Analysis of Community Perception on Medical Mask Waste Classified as Hazardous and Toxic Waste in Surakarta, Indonesia

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Abstract – *Hazardous and toxic waste is a substance, energy, or other component that can pollute the environment and endanger the health of living things. One example of this waste is medical waste. Medical waste is classified as hazardous and toxic waste because medical waste is infectious which has the potential to pose a risk of disease transmission. The Covid-19 pandemic has led to an increase in medical waste such as disposable masks. This mask waste requires special management so that it does not become a medium for spreading the virus. This study aims to find out how the public's understanding of mask waste is classified as infectious hazardous and toxic waste, and how the community's knowledge is in managing mask waste. The method of data collection was done through a questionnaire using a Likert approach. The data obtained were analyzed using quantitative and descriptive analysis methods. The results showed that the understanding and awareness of self-management of medical mask waste in the city of Surakarta was high, but the presentation of willingness to collect and send it was quite low. More initiatives and roles from the government and the community are needed in the management of medical mask waste.*

1. Introduction

Hazardous and toxic materials are substances, energy, or other components which due to their nature, concentration and quantity, either directly or indirectly, can pollute, damage the living environment, and may endanger the environment, health, survival of humans and other living creatures. The production of hazardous and toxic waste materials continues to increase not only in developed countries, but also in developing countries including Indonesia (Kurniawan, 2019). The increase in hazardous and toxic waste occurs in line with the increase in industry, where almost every industry produces hazardous and toxic waste. Along with the increasing number and types of hazardous and toxic materials, of course the challenges faced in the management of hazardous and toxic waste materials are getting bigger. Management of hazardous and toxic waste is regulated based on PP No. 101 of 2014 concerning Management of Hazardous and Toxic Waste. Without proper management, hazardous and toxic waste

has a much more severe environmental damage than other types of waste. Hazardous and toxic waste that is simply dumped into environmental media not only has an impact on the environment, but can also potentially threaten the health of humans and other living creatures (Maulana et al., 2020). So that the negative impact caused by the disposal of hazardous and toxic waste materials into the environment becomes a crucial problem and must be addressed immediately with proper management. Hazardous and toxic waste management is carried out with the precautionary principle by using safe and environmentally friendly waste management methods. In its management, special treatment and facilities are needed, starting from the production of waste (from cradle) to being destroyed (to grave) (Prasetiawan, 2020).

Medical waste in Indonesia is categorized as hazardous and toxic waste that can potentially pose risks to health, work environment and disease transmission. According to the World Health Organization (WHO),

medical waste is waste generated from a health service, including all waste products originating from health installations, research facilities and laboratories related to medical procedures. Medical waste is divided into liquid and solid phase waste. Liquid medical waste produced is limited from health care facilities, so that its handling can be easier to do (Prasetiawan, 2020). Meanwhile, solid medical waste is waste generated from a health service in solid form, including infectious waste, pathological waste, sharp object waste, pharmaceutical waste, cytotoxic waste, chemical waste, radioactive waste, pressurized container waste and waste with high heavy metal content (Maharani et al., 2017). According to the United State Environmental Protection Agency (USEPA), solid medical waste is solid waste that can pose a risk of disease transmission. Solid waste includes chemical waste, toxic waste, and infectious waste that can threaten human health and the environment (Siddik and Wardhani, 2020).

