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Face Mask Waste Management as Risk Waste: Prevention of Covid-19 Virus Transmission in Kota Kinabalu, Sabah

Abdul Hair Beddu Asis[1], Mohammad Tahir Mapa[2], Abang Mohd. Razif Abang Muis[3], Syamsul Azizul Marinsah[4] & Habibah @Artini Ramlie[5]

Pusat Penataran Ilmu Dan Bahasa Universiti Malaysia Sabah
Email: [1]khairasis@ums.edu.my
Fakulti Sains Sosial dan KemanusiaanUniversiti Malaysia Sabah
Email: [2]herma@ums.edu.my
Pusat Penataran Ilmu Dan Bahasa Universiti Malaysia Sabah
Email: [3]amrazif@ums.edu.my
Pusat Penataran Ilmu Dan Bahasa Universiti Malaysia Sabah
Email: [4]syamsulazizul@ums.edu.my
Pusat Penataran Ilmu Dan Bahasa Universiti Malaysia Sabah
Email: [5]habibah_artini@ums.edu.my

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Abstract

The issues of the Corona virus outbreak or Covid-19 has changed the landscape of human life in a more cautious way including the use of face masks when working outside the home. The first step in preventing the Covid-19 virus from the public is to wear a face mask and regularly wash hands and maintain hygiene. As a result, the demand for face masks in the market is increasing and the government has increased the production of face masks through production of local factories and imports from abroad. This indicates that the public is aware of the high prevalence of covid-19 and that the use of face masks is high. However, a new problem is the method of disposing of face masks not being properly managed. So far. The face masks are not categorized as hazardous or clinical waste. People throw the face masks as normal waste. Although face masks are not categorized as hazardous wastes, they do need to be taken seriously as the Covid-19 outbreak is extremely rapid and can spread through the face masked. Therefore, this study will identify the potential for transmission of the covid-19 virus through the face masks and integrated face masks waste management methods by local authorities and the community as a hazardous waste. This study uses content analysis methods based on past research facts and general monitoring to get answers to the objectives

to be achieved. The results show that face masks are highly potential agents of transmission of Covid-19 virus if not managed properly. This study has also classified residual face masks as risky wastes. Therefore, this study introduces the appropriate face mask waste management method to prevent infection from waste operators. This study is very important to prevent the existence of new clusters as a result of neglected management of face masks.
Keywords: Face mask Management, Solid Waste Management, Covid19 Virus, Sustainable Development, Risk Waste And Contagious Disease.

INTRODUCTION

The outbreak of the Corona Virus or COVID19 has changed the pattern of human activity both physically and mentally. Concerns over the spread of the epidemic are growing when WHO announcement Covid 19 as a pandemic. During this period, concern over personal health control is increasing among the community such as wearing face masks while doing activities in public places. This is was in accordance with the order from the Malaysian government to use face masks when exposed to the public (Portal Rasmi Kementerian Kesihatan Malaysia, 2023). This situation has led to an increase in the demand for face masks and the government has to import from abroad as well as increase production at the local level (Berita Harian, 2020). Most face masks on the market are of the disposable type. It is estimated that Malaysians need 400,000 pieces of face masks every day (Asis et al., 2021). According to the Ministry of Health Malaysia, face mask waste is not categorized as hazardous waste. However, the government needs to review this categorization as the potential transmission of the COVID-19 epidemic is high if the waste is not managed properly.

LITERATURE REVIEW

Covid-19 Virus Issues

At the end of 2019, the world was shaken by the existence of the Corona Novel virus (SARS-CoV-2) in China by recording a total of 45171 cases on 12 February 2020 (WHO, 2020). This number is the third highest in the last two decades. The virus spreads so rapidly that it is declared a pandemic by the WHO (Yu et al., 2020). Various measures have been recommended by the WHO to break the Covid-19 chain. These practices are personal hygiene, social distance and wearing face masks while in public places (WHO, 2020).

