Status and Challenges of COVID-19 Waste Management

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Abstract: Bio-medical waste is constantly a source of worry owing to the risk it possess to the community's health. COVID-19 is an extremely infectious in nature and deadly virus. A huge amount of biomedical waste is produced to fight against such situations. Traditional waste management solutions cannot cope with covid waste since the rate of waste creation is quite high and infectious. Safety equipment like PPE kits, testing kits, and other medical waste is generated while the handling of COVID-19 patients. The long survival of the corona virus on diverse surfaces is a significant source of its spread. Such infectious waste has become a major environmental and social issue that must be handled. This work provides light on several aspects of the COVID-19 waste volume status and issues associated with COVID-19 waste management. Better waste management can decrease environmental exposure time, transportation danger, and so on. Some recommendations like a small local COVID-19 waste treatment plant may help in reducing the danger of corona virus transmission and mobility, as well as limiting its risks of the hazardous component.

Keywords: COVID-19 waste, Health management, Biomedical Waste, Bio Medical Waste Management

1. Introduction

Novel Corona virus disease commonly known as COVID-19 ,cause illnesses ranging from the common cold to pneumonitis, blood clots, and another severe form of the disease. The family of the virus is optimized to spread quickly and extensively, primarily through gout, respiratory secretions, and direct contact through the respiratory tract. Its rapid contagious nature spreads through droplets of saliva or infectious person nasal discharge or coughs or sneezes, is a problematic one (**Li CS & Jenq ,1993**). Its approach to the respiratory system of the living object and raises alarm to humankind. So the detection of microorganisms is a major step in this regard. The contagious nature of disease needs preventive strategies like urgent patient segregation, disease diagnosis, and proper clinical care, careful infection control are some protective mechanisms. For example, airway protection mechanism, restrain droplets contact protective mechanism adopted for covid and its spread control. A medical instrument like CT Scan, high-resolution X-ray, MRIs, etc., are few such developed devices for public health management techniques. Early detection and infected people segregation are the only preventative measure not only to limits its spreading but also to protect others **(kumar& Singh,2020)**. All this shows that huge biomedical types of equipment are used in this regard.

The leap and bound trends of COVID-19 cases are observed. The second wave started in March 2021, shortage of hospital beds, cylinders of oxygen, and other medicines in parts of the country due to their exponential rise as shown in figure 2. It has crossed all records of the first COVID-19 waves. Health specialists think that India needs significant action in this respect, with various coordinated strategies to be implemented to maintain numbers low. To prevent/fight this deadly pandemic, numerous efforts have been taken, including sampling, testing, patient isolation, personal protective equipment (PPE), social distance, and life-sustaining therapies with help of yoga. It also involves personal precautions like social distance, masks and gloves, regular hand washing, and so on. **(Chartier Y et.al ,2014; CPCB,2021; Hirani,2014 ; Kumar,2021)**

COVID-19 has made their use of domestic isolation, bulk testing, vaccination, and individual safeguards mandatory like facemasks, surgical gowns, personal protective equipment (PPE), aprons, and nitrile gloves, resulting in a rapid build-up of potentially infectious waste streams (**Singh et.al, 2020**). The treatment of one patient generates around 3-5 kg of trash **(CPCB, 2020)**. The covid waste is very contagious, which is exacerbating the issue. Current research shows that this virus can survive on different surfaces over a long period of between 2 and 3 days, which is an important factor in its propagation. The new mutant variants like delta, delta + of the virus spread quickly and have the ability to gradually infect the surroundings. As a result, waste management is important for controlling the virus's spread. More waste will result in increased viral transmission and dissemination.

