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PANDEMIC OUTBREAK OF COVID-19 ON SOLID WASTE OVER THE ENVIRONMENT

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Abstract:

The COVID-19 epidemic disrupted the municipalities' essential municipal service, which included the municipal solid waste (MSW) management. This research has examined the literature about MSW and the solid medical waste (SMW) management strategies, waste management programs specifically designed for this particular pandemic and the impacts they have on both now and into the future. Separation of waste and the segregation of the waste stream play crucial functions in reducing the health, environmental, and social effects of waste and the management of it. The potential for global warming associated with MSW and SMW were discovered to vary from -0.64 to 525 kg CO2 equivalent per tonne or -52.1 up to 3720 kg CO2 equivalent per tonne respectively, and they depend upon the disposal and sterilization process. In the same way, MSW and SMW disposal costs ranged between 90 and $242/tonne, or 12 to $1530.0/tonne in the case of SMW, and MSW, respectively. Many changes to the management and collection of waste due to the COVID-19 epidemic affected recycling and waste segregation. Since the onset of the disease, several sectors, such as the industries of food and waste and healthcare sectors, have relied on the use of more single-use plastics to stop the spread of COVID-19. An environmentally friendly alternative (biodegradable/compostable) to widely used single-use plastics is desired for easing waste management problems. There are a myriad of initiatives underway to control the increasing amount of MSW and SMW, as well as preventing the spread of disease-causing organisms, the movable incineration technology using grates and an effective disinfection procedure is the possibility of a solution to the COVID-19-related

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waste issues. A proper disinfection process and the right technology can reduce the chance of spreading infectious diseases and improve the sustainability of the waste management system particularly the waste that is contaminated.

1 INTRODUCTION:

Municipalities provide services for managing waste for their residents in order to satisfy one of their most basic demands - timely and safe disposal of garbage. These essential services are usually disrupted by outbreaks of disease such as the coronavirus novel (COVID-19) which could cause the incorrect treatment and storage of garbage. The accumulation of wastes frequently filled with organic matter, biological fluids, and microorganisms can cause health issues or even the collapse of whole city waste disposal systems1 and consequently create frustration and anxiety. Waste that is not properly managed can have negative environmental, social, and health-related consequences, such as the risk spread of infectious disease especially during epidemics such as COVID19. A proper handling of municipal solid trash (MSW) along with the solid medical waste (SMW) is essential to limiting disease transmission. illnesses. 1. SMW is usually disinfected and is then treated as MSW general by municipal authorities. For instance the disinfected SMW is managed in conjunction with MSW is typically disposed of in Canada however, management of the waste differs by region. The severity of the potential risk of transmission due to inefficient handling of waste will depend on the type of the waste and the vulnerability local to. In the year the year 2020 COVID-19 caused disruption and a challenge to municipal waste management processes, that were frequently operating in an unsustainable manner, but with no capacity to manage the increased volume of waste, and also other challenges caused by the pandemic. COVID-19 devastated virtually every area of human activity, including the economy, education food, healthcare, and systems, with corresponding effects to MSW managing systems. For instance in Europe 80 percent of businesses that were in the apparel and textile sector were cutting their employees because sales had decreased by 50% due to the disease.