Importance of Using Face Mask

Facial masks are believed to prevent the transmission of the Covid-19 virus (Feng et. al., 2020). Generally, all countries have recommended the use of mouth and nose masks while in public. China, Japan, Taiwan and South Korea have mandated the use of face masks as early as the existence of this Covid-19 virus (Feng et., al., 2020). The death of many health workers during the outbreak was due to a lack of safety equipment (PPE) including face masks. The increasing demand for the use of face masks is evidenced by the increase in its use from 74.5% to 97.5% among the people in Hong Kong (Cowing et., al., 2020). Mexico City recorded an increase in the use of face masks during the outbreak of influenza in 2009 (Condon et., al., 2010). This shows that the increase in the use of face masks is due to the public awareness of the dangers of epidemics and better health care. Studies by Travica (2020) prove that wearing a face mask can break the virus chain from spreading. The law of compliance with the use of face masks in public places such as when using public transport, supermarkets and when outdoors, has been practised in some countries and as a result has reduced the statistical rate of epidemic infections such as in Hong Kong (Wang et., al., 2020). Wearing a face mask can not only break

the chain of Covid-19 virus but also various outbreaks such as tuberculosis (tuberculosis), colds and all kinds of respiratory-related diseases (Dharmadhikari et., al., 2012).

Solid Waste Management Concept

The concept of solid waste management involves five main elements, namely waste generation (waste resources) from residential areas, industrial areas and individuals. Secondly, waste storage by the provision of rubbish bins in public areas and residential areas. Third, the waste will then be transported by local authorities or the private sector. The fourth element is that waste will be sent for the waste separation process through the MRF system. The last element is disposal i.e. waste will be disposed of at the landfill (Zulkepeli Laili, 2014).

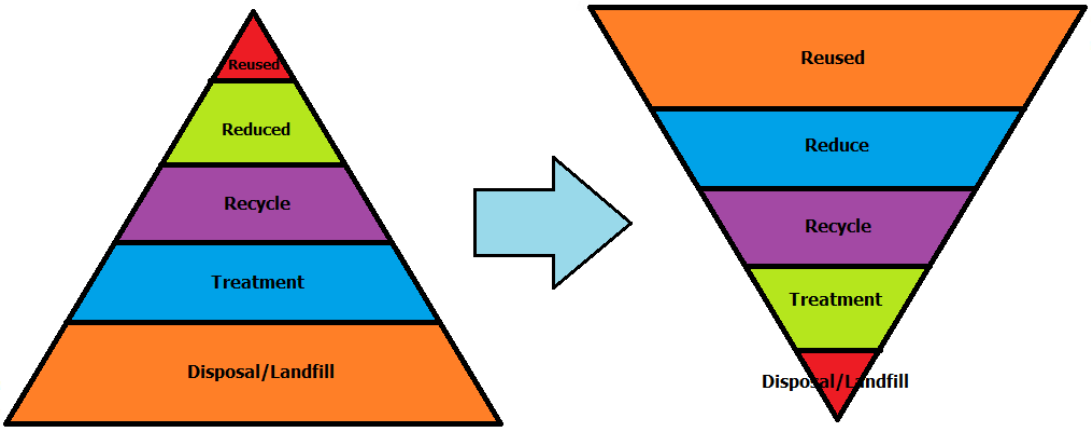

Figure 1 : Solid Waste Management Hierarchy in Malaysia

Sumber : (Abdul Hair Beddu Asis et al., 2021*) Basic Information on the Management and Operation of Solid Waste & Public Cleansing Malaysia.*

Hazardous Waste Management and Clinic Waste

Hazardous Waste Management and clinical waste are subject to Scheduled Waste in the Environmental Act 1974 (Jabatan Alam Sekitar, 2020). Hazardous waste is defined as waste that contains flammable, corrosive, toxic and easily reacts with other substances. The method of disposing of hazardous waste is different from general waste. It involves the construction of combustion plants, wastewater treatment plants, safe landfill facilities and off-site storage (Jabatan Alam Sekitar, 2020). Different handling methods are performed to prevent leakage especially in the process of packaging, transportation and storage. Meanwhile, clinical waste is waste that contains human tissues and chemicals from health centers and is used entirely in hospitals and clinics (Kementerian Kesihatan Malaysia, 2016).

