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PRE AND POST PANDEMIC SOLID WASTE MANAGEMENT- A GENERAL PERSPECTIVE

Niladri Sekhar Roy
SGT University, Gurugram, Haryana, India

Simranjeet Singh
SGT University, Gurugram, Haryana, India

Kanak Dwiedi
Babu Banarasi Das University, Lucknow (U.P.), India

Abstract
The COVID-19 pandemic introduced many new challenges globally including the Municipal Solid Waste Management (MSWM). In pre pandemic era MSWM was facing many obstacles and difficulties nationwide and now this picture became worst in post pandemic era. The data of solid waste generation per day has drastically accelerated and also getting mixed with biomedical waste. Huge numbers of non-point sources of contagious wastes made the Municipal Solid Waste Management more challenging and complex to handle. This study emphasizes the challenges of existing waste management facilities are facing to treat huge waste generation. India was one of the highest COVID positive cases across world which led huge biomedical waste generation. Therefore, the study has focused to enlighten and discuss the problems of waste management in various stages in our country and to share some solutions.

Key Words: Solid Waste Management, Infectious waste, Geotag bags, Rag pickers.

Introduction
The COVID-19 pandemic has affected a lot of nations and the pandemic is still spreading in many countries. This unfortunate time can be seen as a warning sign to the institutional and management systems in various countries, focusing on the need to focus on human relations and their interactions with external contexts. The paradigm is altering as a result of the lessons we have learnt from this period of transformation, which make it clear that adaptability to COVID-19 and post-COVID-19 seems vital. Serious crises have been caused by the COVID-19 outbreak in a number of industries, including economy [1], health care, financial markets, businesses [1], supply and demand chains, and financial markets.

People's consumption habits have apparently started to alter during this but more crucially, the trend of trash generation has reportedly undergone changing patterns [2]. If the unexpected changes in waste generation are not effectively addressed with smart measures, they could seriously impact the environment and put public health at risk. Now the question is what problems will the waste management systems have to deal with in the COVID-19 period and beyond? The issues require a long-term approach since they differ from natural disasters [2]. At present we are facing proper identification of the difficulties in waste management and that can raise the need of the revision of waste management strategies that will be included on the agenda in the future. The suggested

solutions should enable the system to quickly adjust to any pandemics, including COVID-19, particularly in the post-pandemic period. It is important to consider the necessities recommended by the World Health Organization and government health organisations. During the COVID-19 era, one of the specific wastes have been generating dramatically in huge quantities namely plastic waste. Many organizations as well as people have started tiffin service to the medical facilities, homes, quarantine centers and offices. All these boosted up the generation of plastic wastes across the country. These plastic wastes are also a great threat to nature and are not getting collected properly for processing. Mechanical recycling, burning, and landfilling are the methods of plastic waste management that are most often practiced worldwide. The Ellen McArthur Foundation calculated the rate of mechanical recycling of discarded plastics at 16 percent worldwide. Remaining waste plastics were either burned (25%) or dumped in sanitary/unsanitary landfills (40%) or leaked into the environment (19%) due to poor management. But even with increased waste output during the COVID-19 crisis, the problems only became worse, demonstrating how far from ideal these solutions are at solving the entire plastic waste problem.

The past few years of Covid-19 the world saw millions of deaths. The figures are much more severe in top five countries with higher positive cases such as US (24.5 M), India (10.6 M), Brazil (8.57 M), Russia (3.57 M) and United Kingdom (3.47 M). Many countries including India have started producing PPEs in the form of jackets, gloves, masks, sanitizers etc. Huge production of such items added a new headache to the solid waste management facilities. Not only the waste generation increased dramatically but also mixed with covid-19 wastes especially in quarantine centers and homes where people got quarantined. After the lockdown has been imposed, the production of different plastic items also increased drastically in the form of small containers for food supply. Global pandemic has changed the quality as well as quantity of solid waste and their management and put the sanitation labors in high risks [5]. Although different agencies across the world have given guidelines for handling Covid-19 wastes but in India the scenario is more complex. Most of the societies do not follow the guidelines. Poor mentality towards health and nature led the generation of highly contagious mixed wastes comprised Municipal Solid Waste and Covid-19 wastes. This infectious waste has become serious threat to waste management practices, sanitation workers and rag pickers. This study will discuss the pre and post pandemic challenges of solid waste management and probable solutions.

Municipal Solid Waste: Quantitative and Generation rate analysis

In India, over 143,449 MT of Municipal Solid Waste are produced daily, of which approximately 111,000 MT are collected, & 35,602 MT are processed. City-wise waste generation from 2001 to 2018 is described by CPCB in their annual report as showing a considerable fluctuation in the waste per capita/day generation at a rigorous exponential rate (0.24 to 0.85) between those years [7]. Which is anticipated to quickly rise in the near future (CPCB India, 2018a) [2]. For the 29 Indian states, the MSWM system's consolidated status is shown in Table 1 below. The social and economic standing of the populace, geographical conditions, and climatic variables all these factors affect waste categorization in Indian cities. Municipal waste production is increasing in the populous cities. The variation in the waste generation creates extra difficulties for the municipalities, demonstrating that

same strategy cannot be implemented in all cities. Other than fewer cases, most of the towns are unable to handle the situation. Larger cities like Mumbai, Delhi, Kolkata, Chennai, Hyderabad, and Bangalore account for a significant portion of the country's solid waste generation. A diverse solid waste is produced daily in these areas by their dense populations, which accounts for around 70% to 80% of all the waste produced daily in India (MNRE India, 2018). According to the MNRE study from 2018, states with high population densities including Maharashtra, Tamil Nadu, Uttar Pradesh, the National Capital Region, Gujarat, Karnataka, and West Bengal produce a significant amount of trash nationwide.