In the condition of the Corona Virus Disease 2019 (Covid-19) pandemic, the amount of medical waste has increased, one of which is solid waste in the form of mask waste. This is due to government policies that require all people to wear masks when doing activities outside the home. The obligation to use masks for the entire community is followed by an increase in the use of masks. Although there are people who use cloth masks, most people prefer to use medical masks because they are in accordance with government recommendations. Handling medical waste generated from both patients and medical staff is one of the important aspects in overcoming the Covid-19 outbreak (Nugraha, 2020). Mask waste is classified as infectious medical waste that needs to be handled specifically. Because it is feared that this waste can become a medium for the spread of the virus if it is not managed properly (Juwono and Diyanah, 2021). In addition, mask waste that accumulates everywhere can have an impact on polluting and damaging the environment (Ameridya et al, 2021). Not only mask waste, but all types of medical waste need to be managed properly because medical waste can also increase the potential for polluting the environment, and can cause work accidents and disease transmission. Medical waste treatment is carried out with the aim of changing the biological and/or chemical characteristics of the waste so that the potential hazard to humans can be reduced or even non-existent (Hamdi and Purnama, 2019).

Indonesian Ministry of Environment and Forestry has issued Circular No. SE.2/MENLHK/PLB.3/2020 concerning Management of Infectious Waste (Waste of hazardous and toxic materials) and Household Waste from Handling Corona Virus Disease (Covid-19) including guidelines for managing disposable masks. The Ministry of Health also issued a similar guideline, namely guidelines related to the management of mask waste from the community. The government's goal in issuing the Covid-19 infectious waste management guidelines is to minimize the risk of transmission and environmental pollution (Laelasari, 2021). In addition, public knowledge regarding medical waste management is still very minimal. Most people still do not know the meaning and types of hazardous and toxic waste, especially hazardous and toxic waste from Covid-19 (Maimunawaro, 2021). Collected medical waste should not be disposed of directly into the domestic trash, but must be managed first (Kusumaningtiar et al, 2021). Before being disposed of, a sorting process must be carried out first, then treatment is carried out before finally being disposed of in the domestic trash. The treatment for mask waste before being disposed of is like disinfecting the mask, then changing the shape of the mask by cutting or damaging it, and putting it in a tight plastic bag. However, in its application there are still many people who do not know how to properly manage mask waste. One of the causes of public ignorance in managing mask waste is because there is still a lack of education and socialization facilities regarding this matter. Therefore, to overcome mask waste as infectious medical waste that must be managed properly, the government's role is needed in providing educational facilities for the community, as well as awareness from the community to manage mask waste.

2. Materials and Methods
2.1. Research Time
This research was conducted for 21 days starting from October 30, 2021 to November 19, 2021. The stages carried out include the preparation stage, the implementation stage, the data collection and calculation stage. The preparatory stage is carried out on October 30, 2021 to November 4, 2021, by determining the theme and title of the research, as well as making question questionnaires to be submitted to respondents. The implementation phase was carried out from November 5, 2021 to November 13, 2021 by distributing questionnaires regarding the understanding and management of the community regarding mask waste. The data collection and calculation phase is carried out on November 14, 2021 to November 19, 2021 by compiling the data that has been obtained from the results of the questionnaire survey.

2.2. Research Location
This research was conducted in the city of Surakarta, especially around the Sebelas Maret University which is located on Jl. Ir. Sutami, Kentingan, Jebres District, Surakarta, Central Java.

2.3. Tools and Materials
The tools used in this research include PC, questionnaire, stationery, and Ms. Excel. And the materials used are literature in the form of journals and other sources, tally sheets, and data from questionnaires and interviews.

2.4. Methods

In this study, there are two types of data used, namely primary data and secondary data. The primary data used is data on the knowledge and perceptions of the people of Surakarta City on hazardous and infectious waste of medical mask waste, this data was obtained from questionnaires and interviews. The number of respondents as many as 31 people with different backgrounds. While the secondary data used in the form of data and understanding about the waste of hazardous materials and infectious medical mask waste obtained from a literature study. The data collection method is carried out through a questionnaire using the Likert approach, in this method the questions / statements on the questionnaire will be accompanied by five responses with different scores for each response. The responses were strongly disagree (ST) with a score of 1, disagree (TS) with a score of 2, unsure (R) with a score of 3, agree (S) with a score of 4, and strongly agree (SS) with a score of 5. Then the data from the questionnaire is calculated with the formula in order to obtain research results.