Face Mask Waste Management

Studies on facial waste management and health are still lacking as this waste is still categorized as non-hazardous waste and handled with other solid waste. Due to the Covid-19 pandemic transmission situation, studies on proper face mask waste disposal methods need to be conducted.

It is estimated that the number of face masks required by the Malaysian population during the period of a pandemic is 400,000 pieces per day (BERNAMA, 2020). It is said, that the use of face masks is effective during dusty, hazy and most recent conditions during virus transmission (Kementerian Kesihatan Malaysia, 2016). In general, face mask waste is close to

clinical waste, but it has not been determined whether face waste can be categorized as clinical waste.

Virus Transmission Through Residual Face Mask

Disposing of face mask waste just like ordinary waste can cause the spread of disease to the community, especially to the waste operator. Many of them can be exposed to viruses and bacteria these days. Most likely the spread occurs during the process of unloading waste to the truck (Awani, 2023). Operators without personal protective equipment (PPE) will leave them vulnerable to the infection and may become agents of the epidemic. According to a report from the Engineering Services Division, Ministry of Health Malaysia (2016), the spread of infectious diseases is due to negligence in managing clinical waste. Therefore, a study on face mask waste is necessary to determine a systematic approach and further avoid the spread of the epidemic.

AREAS OF STUDY

The study area is located in Kota Kinabalu district which is the capital of Sabah, Malaysia. The study area covers the entire administrative area of Kota Kinabalu City Hall (DBKK) which is 351km2 consisting of Sepanggar, Manggatal, Inanam, Likas and downtown areas. The total population of this area is 452058 people (Department of Statistics Malaysia, 2010).

The waste production rate in DBKK region is 58% or 75778.9 tons per year with 18119 garbage truck trips recorded. Meanwhile, the second highest amount of garbage is from public areas which is 26991.26 tons or 21% with a total trip of 14710 times. These public areas include industrial areas and other commercial areas located in each local authority. Local authorities do not conduct collection in industrial areas therefore the industry is instructed to send their waste materials to landfills (Hair, 2016).

