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O 22. IMPACT OF SOLID WASTE MANAGEMENT SYSTEM DURING THE COVID-19 PANDEMIC PERIOD

Zoran Sapuric[1*], Sukru Dursun[2], Hysen Mankolli[3]

[1]*University American College, Skopje, N.Macedonia*
[2]*Konya Technical University, Konya, Turkiye*
[3]*Independent Environment Researcher, Illinois, USA*

E-mail*: sazoran@hotmail.com, sdursun@ktun.edu.tr, hysenmankolli@yahoo.com;*

ABSTRACT: The new type of Coronavirus (COVID-19) has disease characteristics and first emerged as an epidemic in the Wuhan municipality of China in December 2019. It has reached Europe since the beginning of 2020. In response to this situation, in many European countries, various restriction measures have been implemented at the national level to limit temperature change and both waste production and waste transformation organization have been observed. Although the COVID-19 pandemic continues to affect Europe to this date, this report focuses on the first "wave" between February and June 2020. The information presented focuses on this period unless otherwise stated. Pandemic and related restrictions may be imposed, the municipality has brought different conditions regarding waste management. Local governments retain a lot of power to provide for cleaning staff costs and improvements to address staff shortages. The pandemic has made it difficult for local government to provide municipal waste services to residents. At first, as the pandemic progresses and quarantines are imposed in many countries, utilities and municipal waste operators are forced to continue adapting their waste management systems and new transfers. The key view for many local waste authorities has been to ensure staffing, particularly when collecting potentially generating waste. Collection of research papers and packaging scraps has continued throughout the quarantine period, and breakthroughs have been experienced when separate collection is offered. Participants in the surveys stated that their big earnings increase at the same frequency as always. The different causes of the disease that occur include personal deficiency, increased production of the household, etc. specify.

Keywords: COVID-19, Pandemic, Municipal Solid Waste, Solid Waste Management

1. INTRODUCTION

The emergence of the novel coronavirus (COVID-19) disease has attracted global attention since December 2019. It is a contagious virus that starts with respiratory symptoms. It has been tried to be protected with personal protective equipment and personal isolation rules. Coronavirus Cases: 500 Millions; Deaths: 6 Millions Worldwide. It was first seen in Wuhan province of China, 468.9 tons of medical waste are generated every day in association with COVID-19. In Indonesia (Jakarta) that the medical waste scale reached 13,000 tons apx 60 days after people were first infection. Currently, millions of contaminated face masks, gloves and materials for diagnosing, detecting and treating SARS-CoV-2 and other human pathogens are undergoing the irreversible process of becoming infectious waste. This, in turn, will cause environmental and health problems if they are stored, transported and handled improperly [3]. Moreover, due to the increased healthcare waste owing to the COVID-19 pandemic, the threat that unsafe disposal of medical waste will spill over into environmental pollution is palpable and immediate [11]. Consequently, one of the many problems that will inevitably occur is contagious waste, which, if not managed properly, may be the root cause of severe diseases and environmental problems. One of the effects of Covid-19 pandemic on medical waste was to increase the generation of this type of waste, which in the studied hospitals were found to be 0.95 to 3.51 kg/bed/day.