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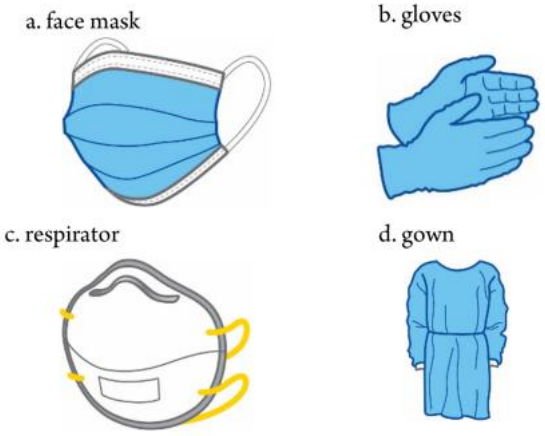
The spread of COVID-19 in March 2020 brought numerous unanticipated pressures on the municipal management of waste. In the majority of jurisdictions, waste management services continued to be offered despite the various lockdown and curfew measures in place to stop the spread from the infection. Waste management workers who worked through the epidemic had a higher risk to become infected with the virus due to frequent contact with colleagues or exposure to contaminated materials. 4. At the same that municipal services were experiencing an increase in absences which was straining their workforce and impacting their ability to operate. In addition, as more individuals changed their lives in order to be at home working, the typical garbage trends and quantities were also changing, which required changes to the program's delivery. Municipal waste management programs were also faced with an increase in the use of PPE (personal protective equipment) (PPE) (Figure 1.) which is typically composed of single-use plastics like gloves and masks and single-use plastics that are recyclable and used to protect food items from contamination and other products for consumers. Every month, around the world there are 129-210 billion disposable masks as well as 65-billion disposable gloves get being used.

Additionally, the volume of waste has increased within the healthcare industry in the course of the COVID19 epidemic. Unskillful management of medical waste results in negative effects on society. With the awareness of the dangers and difficulties that arise from waste management during an outbreak across the world, experts have advised governments to take the proper protection of waste collectors, and make changes in recycling programmes [6] and designing the safe handling of higher amounts of medical waste in order to protect the public and prevent the spread of infectious diseases.



ISSN: 2057-5688

A 70% rise in the production of waste is expected in 2050 (3.4 billion tonnes) from 2016's level (2.01 billion tons) across the globe due to population growth and urbanization. Seven. The production level (36.1 tonnes per year for each person) is believed to be the

Fig 1 : Commonly used PPE.

most high in Canada and generated 1.33 billion tonnes of waste in the year 2017. Residual pathogens that are present in medical waste create a disposal of waste a challenge as the waste needs to be cleansed prior to disposal. Diverse strategies and methods of management are being employed to control the increasing amount of waste produced during this epidemic, however technological advancements regarding MSW as well as SMW administration and their economic, environmental and social effects remain to be fully synthesized. This research examines strategies for managing waste that are currently being implemented in the COVID-19 pandemic to examine their development and their economic, environmental, and impact on society.[8].

II. METHODS

Different scientific search engine (ScienceDirect, Google Scholar, SpringerLink, Mendeley, Scopus platforms Worldwide science and more.) along with online sources of information (google news reports, articles, websites) were used to collect research papers on MSW as well as SMW management during the prepandemic as well as period of pandemic. MSW SMW, COVID-19 and healthcare disposal, management of waste technology such as contaminated waste management the lifecycle assessment of environmental impacts and the economic and social impact were utilized as key words.

III. COVID-19 OUTBREAK AND MSW MANAGEMENT

The COVID-19 epidemic has created the most difficult challenges when it comes to managing MSW as well as the increase of SMW and PPE that is single-use in the waste stream. Contact with surfaces that are contaminated is a typical method of transmission of infectious diseases and plays a significant part in the spread of infectious diseases.38 In turn, standard methods of managing waste have been

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enhanced because of the epidemic to minimize interactions between the personnel on the site and the general public, thereby reducing the chance of spreading infectious diseases. But a new study has concluded that fomite plays a tiny role in the transmission of COVID-19 and there is an over-emphasis placed on disinfecting surfaces and cleaning packaging.

The increased use of MSW is due to a variety of factors and impacts from the pandemic COVID-19. The enforcing of lockdown procedures that prohibit dining in person has resulted in an increase in the utilization of disposable plastics to packaging takeout food as well as food delivery to homes. The annual increase of PPE usage and the resulting waste is estimated at 20 percent (relative to the pandemic timeframe, i.e., 2020) even during the post-pandemic period, and could continue until 2025. It is thought that PPE production must increase by 40% worldwide in order to meet the growing demand. Thus, healthcare waste is likely to increase until the pandemic has ended or even during the post-pandemic period as the global population adjusts to the new normal.