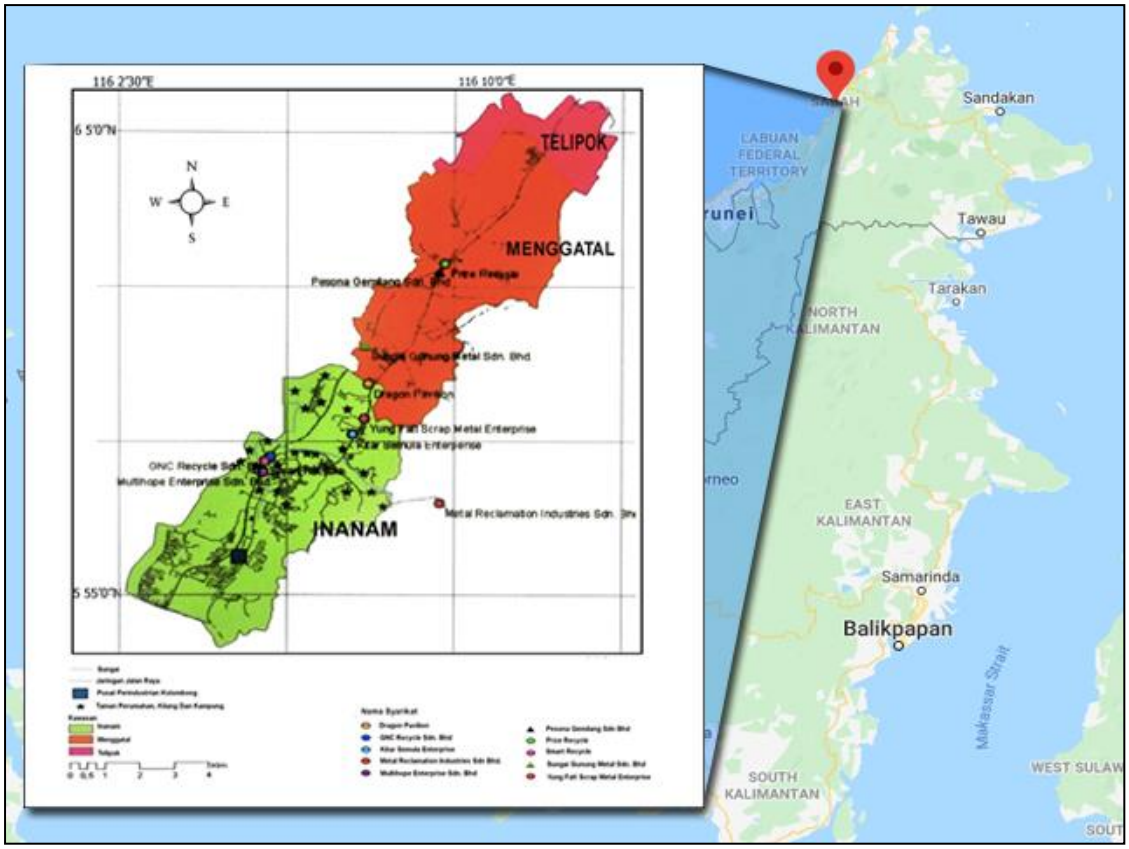

Figure 2 : Location of Study Area Kota Kinabalu City Hall (DBKK)
Source: Modified from google earth, 2020.

METHODOLOGY

This study uses a qualitative and quantitative approach to answer the research problems. This is done through the description of the relationship between the variables and further answering the first and second objectives. The collection of descriptive data is through the review of previous studies to support the findings of this study. A qualitative approach is also used to explain the empirical facts so it can be linked into the socio-cultural contexts that are interrelated with each other. Besides, direct observation of stakeholders involved with the management and use of face mask waste is done using checklist instruments.

Data Collection Methods Used;

i) Content analysis methods:
Past studies are used to support the findings of this study. The information required is the method of collection, collection and disposal of waste of mouth and nose masks practised by the authorities. Other information examined was the practice of safety features by waste operators, the properties and means of distribution of Covid-19 and the potential of face mask residue as a virus-spreading agent.
ii). Observation Method (Questionare):
Observation is done in the supermarket area during an outbreak. A total of 200 respondents were observed by set of questionnaires.

Population and Sampling Techniques

A total of 436,100 people lives in Kota Kinabalu (Department of Statistics 2010). The study population is the residents who live in the administrative area of DBKK (Kota Kinabalu City Hall) in high, medium and low-cost housing areas. The samples for this study were those who had used face masks. Purposive sampling technique was used for sample selection. According to Palys (2008), a purposive sampling technique is used when the researcher can expect that the person selected as the respondent is able to answer the research goals. This type of sampling allows researchers to select specific informants to facilitate the development of a formulated theory (Richards, 2007).

Table 1: Number of respondents

No	Areas	Respondent
1.	Bataras King Fisher	50
2.	Bataras 1 Borneo	50
3.	Survey Likas	50
4.	CKS Sulaman	50
Total		**200**

Qualitative data were taken by using supermarket visitors as a sample with a total of 200 respondents. According to Fraenkel (2006), "purposive sampling" is suitable for qualitative studies. Meanwhile, according to Creswell (2013), sample selection using purposive sampling

which is also known as "maximal variation sampling" is to enable researchers to obtain more and meaningful data.

This study uses qualitative descriptive analysis by identifying information from previous studies as a comparison and support to the results of this study. In addition, this study uses frequency analysis to identify the amount and response of doing the reaction that has been stated in this study.