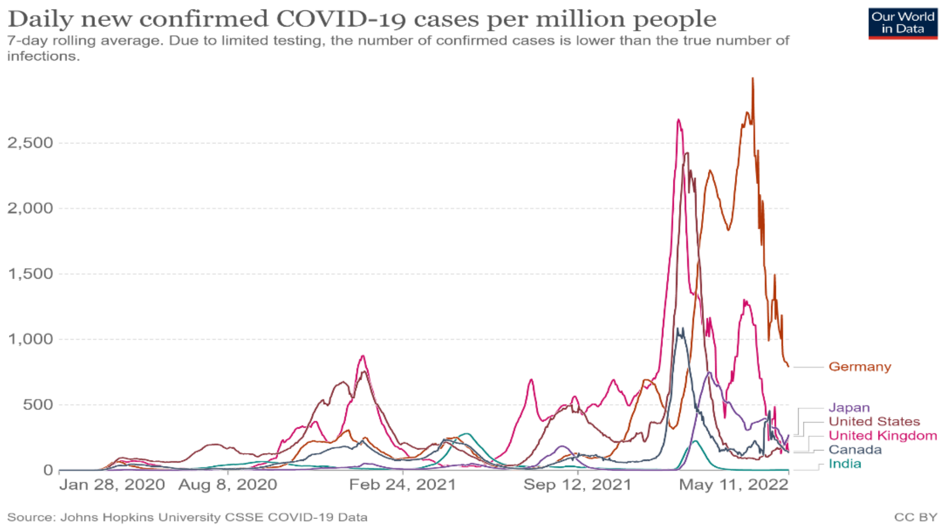

Figure 1. Aily new confirmed Coid-19 cases from Jan. 2020 to May 2022

Tens of thousands of tones of extra medical waste from the response to the COVID-19 pandemic has put tremendous strain on health care waste management systems around the world, threatening human and environmental health and exposing a dire need to improve waste management practices, according to a new WHO report. The WHO Global analysis of health care waste in the context of COVID-19: status, impacts and recommendations bases its estimates on the approximately 87,000 tones of personal protective equipment (PPE) that was procured between March 2020- November 2021 and shipped to support countries' urgent COVID-19 response needs through a joint UN emergency initiative. Most of this equipment is expected to have ended up as waste. Today, 30% of healthcare facilities (60% in the least developed countries) are not equipped to handle existing waste loads, let alone the additional COVID-19 load. Recommendations include using eco-friendly packaging and shipping, safe and reusable PPE (e.g., gloves and medical masks), recyclable or biodegradable materials; investment in non-burn waste treatment technologies, such as autoclaves; reverse logistics to support centralized treatment and investments in the recycling sector to ensure materials, like plastics, can have a second life.

As of April 22, 2022, 54,000 tons of CMW (COVID medical waste) per day has created an additional burden on the environment. Face mask, gloves, protective gear, goggles, disinfectant containers.

2. THERMOCHEMICAL TECHNOLOGIES

In general, personal protective equipment and medical waste are mainly made of plastic polymer, including PP, PE, PVC, PE's, PET and rubber latex. Therefore, there is a need for conversion technologies that can effectively purify such materials and provide adequate disinfection. Use of medical waste as an energy source: It is homogeneous. The amount is great. It has low humidity. Sterilization is required.

Incineration: High temperature incineration (combustion) is the most widely adopted technology to effectively dispose of various medical wastes and kill infectious pathogens. It raises relatively high environmental concerns due to high CO2 emissions and high additional fuel consumption to reach and be stable at a temperature of more than 800 °C. All these possible emissions from the combustion of medical wastes must be controlled with appropriate flue gas treatment. Almost half of the operating cost of the incinerator is used for air pollution treatment.

Thermochemical Technologies: Thermal degradation of PE (HDPE and low-density polyethylene (LDPE)) begins when the temperature approaches 430 °C and ends at 500 °C.PP basically has a similar decomposition temperature to PE but slightly lower, ranging from 420 to 480 °C. PS has the lowest decomposition temperature of 380-440 °C. PET begins to degrade when the temperature approaches 400 °C and stops at around 500 °C, producing CO, CO2 , methane and light hydrocarbons. PVC degrades in two continuous steps.

Carbonization: Carbonization results in the release of volatile matter producing homogeneous solid carbonized (charcoal-like, char) products. The solid product has higher energy density due to increased carbon content and decreased oxygen content, excellent grindability, hydrophobicity and stability (stable and long storage possibility). A smaller oxygen/carbon ratio is achieved due to the release of volatile matter, resulting in reduced auto-ignition during grinding. Carbonization is divided into 2 different processes as dry and wet carbonization.

Dry carbonization (Torrefaction): Dry roasting is called light pyrolysis and slow pyrolysis. It is a thermochemical process carried out in an almost inert atmosphere and the materials are slowly heated under ambient pressure and a temperature of 200–300 °C. 4Torrefaction requires raw materials with a low moisture content (such as less than 15% by weight). Therefore, general medical wastes, especially the wastes mentioned above, can be incinerated directly without the need for drying, as they are basically dry.

Wet Carbonization (Hydrothermal Carbonization): It is one of the hydrothermal treatments adopted to produce uniformly carbonized material at high temperature (typically ranging from 180 to 280 °C) and a saturated pressure of 2-10 MPa. It is suitable for material with relatively high moisture content, as the drying step can be skipped. Subcritical water accelerates the reaction by acting as a solvent and reagent during the reaction. The solid product of hydrothermal carbonization is often referred to as hydrochar.

Pyrolysis: It is the thermal degradation of long chain polymeric molecules into shorter and less complex molecules under an inert or oxygen-deprived atmosphere, in the presence or absence of catalysts. The pyrolysis products can be a mixture of solid, liquid and gas. It can produce high amount of liquid product in wide temperature range. According to their properties, the resulting products are not only suitable for use as fuel, but also can be used as chemical raw materials. It has low carbon emissions due to lower carbon monoxide (0.8–3.9 %) and carbon dioxide (1.0–9.1 vol.) formation compared to combustion. There are two types: thermal and catalytic pyrolysis.