Furthermore, the data analysis method used in this research is quantitative and descriptive analysis. Where the data from the questionnaire that has been calculated will look for intervals so that it is found the level of understanding and perception of the people of Surakarta on hazardous and toxic waste of infectious medical mask waste, for the intervals are as follows 0-19,99% strongly disagree (ST), 20-39 .99% disagree (TS), 40-59.99% undecided (R), 60-79.99% agree (S), and 80-100% strongly agree (SS). Then the results of this quantitative analysis will be linked to the results of interviews using a descriptive approach. The stages of this research are as follows:

a. Research preparation, at this stage the researcher prepares all the things needed in research such as preparing tools and materials.
b. The data collection process was carried out by distributing questionnaires and interviews to obtain data on the understanding and perception of the Surakarta community towards hazardous and infectious waste of medical mask waste.
c. The data processing process, the data obtained is then processed by performing calculations and determining intervals.
d. The process of data analysis and discussion, data resulting from questionnaires and interviews were then analyzed using quantitative and descriptive approaches. Then the results of the analysis will be reviewed for further discussion.

3. Results and Disscussion
3.1. General hazardous and toxic waste and Infectious hazardous and toxic waste

Hazardous and toxic waste is a residue from an activity and contains substances, energy, and or components that are harmful and toxic, which can endanger human health and the environment (Afiudin and Dewi, 2019). Hazardous and toxic waste itself is very dangerous because this waste has properties that are not the same as waste in general, hazardous and toxic waste materials are unstable, reactive, explosive, flammable, corrosive, and toxic (Purwati, 2016). One type of hazardous and toxic waste is classified as infectious waste. Infectious waste is waste that is contaminated with pathogenic organisms in sufficient quantities to transmit disease to susceptible humans. Infectious waste can be in the form of medical waste such as used masks, used gloves, used plastic tableware, used bandages, used syringes and infusion sets, as well as PPE used by health workers. If not managed properly, it is feared that medical waste, especially from handling patients with infectious diseases such as Covid-19, will become a source of disease transmission for waste management officers and even the surrounding community.

3.2. Sources of Hazardous and Toxic Waste Infectious Mask

The Covid-19 pandemic has caused an increase in medical waste due to the use of chemical equipment and disposable medical devices in large quantities. According to Yolarita and Kusuma (2020), infectious hazardous and toxic waste has doubled due to the Covid-19 pandemic. One of the hazardous and toxic medical waste materials is a mask. The use of masks is part of a comprehensive series of prevention and control measures that can limit the spread of certain viral respiratory diseases, including Covid-19. Hazardous Toxic Material Waste (hazardous and toxic materials) solid medical is goods or materials left over from activities that are not reused which have the potential to be contaminated by infectious substances or in contact with patients and/or officers in health care facilities who handle Covid-19 patients. Masks can be used either to protect a healthy person (worn to protect themselves when in contact with an infected person) or to control the source (worn by an infected person to prevent further transmission).

3.3. Analysis of Public Knowledge Regarding Hazardous and Toxic Waste Infectious Masks

Analysis of public knowledge related to hazardous waste and infectious masks was carried out based on the data from the Likert questionnaire, the results can be seen in Table 1. Results of the Survey Using the Likert Method and Table 2.Results of the Questionnaire with the Answers "Yes" and "No". The number of respondents is 31 people with details, based on gender there are 12 men and 19 women, then for the age range of respondents is 16–25 years old, and based on the last education there are 27 high school/vocational high school graduates, 1 diploma, and 1 bachelor's degree. In this questionnaire there are 16 questions that we ask along with five response options.