Table 1. Waste Disinfection / Management Technologies Being Used to Disinfect SMW during the COVID-19 Pandemic

treatment	ref
high-pressure steam sterilization (121 °C, 110 min)	25
high-temperature pyrolysis (540−830 °C)	53
high-temperature incineration (800−1200 °C)	53,54
incineration (>1100 °C)	48
double-chamber incineration (primary chamber 750−980 °C temperature, while the secondary chamber is designed to operate at a temperature of at least 1100 °C	55
chemical disinfection:	
sodium hypochlorite (NaOCl), chlorine dioxide (ClO_2), ultraviolet irradiation, ozone are used for liquid waste	54
H_2O_2 (>0.5%); ethanol (>75%), isopropyl alcohol (>70%), formaldehyde (>0.7%), povidone iodine (>0.23%), sodium hypochlorite (>0.21%), irradiation for 60 min	56
microwave technology (177−540 °C)	48
deep burial (1−2 m, topsoil cover 1 and 2 m above the groundwater level)	47

Table 2. Estimated Healthcare Waste Generation Rate before and during COVID-19 in Selected Municipalities/ Province (Healthcare Waste Includes Both SMW and Liquid Waste Streams)

	waste generation rate, tons/day			
municipality/ city	before COVID-19	during COVID-19	increase (%)	ref
Bangkok	27	160	493	57
Ha Noi	26	154	492	57
Jakarta	35	212	506	57
Wuhan	40	240	600	42,44

Diverse strategies are being used to control the rise in COVID-19-related medical care and MSW. Within the European Union (EU), hazardous waste (face masks gloves, face masks, and

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tissues) must be double-bagged.11 China has directed hospitals to utilize double-layered medical waste bags that must be identified as COVID-19 waste. Additionally, the bag's surface must be cleaned with alcohol. China has also advised handling of COVID19 waste by those who have special training in handling the waste that is contaminated. In Germany takeout food containers were classified as hazardous waste in COVID-19. They were thought of as recyclable waste.

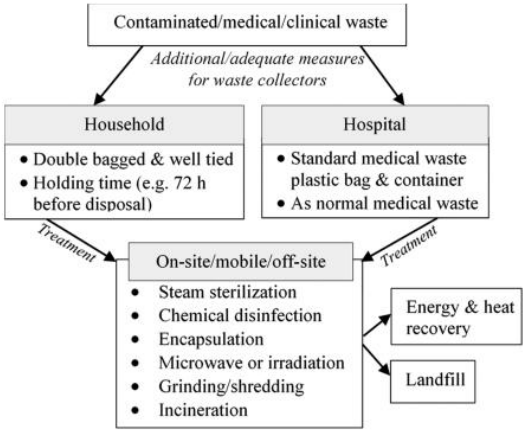

Fig 2: Contaminated waste handling approaches during COVID19.

IV ENVIRONMENTAL AND ECONOMIC IMPACTS OF SOLID WASTE MANAGEMENT SYSTEMS

The increasing use of single-use plastics during the outbreak is a negative impact on MSW management, and causes unintentional environmental problems. For example, usage of energy dramatically increased when managing medical waste (healthcare hospital waste as well as personal care at home) and, consequently, the footprint on the environment. The CO2 content within the exhaust gas resulting from the incineration process varied between 7.1 to 9.8 percent. Limits for emission (CO SO2) is determined to be the most high for Vietnam and followed by US along with China. However, HCl and NOx emission limits were the highest in Japan. However, the actual emissions exceeded the stipulated limits. This may be due to the technology chosen. In the case of widespread burning of SMW or MSW in a highly populous area could be a problem due to emissions of pollutant gasses.

