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Design and Fabrication of Safe Mask and Hand Gloves Disposal Machine

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Abstract: *The origin of the novel human coronavirus (SARS-CoV-2) and its potential for harm increased face mask and medical waste in the environment, thereby necessitating the urgent prevention and control of the pandemic. The article estimates the face mask and medical waste generation in Asia during the pandemic to convince the waste management and scientific communities to find ways to address the negative impact that the waste disposal has on the environment. Standardization, procedures, guidelines and strict implementation of medical waste management related to COVID-19, community habitats and public areas should be carefully considered to reduce pandemic risks in hospitals, as proper medical waste disposal effectively controls infection sources. Improper disposal of the face mask can lead to various problems which include large heaps of mask all over, bacteria causing infection, unhygienic environment etc. The used mask that have not been disposed of properly sometimes block the drainage system. Incineration is a better technique to dispose of such waste but burning of used mask releases harmful gases that effects health and environment. To incinerate mask, electrical or physical fire – based incinerators can be used. Toilet facilities in India are very poor as they lack bins for the disposal of mask [1]. This system is one of the best way to dispose waste burn mask using electrical fire based burner without allowing smoke generate in the process to escape into the atmosphere. This steps must be taken to solve the problems that improper disposal of mask causes to the environment and to the public health.*

Keywords: Mask fabrication

I. INTRODUCTION

The first outbreak of coronavirus disease 2019 (COVID-19), which is caused by a novel severe acute respiratory syndrome, namely, coronavirus 2 (SARS-CoV-2), occurred in Wuhan, Hubei Province, China [2]. Although most countries have closed their borders to prevent unnecessary travel and immigration, the possibility of confirmed cases and deaths is still increasing due to increased community transmission and increased capacity for testing. World Health Organization (WHO) and the US Centers for Disease Control and Prevention, the National Centers for Disease Control and local governments have announced various guidelines, including frequent, social distancing and quarantine (home, local and state quarantine), to reduce the spread and health risks associated with COVID-19. These institutions have also recommended medical personnel and the general population to use personal protective equipment (PPE) such as surgical or medical masks, non-medical face masks (including various forms of self-made or commercial masks of cloth, cotton or other textiles), face shields, aprons and gloves. More and more countries have recommended wearing masks when going out in public places. The press conference study of the Joint Prevention and Control Mechanism of the State Council of China found that approximately 468.9 tons of medical waste are generated every day in association with COVID-19 [4,5]. On the other hand, it was found in Indonesia (Jakarta) that the medical waste scale had reached 12,740 tons approximately 60 days after people were first infected by coronavirus in the area [6,7]. Infectious waste is as any material that is suspected to contain pathogens (bacteria, viruses, parasites or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. It also comprises waste contaminated with blood, bodily fluids, tissues, organs and sharp objects from treatment and, therefore, also includes diagnosis, swabs, medical devices and so on [8,9]. Therefore, it is harmful to health. In particular, infectious waste generated by the COVID-19 outbreak has posed a major environmental and health concern in many countries.

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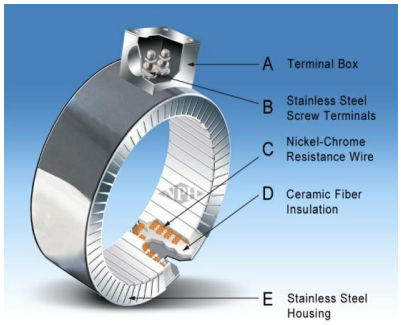
II. LITERATURE SURVEY

Waste obtained from hospitals is heterogeneous in nature because they consist of various degrees of elements in major and minor quantities, some of which are toxic and extremely infectious if not properly managed . Hence, the need for incineration to decontaminate the medical waste by subjecting it to thermal destruction process at high temperature (1100°C - 1600°C) under controlled operational conditions. The products of combustion are ash residue, water and carbon dioxide. Incinerator is the unit in which the process occur. A well- designed incinerator does not only consider reduction of waste volume as priority but the environment as well must be put into consideration, hence, the need for incorporation of a gas cleaning device to the incineration process to ensure the release of clean and safe air to the atmosphere. A complete combustion of the medical waste and reduction in potential pollutants contained in the emission lends the process well to waste disposal in areas where population density is relatively high and availability of sites for landfill is low. Incinerators reduce the solid mass of the initial waste by 80–85% and compresses the volume by 95–96%, based on the composition and extent of recovery of the material. Thus, as incineration does not replace landfilling completely, it reduces the required volume for disposal definitely