Table 1. Table of Scores from Questionnaire Results Based on Formula Calculations

No.	Questions	Score
1	I know about hazardous and toxic materials and also know about hazardous and toxic waste	85%
2	I know the characteristics of hazardous and toxic materials and hazardous and toxic waste	76%
3	I know the types of hazardous and toxic waste	73%
4	I know that hazardous and toxic waste has a negative impact	86%
5	I know that hazardous and toxic waste needs to be managed	89%
6	I always wear a medical mask every day	67%
7	I always wear a cloth mask every day	54%
8	Every day I always use a medical mask covered with a cloth mask	54%
9	I use a medical mask with the rule of one time use / always replace after use	74%
10	I have previously known that medical mask waste is part of hazardous and toxic waste	77%
11	I have previously known that medical mask waste should not be thrown away mixed with other types of waste	81%
12	I know the address for the medical mask waste collection	45%
13	I know that mask medical waste is collected in a place that has been designated by the government to be managed	60%
14	I know the actions that need to be taken before collecting medical mask waste at the collection place	70%
15	I cut the medical mask before throwing it away or collecting it at the collection place	77%
16	I want/willing to send the medical mask waste to the collection point	46%

Table 2. Questionnaire Survey Table

No.	Questions	Number of Respondents: 31 respondents	
		Answer	
		Yes	No
1	I know about hazardous and toxic materials and also know about hazardous and toxic waste	29	2
2	I know the characteristics of hazardous and toxic materials and hazardous and toxic waste	22	9
3	I know the types of hazardous and toxic waste	22	9
4	I know that hazardous and toxic waste has a negative impact	29	2
5	I know that hazardous and toxic waste needs to be managed	29	2
6	I always wear a medical mask every day	15	16
7	I always wear a cloth mask every day	14	17
8	I always use a medical mask covered with a cloth mask every day	25	6
9	I use a medical mask with the rule of one time use / always replace after use	25	6
10	I have previously known that medical mask waste is part of hazardous and toxic waste	19	12
11	I have previously known that medical mask waste should not be thrown away mixed with other types of waste	21	10
12	I know the address for the medical mask waste collection	6	25
13	I know that mask medical waste is collected in a place that has been designated by the government to be managed	10	21
14	I know the actions that need to be taken before collecting medical mask waste at the collection place	19	12
15	I cut the medical mask before throwing it away or collecting it at the collection place	10	21
16	I want/willing to send the medical mask waste to the collection point	1	30

The questions are divided into two groups, namely questions 1–5 is aimed at knowing the public's understanding of hazardous and toxic waste, and questions 6–16 the aim of this study is to determine the perception and pattern of community behavior towards hazardous and toxic waste of infectious waste masks.

In the first group of questions, the following results were obtained, on the question of knowledge about hazardous and toxic materials and hazardous and toxic waste, a score of 85% was obtained, of 31 respondents 29 of them answered knowing and 2 respondents did not know. So that it is known the interval of public perception in the first question with an interval of strongly agree, meaning that many people already know about hazardous and toxic materials and hazardous and toxic waste. Then the question about the characteristics of hazardous and toxic materials and hazardous and toxic waste materials obtained as many as 22 respondents answered knowing and 9 respondents did not know. The results obtained on questions regarding the characteristics of hazardous and toxic materials and hazardous and toxic waste materials with a score of 76% with agreed intervals. This shows that public knowledge about the characteristics of hazardous and toxic materials and waste of hazardous and toxic materials is good. Furthermore, the question regarding the types of hazardous and toxic waste obtained a score of 73% with an agreed interval. This shows that public knowledge about the types of hazardous and toxic waste is good. Then for the fourth and fifth questions, it is included in the interval of strongly agree with the percentages of 86% and 89% respectively regarding the negative impact of hazardous and toxic materials and the management of hazardous and toxic waste. This shows that the community already understands and knows the impact of hazardous and toxic waste and the community has an understanding of the hazardous and toxic waste that must be managed.