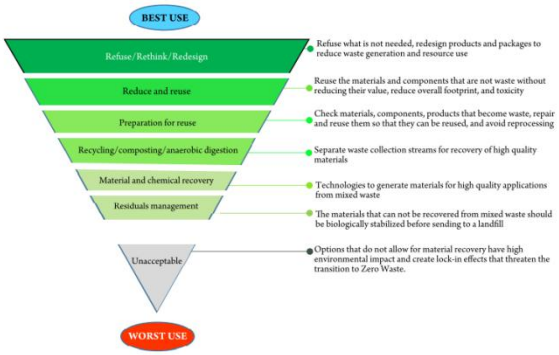

Fig 3: Hierarchy of waste management

The WHO has three categories of technologies for managing contaminated waste according to their preferences. For

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instance burning open or in a pits is considered to be the least preferred, while autoclaving single chamber and double chamber incinerators operate intermittently and double chamber incineration, as well as low-heat chemical processes are the most preferred methods. Separation and segregation of waste streams based on their specific characteristics has been discovered to be the primary factor to reducing the environmental impact on the system for managing waste. For instance, anaerobic digestion of waste from food production, the recycling of the recyclable part from MSW instead of incineration and also waste reduction are considered to be beneficial for the environment.

V DISCUSSION

The epidemics of the pandemic have a profound influence on the production of MSW and SMW and their management. While waste collection plays an important role to play in recycling and recycling, the disruptions to management and collection of waste have led to numerous challenges within waste management systems such as recycling, resulting being a part of the circular economy. Many collectors are facing health problems likely caused by infections due to the presence of used hand and face masks and other medical wastes in the waste stream that is collected.

Inadequate management of waste during the postpandemic and pandemic periods can exacerbate waste management and increase the transmission of infectious diseases. Technological advances (design, decentralization, automation, etc.) and investments made by private and public institutions could improve waste collection without interruption and management. While the process of mobile incineration could be an solution for the efficient management and disposal of hazardous wastes, this can increase the risk of air pollution in an urban areasince the healthcare facilities are generally located in urban or populated areas that require to be considered carefully.

Solid waste management information plays crucial roles in planning for waste management and policy formulation, particularly in the context of the rising population as well as urbanization.4 A

ISSN: 2057-5688

database of disposal of waste and the management of it during pandemic and prepandemic times can be helpful in predicting the amount of waste generated and preparing for a successful waste management strategy for any upcoming pandemic. Additionally, any effort to ease regulations and rules regarding the management of contaminated waste has to be taken with care and analysis.

It has also been observed that the different measures taken to stop COVID-19's spread have been proven as beneficial to the environment, yet have negative effects for the economic. For instance the case of New York, air pollution fell to 50% as in comparison to the previous year's levels but China saw an increase of 25% in emissions. Because of the diverse impact on the COVID-19 pandemic and predictions of the long-term effects of economic, behavioral and social changes as well as system dynamic and causal loop diagram models can aid in better understanding of the shifts in the production of waste. While a variety of waste management strategies have been put in place due to the outbreak however their economic, environmental and societal effects/viability have to be assessed. The plan to increase the efficiency of waste management through increasing the rate of recycling could be impacted by the outbreak as regions and countries have to alter their waste management strategies in order to limit the spread of the disease. Therefore, proper and appropriate disinfection with incineration could be an ideal waste management strategy in this outbreak to increase the sustainableness of the system.

VI SUMMARY AND RECOMMENDATION

Separation of non-contaminated and contaminated waste at its source, and then the subsequent use of recycling and other appropriate waste management techniques are suggested in order to minimize the environmental impacts on the environment of MSW and SMW in the case of a pandemic. This approach should continue even in the time of post-pandemic to minimize the negative environmental impact and health risk. Many efforts are being made to reduce the issues with waste management that are associated with the increased amount

ISSN: 2057-5688

of MSW and SMW that are being experienced by a variety of areas during the COVID-19 andemic. There are a myriad of programs in place to improve waste management system in the midst of the epidemic, novel techniques are needed to manage the infectious waste and making sure that the environmental impact is minimal, ensuring sustainability in waste management and creating a circular economic system. The advancement of technology is essential in order to minimize the waste management issues and the participation of all stakeholders in the various sectors in the management of waste system will be crucial in the development of sustainable policies for managing waste. This will assure that the waste management systems can withstand the threat of future emergencies. Also, careful thought should be given to the choice of technology based on types of waste, the locations and acceptance by the public.

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