2. COVID-19 Waste Scenario

New paragraph: use this style for beginning a new paragraph. COVID-19 waste refers to all waste generated during Covid investigation, vaccination, or treatment of infected patients, or Covid-related research activities

(Acter, T., Uddin et.al 2020). Various government agencies like Government Hospitals, Nursing Homes, Clinics & Primary Health Centres (PHCs), and various private and social organizations like NGOs are involved in COVID-19 management. These have different levels of manpower, infrastructure, training and awareness, and disposal infrastructure, therefore different strategies need to be formulated for infected waste management **(Pasupathi P& Singh,2011)**. The various studies on COVID-19 show a good relationship between the number of cases and associated waste generation as shown in Fig 1.

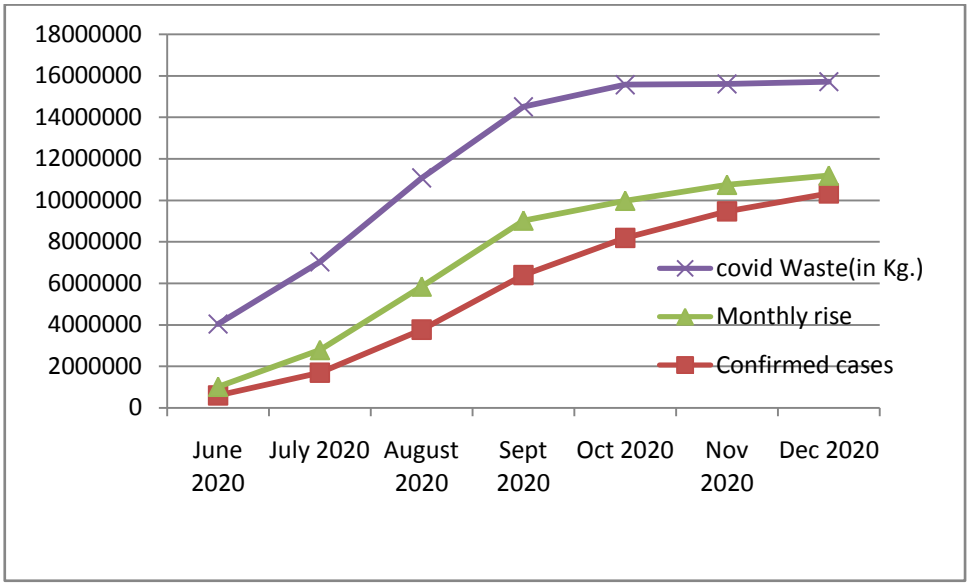

Figure 1. Relation between COVID-19 cases and generated waste [Ref – CPCB, MoH]

India is experiencing problems in COVID-19 waste management, due to huge scattered volume. These problems are associated with a task like collection, segregation, handling, and disposal, as well as worker safety and hygiene. Government bodies such as WHO, CPCB, and the Ministry of Health have issued recommendations on how to deal with COVID-19 waste in hospitals as well as home isolations regularly. According to CPCB standards, COVID-19 Waste shall be disposed of with biomedical waste following BMW rules, 2016 through authorized Common Biomedical Waste Treatment Facilities (CBWTFs) or captive treatment facilities such as deep burial pits (where CBWTF is not available). CPCB has also categorized waste based on risk assessment because different wastes cannot be addressed in the same way, which help in waste volume reduction and effective management (**CPCB**).

Month	WASTE GENERATED	CBWTF NO
June 2020	3025.41	193
July 2020	4253.46	198
August 2020	5238.45	198
Sept 2020	5490	198
Oct 2020	5597	198
Nov 2020	4864.53	198
Dec 2020	4527.55	198
Jan 2021	2294	198
Feb 2021	1484	198
March 2021	2325	198
April 2021	4170	198
May 2021	6090	198