3.4. Analysis of Community Behavior and Treatment Regarding Hazardous and Toxic Waste Infectious Masks

Next is the analysis of the behavior and treatment of the community towards hazardous and toxic waste of medical mask waste. In this analysis the results used are the results of question number 6–16, this can be seen in Table 1. Survey Results Using the Likert Method and Table 2. Questionnaire Results With "Yes" and "No" Answers. Analysis of community behavior and treatment related to hazardous waste and infectious masks was carried out based on data from a questionnaire on questions related to the use of types of masks, in the general public there are 2 types of masks, namely medical and cloth.
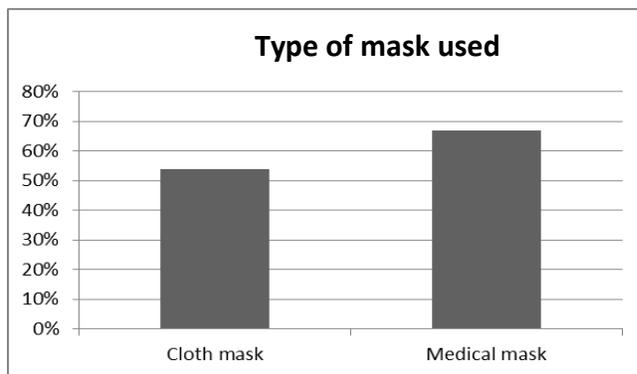

Figure 1. Comparison of users of cloth masks and medical masks

Question List Description:
(6) I always wear a medical mask every day
(7) I always wear a cloth mask every day

To get the results of the questionnaire, it is known that there are still many people who use cloth masks (54%) while the use of medical masks is higher at 67%, even though the risk of getting viruses or bacteria is higher when using a cloth mask only. Thus, more awareness is needed to use cloth masks and medical masks at the same time.
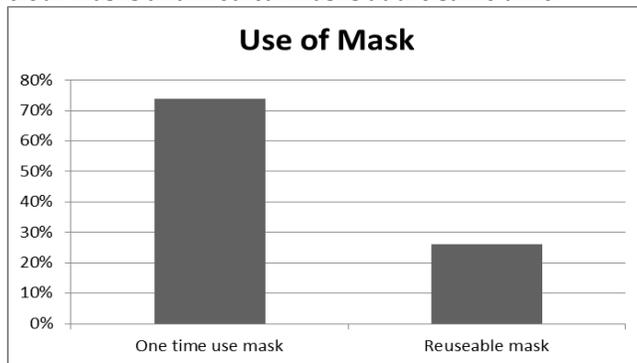

Figure 2. Comparison of users one time mask and reusable mask

Question List Description:
(9) I use a medical mask with the rule of one time use / always replace after use

Then the question regarding the use of medical masks that should only be used once and then thrown away, it was found that 74% of respondents wore medical masks only once and there were 6 respondents who used medical masks repeatedly. The data shows that most respondents are aware that the use of medical masks will be more effective when they are not used repeatedly.

Figure 3. Comparison of users one time mask and reusable mask

Question List Description:
(10) I have previously known that medical mask waste is part of hazardous and toxic waste

In the next question, the respondent's knowledge of mask waste is included in hazardous and toxic waste. In this question, only 19 respondents knew that mask waste was included in hazardous and toxic waste.

The next question regarding knowledge about mask waste that should not be mixed with other types of waste obtained high results with a percentage of 81%, where 21 respondents knew and 10 respondents did not know.
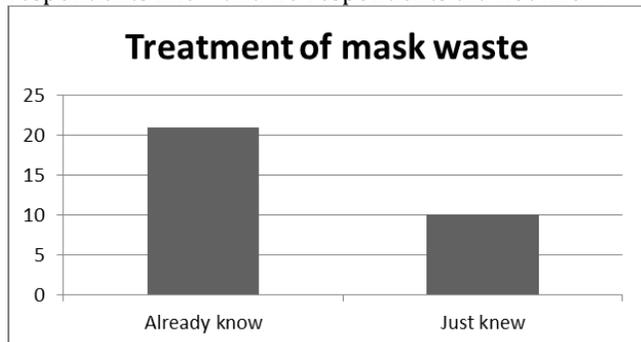