RESULT

Potential of Face Mask Removal as a Covid-19 Virus Spreading Agent

Facial masks have been shown to reduce the transmission of Covid-19 viruses that are spread through fluid droplets during the process of breathing, sneezing or during a conversation. It is estimated that the minimum size of a liquid droplet produced by the process is about 5µm to 10 µm (Greenhalgh et al., 2021: Morawska & Cao, 2020). The size of the liquid varies according to the situation. The maximum number of fluid droplets is during speaking (Guo et.al., 2021). The infected patient may not have symptoms such as high temperature, cough or fatigue, but the virus is already present in the patient's body. For such patients, the virus will still spread through the droplets of water especially during conversation. Therefore, using a face mask is very practical in preventing the spread of Covid-19 virus.

The simplest safety measure that can be taken is through the use of face masks while in public areas and during activities in certain areas. Patients who use face masks can transfer liquid droplets containing Covid-19 virus to face masks. Therefore, the surface of the face mask will be home to many Covid 19 viruses. The World Health Organization (WHO) states that the virus can survive on paper surfaces for 5 to 9 days. Kampf et al., (2020) stated that the Covid-19 virus can survive on dead surfaces such as metals, glass and plastics for 9 days. Besides, the duration of virus detection also varies. As for the surface of the tissue, the virus can be detected after 3 hours of the incubation period, while the surface of wood and cloth can only be detected after day 2. The virus is very stable on a smooth surface that is a virus can only be detected on day 4 (for example on paper and glass surfaces). Meanwhile, on stainless steel and plastic surfaces, the virus can only be detected after the incubation period of day 7. Similarly, the virus on the face mask used during the operation process can also be detected after day 7 (Alex et. al, 2020).

Alex et al, (2020), also found that the virus can survive on the surface of the surgical mask until day 7. Therefore, the surgical mask residue should be disposed of properly to prevent the spread of the virus during the disposal process. This situation is also similar to the use of face masks by the public during pandemics. The only difference between the two is the disposal practice. Surgical masks are disposed of by clinical waste methods, while face masks used by the public are still handled by conventional disposal methods.

The type of material used for face masks needs to be identified to know the lifespan of the virus on the surface. The face masks that are widely used at this time consist of various designs and materials. Its main function is to filter out harmful particles from entering the mouth or nose and also to filter the fluid coming out of the user's mouth (Asadi et al., 2019). In the context of health, some standards have been outlined to maximize the function of the face mask. Facial masks made of the fabric have a filtration rate of 49% to 86% for particles of 0.02 µm. While the face mask used during the surgical process has the ability to filter 89% of particles (Davies et al., 2013). Currently, most people use surgical face masks made from mixed paper and fibre and used as disposable masks (Leung et al., 2020).

Table 2: Total Waste of Removed Mask

No.	Areas	Total Respondent	Using Face mask (%)	Without Face mask (%)
1.	Bataras King Fisher	50	90	10
2.	Bataras 1 Borneo	50	88	12
3.	Survey Likas	50	92	8
4.	CKS Sulaman	50	90	10
Total		**200**	**90%**	**10%**

Based on surveys conducted in several supermarkets such as Bataras King Fisher, Bataras 1 Borneo, Survey Likas and CKS Sulaman in Kota Kinabalu during MCO 2 and MCO 3 (Movement Control Order) found that 90% of the 200 people who entered the supermarket wore face masks. 90% of them use disposable face masks that are able to filter out particles measuring 3.1 µm and 10% use reusable face masks (made of fabric). 100% of disposable mask users throw their masks upon exit from the supermarket or before getting into the car.