Table 1. INDIA COVID-19 Waste Generated and No of CBWTFs Engaged

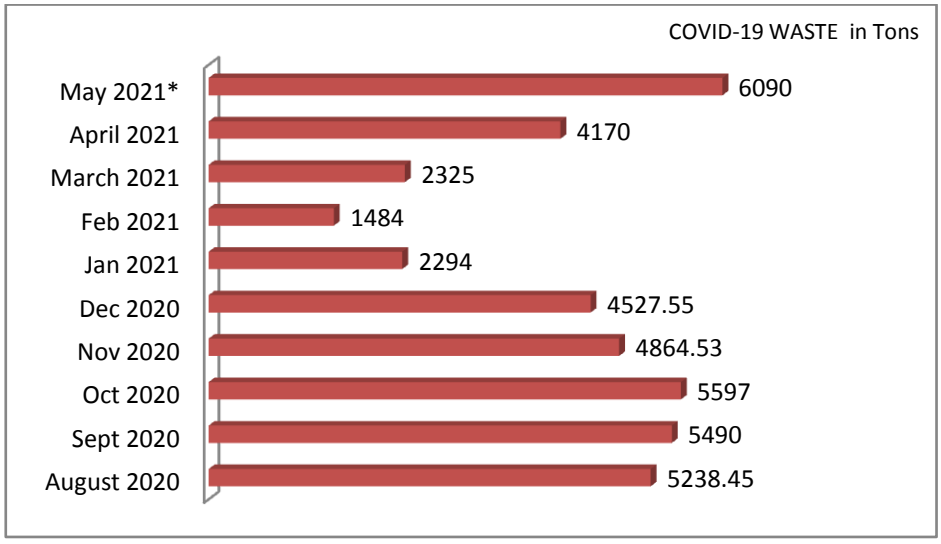

Figure 2. Generated COVID-19 Waste in India [Ref: CPCB]

These CPCB guidelines have established the responsibilities of each sector/stakeholder engaged in COVID-19 related waste generation collection or management agencies. In July 2020, the CPCB released recommendations for dealing with trash generated during COVID patient quarantine/isolation. Handling such waste by any agency should be done with caution while wearing the required PPE equipment, which includes a long-sleeved gown, heavy gloves, boots, mask, glasses, or facial shield. Hand hygiene and a bath should be done after removal, where possible. These guidelines provide means for proper disinfection, disposing of garbage, or incinerating even in remote villages (**CPCB,2021; Singh, Kumar,2020**).

A massive surge in the generation of COVID - BMW has been observed during the second wave of COVID-19. There is an exponential increase in the quantity of COVID-19 BMW generation since February 2021. The number of discarded PPE kits, masks, gloves has increased waste many folds as shown by figure 2. About 198 Common Bio-Medical Waste Treatment Facilities CBWTF are involved in COVID-19 waste treatment and disposal in India. The CPCB tracking apps and various computational online tracking facilities are used a regulate COVID-19 waste and every COVID-19 biomedical waste generator is obliged to provide data on daily basis. However, COVID-19 BMW management is still in its early stages. Some colour code or levelling has been suggested based on infectious waste potential. As a result, COVID-19 waste has a high risk of infection during waste transportation and handling. Such infectious biological waste management has received a variety of attention. The state-wise distribution of such COVID-19 waste has been shown in figure 4 and figure 5.