Figure 4. Comparison of treatment of mask

Question List Description:
(11) I have previously known that medical mask waste should not be thrown away mixed with other types of waste
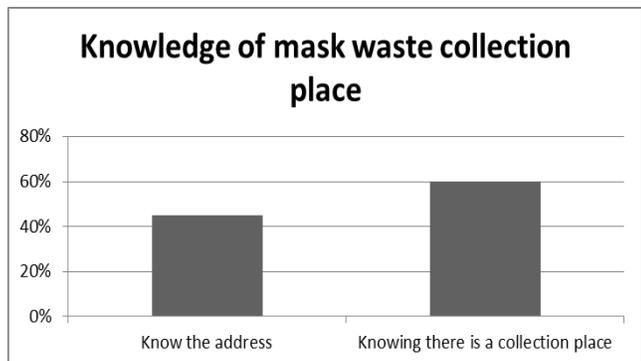

Figure 5. Comparison of treatment of mask

Question List Description:
(12) I know the address for the medical mask waste collection
(13) I know that mask medical waste is collected in a place that has been designated by the government to be managed

Then on the question regarding the address for collecting mask waste, only 45% of respondents knew about it and there were only 60% of respondents who knew about mask waste collected in the provided place, appropriate management would be carried out. Then from the question about the actions that need to be taken before collecting mask waste, most of the respondents already know that one of them is by cutting the masks before they are collected. From the results obtained on the question of knowledge about hazardous and toxic waste and how to manage it, it turns out that there are still many respondents who do not know about the types of hazardous and toxic waste and their management, so that socialization is needed to form an understanding of hazardous and toxic waste to the public. And in the last question of the questionnaire related to the willingness of respondents to send mask waste to the designated collection point, only 1 respondent did so. From these results, it can be seen that the production of community medical mask waste is quite large due to the good habits of people who use medical masks with one-time use rules, besides that the production of medical mask waste is said to be quite large because from the survey results the percentage of medical masks used is more than cloth masks.

Furthermore, from the survey results, it can also be understood that the level of knowledge and understanding of the community regarding hazardous and infectious waste of medical mask waste is quite high. This is also accompanied by a high percentage of awareness of managing medical mask waste independently. However, the percentage of willingness to collect and send medical mask waste to the management site is very low at 46%, this is directly proportional to the percentage of public knowledge about the address for collecting medical mask waste, which is 45%. From this it can be seen that the level of knowledge and awareness of the community is already high but it is not accompanied by the percentage of willingness to collect and send medical mask waste to the processing address. Allegedly this phenomenon occurs due to the many steps that need to be done, lack of information, and time consuming. This assumption is reinforced by the results of interviews which state that the lack of information regarding the collection and delivery of medical mask waste, especially the delivery of medical mask waste is considered complicated by the community. From the results of the interviews, respondents also hoped that the government would take the initiative in taking medical mask waste from each region.

4. Conclusion

From the results and discussion, it can be concluded that the understanding and awareness of self-management of medical mask waste in the Surakarta City community is high, but the presentation of willingness to collect and send it is quite low. This is thought to be due to the lack of information regarding the collection of medical mask waste and the public's view that the collection and delivery of medical mask waste is a complicated and time-consuming

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step. Thus, it is hoped that there will be more initiatives and roles from the government for the collection and management of medical mask waste.

References

Afiuddin, A. E., dan A. K. Dwi. (2016). Studi Perbaikan Tempat Penyimpanan Sementara (TPS) Limbah bahan berbahaya dan beracun Sesuai Dengan Limbah Yang Dihasilkan Dan Peraturan Terbaru Di PT. X. *Journal of Proceedings Series*. 2: 78–84.

