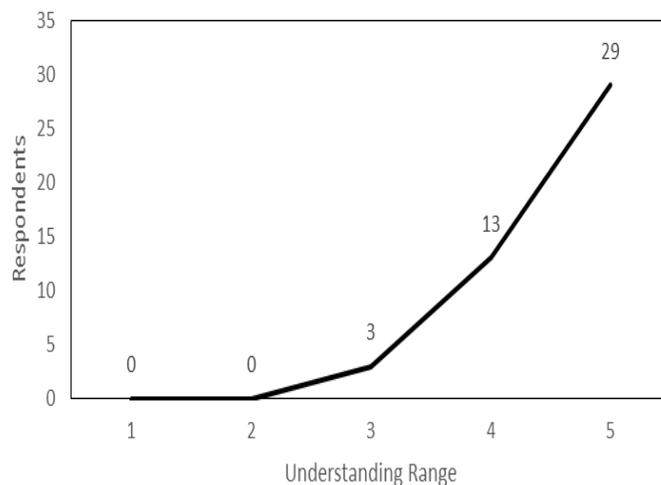


Figure 2. Public Understanding of the Dangers of B3 to the Environment

Figure 2 above shows the respondent's level of understanding about the dangers of B3 waste which can cause environmental pollution. The survey was conducted with a range of numbers 1-5 which means that number 1 is

an assumption that disposable medical mask waste is not very harmful to the environment, while number 5 is an assumption that disposable medical masks are very dangerous for the environment. Then the results obtained to state that there are no people who think that B3 waste does not pollute the environment. In the range of number 3, there are 3 respondents who think that B3 waste does not pollute the environment too much. In the range of number 4, there are 13 respondents who think that B3 waste causes environmental pollution. And there are 29 respondents who think that B3 waste is very polluting to the environment. From the respondents' understanding, it was found that disposable masks are also included in the waste that pollutes the environment. However, they only know that mask waste can pollute the environment because the characteristics of masks are difficult to decipher and there are microorganisms that can be transmitted.

Disposable mask waste is included in the category of waste that is difficult to decompose because it is made of plastic microfibers. Apart from polluting the environment, disposable masks can also spread the virus if not handled properly. Disposable masks can take up to 450 years to decompose. Mask waste that is still intact in the environment that is not handled properly can be carried into rivers and seas and cause water pollution and can be dangerous for the ecosystems in the river or sea. This disposable medical mask waste will have a negative impact on our ecosystem, some of the impacts that arise on animals and the environment. In marine ecosystems, some animals cannot distinguish between waste and their food, be it other types of waste or mask waste, therefore it is not uncommon for marine animals to eat the garbage on purpose because it is considered their food. If animals in the sea consume microplastics and then these animals will become human food, of course, it will also affect the food chain and have an impact on health. This shows that the public's indifference to mask waste does not only cause environmental pollution and harm to other creatures but can also have an impact on humans themselves. In addition, the impact of mask waste if it is in the ocean is likely to carry viral pathogens and can last between 2 to 13 days. The waste is degraded into microplastics which can pollute the environment and it will have a wide impact, fish can also be entangled in mask straps because the mask straps are elastic which are difficult to stretch, not infrequently several types of fish die due to being entangled in mask straps. Then the impact of mask waste on the surrounding environment, masks that are disposed of carelessly can certainly cause the spread and transmission of viruses, besides the impact of disposable mask waste is very influential for animals, plants as well as ecosystem sustainability. If this is continuously done, it will make the environment where we live, the forest and water environment will cause pollution, the land which is usually planted with rice or vegetables can fail to harvest due to the soil and water contaminated with medical waste first.

Therefore, it is necessary to properly manage medical mask waste by professional parties, but we as a society and also mask users should be wiser in sorting and disposing of medical mask waste so as not to pollute the surrounding environment and not harm others creatures.