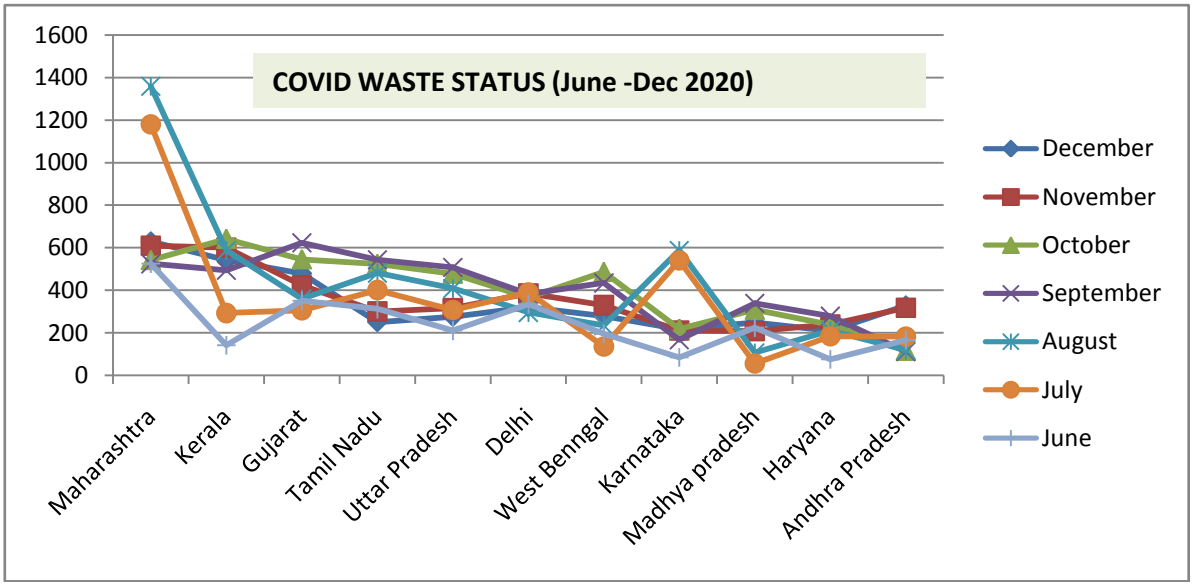

Figure 3: Covid Waste Generation (Max-to min during June- Dec 2021) [CPCB]

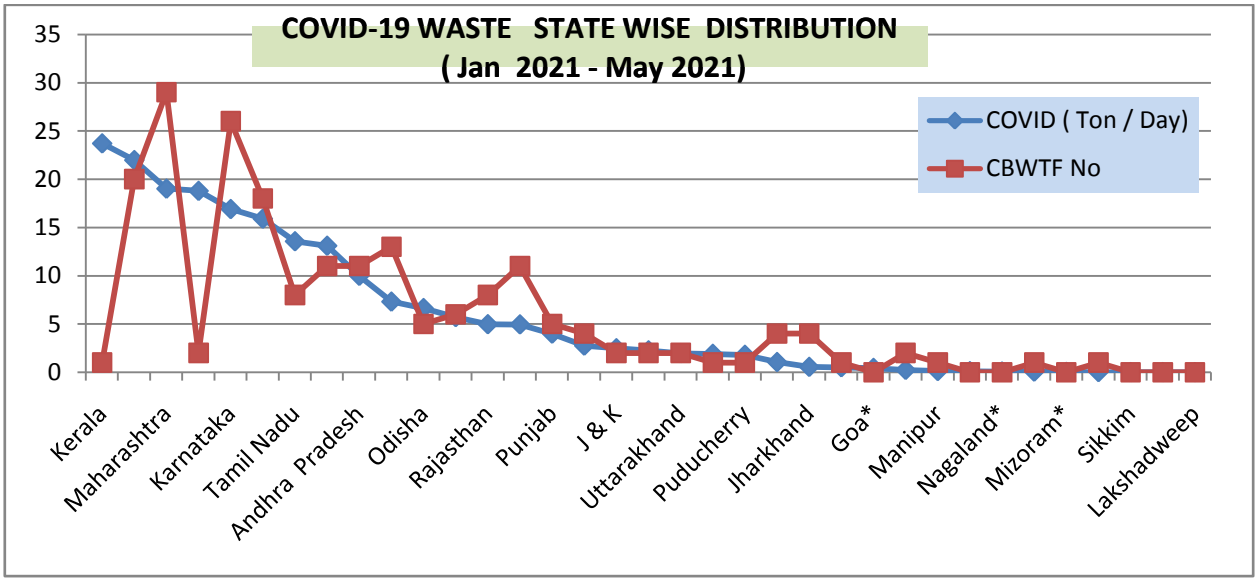

Figure 4: Covid Statewise Waste Generation (Max-to min during Jan-May 2021) [CPCB]

The management methods like incineration, gasification, and plasma waste technologies are suggested for their safe and effective options for dealing with such hazardous waste. This would eliminate the waste-induced covid danger while also providing effective waste management. For such infected effective management, an in-house micro-plasma covid waste treatment waste plant concept is recommended. Challenges are there w.r.t. the limitations in capacities of existing facilities and incinerators; also challenges include manpower (getting them to work, protecting them from the infection), recycling, training, precautions. Clarity and public awareness are required about this i.e., how to dispose and recycle them.