Table 3: Waste Management Methods for Used Masks

No	Areas	Total Respondent	Throw in the Bin (%)	Do not Throw in the Bin (%)
1.	Bataras King Fisher	50	100	0
2.	Bataras 1 Borneo	50	99	1
3.	Survey Likas	50	100	0
4.	CKS Sulaman	50	100	0
Total		**200**	**99%**	**1%**

The most common way to dispose of is to throw them in the trash cans provided outside the premises. But some respondent observed also throw everywhere in the car park area (1%). On average, the daily use of face masks by Malaysians is around 400,000 pieces. This also shows that the total amount of face mask waste disposed of is 400000 pieces per day. If the waste is discarded indiscriminately it will expose the virus found on the mask to the waste operator during the collection process. The garbage transport process is done 7 times every week, starting from 10 pm to 6 am. While the housing area is 3 times a week from 7 pm to 3 am (Laman Rasmi Dewan Bandaraya Kota Kinabalu, 2020). Examining the waste collection schedule and virus lifespan on most mask surfaces, there is a high (significant) possibility of viral infection to the waste operator.

The Face Mask Waste As A Risky Residue

Generally, face mask waste management is still included in ordinary solid waste management and is categorized as non-hazardous waste. Waste face masks are still categorized as general waste that can be disposed of in regular bins. Therefore, the method of collection, transportation and disposal of face mask waste is the same as ordinary waste which is sent to the landfill area located in Kayu Madang, Kota Kinabalu.

Face mask waste is not classified as hazardous waste because its original nature is harmless unless it contains a virus. Hazardous waste disposal methods need to go through different packaging, transportation and storage/disposal methods. Hazardous waste disposal areas do not mix with ordinary waste. This type of waste is disposed of by combustion, wastewater

treatment, safe landfill and off-site storage. In Malaysia, hazardous waste disposal areas have been gazette at the Kualiti Alam Center, Bukit Nanas Negeri Sembilan (Laman Web Rasmi Jabatan Pengurusan Sisa Pepejal Negara, 2020). Based on the characteristics of hazardous waste, face mask waste is not categorized as hazardous waste due to the nature of this waste is non-toxic, non-corrosive and not easily react with other materials.

Waste face masks are also not categorized as clinical waste because the waste is not produced from clinics except face masks for surgical purposes. In Malaysia, clinical waste management needs to go through the process of transportation, storage, disposal at the clinic waste disposal plant by a licensed company appointed by the Department of Environment (DOE). All these processes are regulated under the Environment Act 1974, Environmental Regulations (Scheduled Waste) 2005, Occupational Safety and Health Act 1994, Infectious Disease Prevention and Control Act (MOH) and PSH / PSK Contract Documents (TRPI, MAP) (Engineering Services Division Ministry of Health Malaysia, 2016). Based on the characteristics of clinical waste, face mask waste can not be categorized as clinical waste because it does not come from the clinic and does not contain human tissue or chemicals.

Therefore, face mask waste should be placed in its category, such as risky waste. Risk is defined as the possibility of danger or loss (Dictionary of the Board of the year 1994). According to Martin (20019), the risk is a possibility of loss, accident, weakness and collapse. Thus, risky waste management can be defined as a comprehensive and proactive management of solid waste that is potentially hazardous and could cause harm to humans. This category is suitable for face mask waste because it has properties that can be dangerous and detrimental.

Face Mask Waste Management Concept

The face mask waste management method proposed in this study is as shown in figure 3. The management process starts from generation followed by treatment or packaging process. This stage is an additional process to ordinary solid waste management. The next process is storage using regular bins and the last stage is to transport the waste to the landfill.