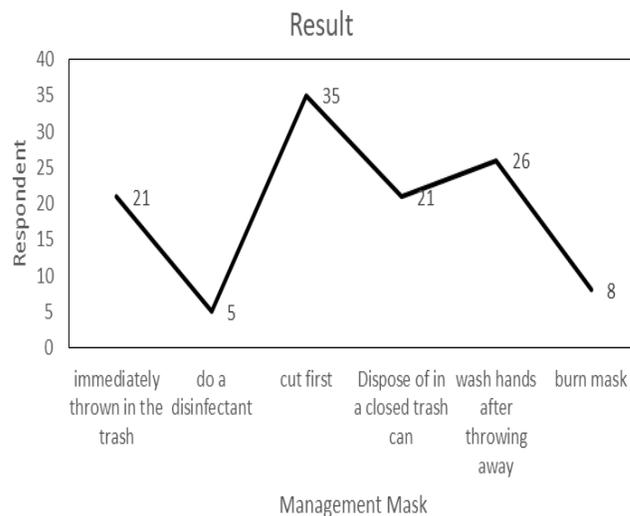


Figure 3. Disposable Medical Mask Waste Management

Can be seen in the Figure 3 of the way respondents dispose of masks, where some respondents have implemented the method of disposing of which is recommended by the government to prevent things that can pose a risk to human health and the surrounding environment. where there are 21 respondents who immediately dispose of the mask waste into the trash, namely the closed trash can without carrying out other preventive activities, then 5 respondents do a disinfectant first before disposing of the medical mask waste, then 35 respondents cut the mask first before throwing it away, this method can be used so that mask waste is not resold by irresponsible persons, then 26 respondents carried out self-cleaning activities after disposing of masks, namely by washing their hands with soap, and lastly, 8 respondents burning masks, burning masks is not recommended, Ordinary people cannot process medical waste such as used disposable masks, let alone burn it themselves. The party that can burn or manage medical mask waste is the hospital or health center because there are several hospitals that have their own incinerator, and if they don't have one, the hospital will usually work with a third party to manage medical waste. Burning disposable medical masks is strongly discouraged. Because, instead of the coronavirus burning to death, it actually creates new problems for the environment and causes air pollution. The process of burning medical mask waste by residents also has the potential to transmit the virus. This is because improper handling of waste can actually spread the virus.

From the results that have been obtained, it shows that people actually know the dangers of disposable masks. However, some of them are still ignorant, so they just tear

the masks and then throw them in the trash that is not specifically for B3 waste. There are even some who throw it anywhere. One of the attitudes of the community is influenced by the lack of understanding of proper mask waste management. Even though regulations for the management of mask waste have been implemented. As for the rules that have been applied to dispose of medical masks, namely, by disinfecting, tearing the mask, then put it in a plastic bag, then throwing it in the trash. It should also be remembered that the trash cans used to dispose of disposable mask waste are not arbitrary. Disposable mask waste is disposed of in a closed trash can specifically designated for hazardous and toxic materials. If disposable mask waste is not disposed of according to regulations, there may be dishonest persons who will recycle masks in an unhealthy manner. This behaviour can endanger the health of others because it is unhealthy. This behaviour can endanger the health of others because it is unknowingly known that the masks used have been used by people infected with Covid-19. This is why there are special rules before handling disposable masks.

#### 4. Conclusion

From the results and discussions that have been described, it can be concluded that most people already understand the waste of disposable masks, including the type of B3 waste. It is shown in the survey results obtained a percentage of 82%. However, not all people know how to properly manage disposable mask waste. Of the total 45 respondents, 35 respondents only managed the mask waste by cutting it before throwing it away and the rest was dumped directly into the trash and burned it. The final result of this research survey shows that the community still has not carried out single-use mask waste management because of a lack of concern for the presence of mask waste which can trigger pollution. Disposable masks that are disposed of without any treatment will cause environmental pollution because their infectious characteristics are included in the type of B3 waste. Pollution caused by disposable masks will not only pollute the environment and be felt by other creatures but will also have an impact on humans because the microplastics in masks disrupt the food chain.

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