Minimization of the impacts of medical waste in HCFs is pre- requisitely a function of appropriate and practicable waste management system. Ethically, it is the responsibility of HCFs management to ensure proper medical waste management, which involves the determination of sources, waste characterization, frequency of generation, safe handling practices, segregation, storage, transportation, treatment and final disposal . Most dominant approach to medical waste treatment and disposal in Africa, Asia and some parts in Europe are landfill, open burning and incineration. However, most of the HCFs often neglect the harmful side of these practices when it is not duly followed according to the World Health Organization standard. The use of incinerator without flue gas emission control device is as good as burning the waste in open space while engineered landfill is synonymous to direct contamination of groundwater. Therefore, this study is geared towards design and the development of a medical waste incinerator equipped with a counter-current packed bed wet scrubber. Where W is the waste load (lbs./day or kg/day), Y is the optimum incinerator capacity (lbs./hr. or kg/hr.) and N is the Optimum burning time (hrs./day). From the survey and measurement, the average wastes quantification from the two public hospitals is shown in Table 1. For unknown future of higher generation of medical waste, the waste load (W) from the HCFs is estimated as 269 kg/day.

1. Band Heater



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Mica **band heaters** are an inexpensive industrial heating solution that surrounds pipes and tubes that require external indirect heating.**Band heaters** use electric heating elements (NiCr wire) to heat-up the external surface of drums or pipes for a gradual heat transfer.

2. Digital Timer

A **timer** is a specialized type of clock used for measuring specific time intervals. Timers can be categorized into two main types. A timer which counts upwards from zero for measuring elapsed time is often called a *stopwatch,* while a device which counts down from a specified time interval is more usually called a timer. A simple example of this type is an hourglass. Working method timers have two main groups: hardware and software timers.Most timers give an indication that the time interval that had been set has expired.Time switches, timing mechanisms which activate a switch, are sometimes also called "timers."

3. Contactor

A **contactor** is an electrical device which is used for switching an electrical circuit on or off.These contacts are in most cases normally open and provide operating power to the load when the **contactor** coil is energized. **Contactors** are most commonly used for controlling electric motors.

III. WORKING PROCESS

The mask is inserted through the door opening and allowed to fall and rest against the door extension which closes the material inlet. The door is then closed, thereby enabling the door extension to rotate downwardly to allow the mask to fall onto the heating coil. The switch is then depressed which activates the heating coil. The heat supplied by the heating coil burns the mask to ash which falls, by gravity, through the heating coil into the removable tray where the debris is collected. The heat supplied by the heating coil is reflected by the angularly positioned heat reflecting surfaces and concentrated at a central point within the heating chamber. By this technique the mask is efficiently burned.

Air passing into the housing through air inlet also aids in both the combustion of the mask and the conveyance of the undesirable fumes and doors to the filter assembly. The fumes and odors, circulated by the incoming air, thereby pass only through the filter element.

The filter assembly filters the gases passing there through and removes any undesirable odors and fumes so that only filtered and clean gases may be returned to the immediate environment of the room through the clean gas outlet.

The operation of the circuit is such that, when the Switch is closed, current will flow through the switching mechanism directly to the heating coil.

Either upon the expiration of a time interval or upon the presence of a specified temperature in the heating chamber, the current to the heating coil will be terminated.