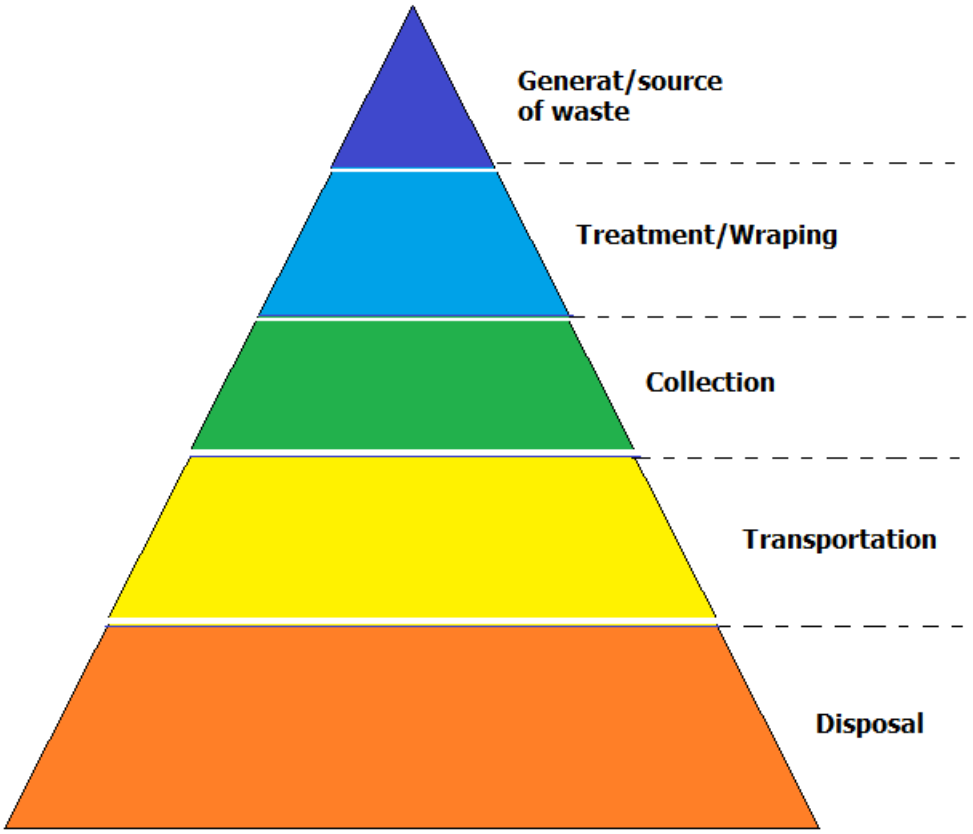

Figure 3: Risk Waste Management Flow Chart

In general, face mask waste needs to be managed with a specific method that is different from managing general, dangerous or clinical wastes. This study found that face mask waste can go through normal waste management flow (refer Figure 3). However, face mask waste should be placed in plastic and tied tightly before being thrown into the general waste bin. This is to prevent the spread of viruses that may be present on face mask waste through wind or contact with waste operators. The use of plastic bag is in line with the by-laws adopted by KKCH known as the Waste Collection and Disposal By-Laws, local government act 1976 part II, prohibition on waste disposal. This by-law states that all household waste must be placed in a plastic bag and sealed before being placed in the waste bin.

CONCLUSION

The categorization of face mask waste as risky waste is very much in line with the solid waste management system in our country. Emphasis on the “new norms” of post-MCO lifestyle makes a face mask become a frontline in performing daily activities. The risk of the virus on the surface of the face mask is high. The spread of the virus through contact is also high if the waste is not managed properly. Therefore, the introduction of face mask waste management method is aligned with the Covid-19 virus transmission control, especially to waste operators who might create a new cluster. Therefore, cooperation between government and community in this issue need to be strengthened to break the Covid-19 virus chain in Malaysia.

The introduction of alternative methods in the management of face mask waste in the findings of this study provides a contribution in a new perspective of the concept of solid waste management. The findings of this study found that the hierarchical level of the concept

of solid waste management needs to be added with one more level, which is treatment/wrapping (refer to figure 3). Increasing the level of treatment/wrapping is important in the management of face mask waste as the risk that the public will face is high when touching face mask waste that contains viruses and is not treated before disposal. The method introduced in this study can be used as a guide to other face mask waste management if there is a risk of bacteria or viruses sticking to the surface of the face mask. This method is also not only focused on face masks to prevent the Covid-19 virus, but to prevent various viruses or bacteria that will appear.

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