Thermal Pyrolysis: Thermal pyrolysis is a pyrolysis that evaluates material using thermal energy without a catalyst. Since the process is endothermic, energy must be supplied to the process. Thermal pyrolysis is a complex process consisting of polymer chain breaking, crosslink formation, side chain elimination and side chain crystallization.

Catalytic Pyrolysis: It is basically similar to thermal pyrolysis in terms of process and conditions; The main difference is in the presence of the catalyst. The catalyst is used to increase the reaction rate by lowering the activation energy of the reaction. Therefore, by using the catalyst, a high reaction rate can be achieved at a lower temperature, ultimately reducing the energy requirement and operating cost of the process.

Gasification: Gasification is a process that heats materials at high temperature under a controlled atmosphere, converting carbon materials into a mixture of carbon monoxide, hydrogen, carbon dioxide, methane, and a longer chain of hydrocarbon gases. The catalyst can be used to lower energy and drive product yield. Gasification products can be used as a fuel or chemical feedstock (syngas), depending on their composition. It is classified in 2 ways as Air Gasification and Vapor Gasification.

Air Gasification: Air gasification is the process of gasification using air or a mixture between oxygen and inert gas (usually nitrogen) as the atmosphere. Steam *Gasification*: Vapor gasification involves steam in the gasification atmosphere, thus making it possible to produce hydrogen-rich gas. Due to this feature, the products of this process are more suitable to be used as chemical raw materials.

3. RESULTS

Masks, gloves and protective gowns, which are the main defense tools in the fight against coronavirus and protection, are turning into a growing waste problem worldwide. Uncollected waste, after being dragged by winds and rains, can enter the sewer and enter the water. To reduce the burden of wastes and environmental pollution, both industrial and municipal wastes should be recycled and reused. Moreover, hazardous, and infectious medical waste should be properly managed by municipal and hospitals. Therefore, proper strategies should be adopted to control environmental degradation **and wastes.** It has been observed that the number of COVID medical wastes from personal protective equipment used during the current COVID-19 outbreak is very large and these wastes are considered to have potential as an energy source. There are many options for safely converting COVID medical waste into a usable fuel or heat. Since this type of waste is contagious, a disinfection step should be added or integrated with the selected technology. In this study, several major thermochemical conversion technologies, particularly their suitability to dispose of COVID medical waste, are reviewed. These include combustion, carbonization/heating, pyrolysis and gasification. Among these thermochemical conversion technologies, incineration is thought to facilitate a wide variety of medical waste types followed by gasification and pyrolysis. The enormous volume, high caloric content and rapid conversion of COVID medical waste require urgent thermochemical methods.

4. CONCLUSION

Waste management is crucial in the prevention and control of Corona virus since it may travel in many ways and can survive in a variety of temperature ranges while also having a long life without a host. As a result, the waste created during the treatment of covid patients must be handled appropriately and quickly at the source. There would be fewer risks of transmission if the waste is handled on the spot. The ideal waste management approach should always be to minimize, reuse, and recycle, however, this is not relevant to biological hospital waste. Hazardous biological waste, such as COVID-19 waste, poses a significant risk to humans and requires specific disposal. Such waste is often handled by procedures such as chlorination, combustion, incineration, and so forth. However, all these processes emit hazardous chemicals into the environment and pose a risk to waste handlers. Modern waste technologies such as incineration, pyrolysis, and plasma waste technology may be utilized to entirely treat biological waste. This will not only help to recycle hazardous waste but also prevent the public from additional COVID-19 transmission. Inclusion of the informal sector can be considered a viable way for improving the recycling rate and reducing the waste inflow into final disposal sites in developing countries, due to low technological requirements and economic investments. However, further investigations and efforts should be implemented for understanding the most appropriate strategy for its involvement. In Latin America various pilot project were implemented by the organization of cooperatives including waste pickers that have provided good results. However, in some areas of Asia and Africa this practice is forbidden and represents an obstacle to a formal selective collection system. Therefore, specific patterns should be implemented for each context, exploiting the activities just in place introducing the CE principles, remembering that informal recycling cannot be the only system in action; improving waste collection and selective collection coverage of municipal areas, introducing awareness and information campaigns, implementing appropriate treatment systems with regulations and control agencies, improving final disposal sites and its management, enhancing financial sustainability of the systems and introducing future management plans are all practices required for improving the integrated SWM system of a country, region, municipality or rural area.

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