Ameridya, A., A. Pratama, R. A. Pudi, dan S. F. Absyar. (2021). Limbah Masker di Era Pandemi: Kejahatan Meningkat atau Menurun. *Jurnal Green Growth dan Manajemen Lingkungan*. 10 (1): 51-58.

Hamdi, K., I. G. H. dan Purnama. (2019). Implementasi Pengelolaan Limbah Bahan Berbahaya dan Beracun dari Fasilitas Pelayanan Kesehatan Melalui Sistem Bank Sampah di RSU Surya Husadha Denpasar Bali.*Archive of Community Health*. 6 (2): 114–127.

Juwono, K. F. dan K. C. Diyanah. (2021). Analisis Pengelolaan Sampah Rumah Tangga (Sampah Medis dan Non Medis) di Kota Surabaya Selama Pandemi Covid-19.*Jurnal Ekologi Kesehatan*. 20 (1): 12-20.

Kurniawan, B. (2019). Pengawasan Pengelolaan Limbah Bahan Berbahaya dan Beracun (bahan berbahaya dan beracun) Di Indonesia Dan Tantangannya.*Jurnal Dinamika Governance*. 9 (1): 39–49.

Kusumaningtiar, D. A., A. Irfandi, V. Azteria, E. Veronika, dan M. Nitami. (2021). Tantangan Limbah (Sampah) Infeksius Covid-19 Rumah Tangga dan Tempat-Tempat Umum.*Jurnal Abdimas*. 7 (2): 85–89.

Laelasari, E. (2021). Manajemen Pengelolaan Limbah Medis Rumah Tangga Era Pandemi Covid-19 di Indonesia.*Prosiding Penelitian Pendidikan dan Pengabdian*. 1(1): 447–458.

Maharani, A. F., I. Afriandi, dan T. Nurhayati. (2017). Pengetahuan dan Sikap Tenaga Kesehatan Terhadap Pengelolaan Limbah Medis Padat pada Salah Satu Rumah Sakit di Kota Bandung.*Jurnal Sistem Kesehatan*. 3 (2): 84–89.

Maimunawaro, M. (2021). Review Terhadap Penanganan Limbah Masker dalam Masa Awal Pandemi Covid-19.*Jurnal Agitasi*. 1 (1): 20–22.

Maulana, A., C. J. J. Waha, dan D. R. Pinasang. (2020). Penegakan Hukum Lingkungan Pidana Terhadap Perusahaan yang Melakukan Dumping Limbah Bahan Berbahaya dan Beracun (Limbah bahan berbahaya dan beracun).*Lex Administratum*. 8 (5): 25–33.

Nugraha, C. (2020). Tinjauan Kebijakan Pengelolaan Limbah Medis Infeksius Penanganan Corona Virus Disease 2019 (Covid-19).*Jurnal Untuk Masyarakat Sehat*. 4 (2): 216–229.

Prasetiawan, T. (2020). Permasalahan Limbah Medis Cobid-19 di Indonesia.*Kajian Singkat Terhadap Isu Aktual dan Strategis*. 12 (9): 13–18.

Purwanti, A. A. (2018). Pengelolaan Limbah Padat Bahan Berbahaya dan Beracun (bahan berbahaya dan beracun) Rumah Sakit di RSUD Dr. Soetomo Surabaya.*Jurnal Kesehatan Lingkungan*. 10 (3): 291–298.

Siddik, S. S., dan E. Wardhani. (2020). Pengelolaan Limbah bahan berbahaya dan beracun Di Rumah Sakit X Kota Batam.*Serambi Engineering*. 5 (1): 760–767.

Yolarita, E. dan D. W. Kusuma. (2020). Pengelolaan Limbah Medis Rumah Sakit di Sumatera Barat Pada Masa Pandemi Covid-19. *Jurnal Ekologi Kesehatan*. 19 (3): 148–160.