IV. PROBLEM STATEMENT

The SARS CoV-2 pandemic has caused a global emergency and aroused social and economic concerns in addition to excessive medical and household waste, which adversely affects municipal waste management, thereby spilling over into environmental issues. In particular, another aspect of the spread of COVID-19 is improper solid waste management. If

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waste is not managed properly, it may lead to the spread of the virus. Consequently, the number of confirmed cases has rapidly increased and the amount of medical waste associated with COVID-19 has also significantly increased. In addition, existing operational protocols for HWM and municipal solid waste (MSW) management should be continued for SARS-CoV-2 waste, with specific precautionary measures, adjustments and arrangements applied to reduce any potential risk of SARS- CoV-2 infection due to the improper waste management process. The following sections describe the used mask and medical waste management in detail. Categorized containers or packaging and pre-treatment Medical waste includes those elements that have been contaminated by blood, body fluids and cultures produced in laboratories, stockpiles of infectious agents or waste generated through medical wards and equipment . During the COVID-19 pandemic, the disposal capacity of medical waste is seriously insufficient . This is because the use of protective masks has greatly increased the possibility of carrying pathogens. Therefore, some medical waste buckets with obvious mark points are placed in the public areas of hospitals and communities to collect abandoned masks. They are packaged in double- layered medical waste bags and treated as general medical waste by specific personnel, municipal solid waste workers and the company's special waste management department . Meanwhile, by stratifying patients on the basis of risk, special care facilities can be facilitated with appropriate health care personnel, procedures and PPEs (long-sleeved gowns, gloves, boots, masks and goggles or face masks) to provide maximum protection against nosocomial infections.

V. RESULTS AND DISCUSSIONS

This study estimates the number of face masks used in self-defense and medical waste generated by the total COVID-19 cases in developed and developing countries in Asia during the crisis. The result showed that more than one hundred thousand people were infected in Asian country such as India, Iran, Pakistan, Saudi Arabia, Turkey, Bangladesh, Qatar and Indonesia. The number of masks used in 49 Asian countries was estimated from the COVID-19 pandemic database on July 31, 2020. Subsequently, it was found that 2,228,170,832 face masks were used in Asia in total. In particular, the selected countries that use the most daily face masks are China (989,103,299 pieces), followed by India, Indonesia, Japan, Pakistan, Iran, Philippines and Vietnam with 381,179,657, 159,214,791, 99,155,739, 92,758,754, 61,762,860, 50,648,022, 48,967,769 and 46,288,632 pieces, respectively. The maximum face mask use by the general population in Asian was found in Eastern Asia (1,110,472,794 pieces), followed by Southern Asia, Southeastern Asia, Western Asia and Central Asia, thereby amounting to 648,945,814, 295,458,617, 142,162,166 and 31,131,442 pieces, respectively. The research conducted by Nzediegwu and Chang perceived the apparent fact that the total number of face masks used every day has increased during the COVID-19 outbreak. This study used mathematic calculation to estimate the numerical value of face mask usage across Asian countries. Consequently, it was found that the quantity of daily face mask usage depends on the number of people residing in a certain country, urban population (per cent), face masks acceptance rate (per cent) and average daily face masks per capita. Thus, this equation can be applied to the estimation of face mask scenarios during the COVID-19 pandemic for healthcare waste management. It was found while conducting this study that the total medical waste generated in Asia is around 16,659.48 tons/day. The countries with the highest medical waste are India (6,491.49 tons/day), followed by Iran (1,191.04 tons/day), Pakistan (1,099.30 tons/day), Saudi Arabia (1,083.17 tons/day), Bangladesh (927.81 tons/day) and Turkey (908.07 tons/day). Information about the medical waste of other countries has been included in Table 1. Indeed, due to the rapid increase in the number of confirmed cases, the amount of medical waste related to COVID-19 has also significantly increased. The use of medical gloves, surgical face masks and aprons has been recommended for essential healthcare service staff such as physicians, nurses, medical technologists and nurses' aides. Moreover, face mask use has been mandated for citizens. A special infection prevention and control team was established to discuss potential problems and countermeasures. The administrative and operating boards include the nosocomial infection control expert, director of infectious disease department, respiratory disease department, nursing department, local government organisations, multi-level quarantine departments, environmental health and safety, logistics departments (special waste management in the private sector partnerships) and administrative leaders.

VI. CONCLUSION

The finding shows that the number of face masks used and medical waste has increased with the steady increase in the number of confirmed SARS-CoV-2 cases. COVID-19 is pathogenic virus, and the concerned authorities should pay significant to all aspects of prevention and control. Standardization, procedures, guidelines and strict implementation of

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medical waste management for the COVID-19 pandemic should be carefully considered to reduce the risk of the pandemic spreading to the environment within hospitals, community residences and public areas.

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