3. COVID-19 Waste Scenario

New paragraph: use this style for beginning a new paragraph. COVID-19 waste refers to all waste generated during Covid investigation, vaccination, or treatment of infected patients, or Covid-related research activities **(Acter, T., Uddin et.al 2020)**. Various government agencies like Government Hospitals, Nursing Homes, Clinics & Primary Health Centres (PHCs), and various private and social organizations like NGOs are involved in COVID-19 management. These have different levels of manpower, infrastructure, training and awareness, and disposal infrastructure, therefore different strategies need to be formulated for infected waste management **(Pasupathi P& Singh,2011)**. The various studies on COVID-19 show a good relationship between the number of cases and associated waste generation as shown in Fig 1.

The government of India has adopted various strategies social distancing, personal precautions, and vaccination for COVID-19 management. This included phases of the lockdown with logistics supply chains, critical equipment supply, rapid testing, and in addition to trained manpower. Managing protocols to ensure continuous treatment of non-Covid patients, designating separate spaces and staff. All this requires effective COVID Bio-Medical Waste (including PPE kits, Masks, etc.) recycling, disposal, and Management. Segregation and collection of COVID-19 waste is still a big challenge in the second wave-like situation. This can be overcome if each citizen and Municipal Corporations play an active role, also mass education is a very important aspect in this respect. COVID - BMW must be collected separately and not combined with other garbage. (**Kumar,2020; Singh,2020; WHO,2019**).

Proper communication between Regulators and Stakeholders is essential for the appropriate implementation of said CPCB waste management guidelines. Awareness is required regarding COVID plastic waste and CPCB Guidelines for handling waste generation during quarantine/isolation of COVID patients are shall be more advertise on collection and management of domestic hazardous waste. This can be done through a locally well know social figure and shall be published in local newspapers and electronic &social media also. Nutritional report cards could be practiced in the college campus; this will help them in management.

The following recommendations can be implemented for better waste management systems:

- Recycling should be thought of first and decomposition should be the last option. Infectious parts of waste may not be negated.
- The COVID–19 waste management liabilities need to be addressed /fixed up from collection to disposal stage, The liability of the government does not end with waste handover. The completer waste to disposal has to be monitor.
- The number of such centers shall be increased and more train power to be created for the same.
- Infected dead body guidelines shall be made simple and very clear to all coming to crematoriums. As per guidelines, no one shall be allowed to handle a dead body without PPE kits and shall be decomposed as per CBCB COVID-19 guidelines.
- Waste segregation methods, from time to time to be updated and monitored for hospitals, vaccination centers, or home isolation based on risk analysis.
- Small size high-temperature waste to energy plants or biological plants to be implanted for local managements.
- Mini-size plasma waste to energy plant to be implanted for local management to avoid any transmission risk.
- For home quarantine under COVID Waste Management standards, do's and don'ts of home quarantine waste must be publicized and extensively distributed in all local languages.
- To minimize the transmission of illness, all COVID waste handlers should be given PPE kits that include long gloves, masks, and a wash afterward.

The vaccine is the ultimate solution to such a virus-related pandemic. On 16th January 2021, India began its immunization campaign and by April provided 3-4 million daily doses. The Indian Covaxin, Covishield, and Russian-Sputnik V vaccines were authorized for use by India. As of 21 June 2021, over 27.1 billion doses with a population of 3.6 percent were completely vaccinated in the country. India has prioritized and protected all health workers against infection (**CPCB, 2021**).

People's participation is very important for a waste management program to be successful. Regular training and awareness programs need to be conducted by NGOs, NCC/NSS volunteers, health departments, and Municipalities.

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 of 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.

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