Table 1: Status of Municipal Solid Waste Management in India

Parameter	Status
Population density	382/person/km
Door to door collection	18 state (of 29 States)
Segregation of the waste at the source	5 states (of 29 States)
Unsanitary landfill site constructed (in numbers)	1285
Compost/vermicompost facilities (in numbers) operated by ULBs	95
ULBs under construction compost/vermi-compost facilities (in numbers)	173
Operating pipe composting facilities (in numbers)	7000
Operating RDFs Facilities (in numbers)	12
Operating Biogas Plants (in numbers)	645
Energy generation Plants (in numbers)	11 (6 operational)
Solid Waste generation	143,449 Mt./day
Solid Waste collection	111,000 Mt./day (77.6%) of total solid waste generated
Solid Waste process/treatment	35,602 Mt./day (24.8%) total solid waste generated

Pre pandemic Challenges

Analysis of annual reports received from 35 SPCBs/PCCs across the country in the year of 2018-19 says that in India, MSW collection efficiency is 98.4% but the collection of waste is only 70%. Door to door waste collection is not the only option for efficient waste collection. In many areas, waste collection is not as per the guidelines provided by the Government. It is also noticed that information provided by 35 SPCBs/PCCs is inadequate and not as per the formats. Due to improper format, the data is very complex to analyze and the extent of actual issues could not be demarcated.

Waste processing and disposal facilities in most of States are not in working conditions and have

inadequate workers. The efficiency of many waste management facilities are very poor and cannot handle the huge amount of mixed wastes coming daily and that led the pile up of waste on dumping sites. It has also been observed that most of the dumpsites are unscientific and operating without following SWM Rules and getting mixed waste. Even after notification by CPCB, State policy and strategy for implementing Solid Waste Management Rules, has not been formed by the most of States/UTs. It is one of the major administrative drawbacks that existing rules, guidelines have not been strictly implemented at state and UT level [3]. Apart from administrative snag, there is lack of coordination between Urban Development Directorates, State Pollution Control Boards, Urban Local Bodies and other agencies concerned.

Post pandemic Challenges

As the pandemic hits the globe, highly contagious covid-19 waste generation added more problems to the waste management authorities across the country. Before the pandemic, proper waste collection in different color coded containers, waste storage and segregation were already insufficient and now mixing of contagious waste with municipal solid waste made waste management more time consuming and difficult [10]. Table 2 displays the guidelines of waste management (SWM) by various organizations.

In 2020; from June to December; India generated 33,000 Tonnes COVID-19 Waste. The generation of Covid-19 wastes has increased in 2021. The average monthly waste generation in 2021 has increased to 203 tonnes per day in May from 139 tonnes per day in April and from 75 tonnes in March. Peak generation of waste was about 250 tonnes per day was reported on May 10, 2021. In 2020, regular bio-medical waste generation in India was at 610 Metric Tonnes per day, but after COVID-19 hit the globe, the waste generation has gone upto 765.5 Metric Tonnes per day. The main problem with the mixed waste is that whole waste is considered as municipal solid waste and acted accordingly instead of considering them in two different waste category.

Table 2: Guidelines of SWM by various organizations

Organization	Guidelines for COVID-19 waste handling
OSHA (Occupational Safety and Health Administration, US)	• Sanitation workers must use personal protection equipment (PPE) for the safeguard from COVID wastes. • Biomedical wastes generated from Covid centers should be treated like other medical wastes
WHO (World Health Organization)	• Hazardous biomedical wastes must be segregated and collected in specific colored bins.

	• Contagious wastes generated from patient care can be treated onsite through high temperature treatment, autoclaving or incineration. • Wastes from waiting areas of health care facilities are non-hazardous and are to be packed in sealed black bags. • If shifting facilities of wastes are not available, then wastes should be burned in controlled condition is favored.
CPCB (Central Pollution Control Board, INDIA)	• Specific colour coded bags/bins/containers for proper separation of waste. • Collected Covid waste should be stored temporarily in separate room before handling it over to CBWTF. • Solid waste management rules should be implemented for the disposal of common or non-hazardous wastes.

Challenges in Waste Management

With the help of all the information from different sources the major challenges in managing solid wastes varies from place to place. Collection of infectious wastes from houses, isolation centers, and quarantine centers is not very effective. There is no or less independent vehicles for collection of COVID-19 waste from those centers. Sanitary workers are unaware about the severity and sensitivity of the disaster. They often collect waste with bare hands and don't even use masks or any other PPEs. Staff and sanitary workers do not have proper training to handle common wastes generated from various centers during COVID-19 [8]. Millions of masks, gloves, and containers of sanitizers can be found on the road and open areas. These infectious wastes pose high risk to the rag pickers specifically. Infectious wastes mixed in municipal solid waste cannot be identified separately; that could lead the spreading the infection amongst workers [9]. Not only the infectious wastes but the generation of plastic wastes have altered the quantitative aspects of solid waste [4].

Recommendation

The pandemic has accelerate the use and production of many items made of plastic materials thus the generation of various waste triggered dramatically [7]. It has been observed that negligence and loose implement of rules and acts are the key factors in unsatisfactory waste management. Strict implementation of acts concerned to the pandemic and wastes is mandatory in India where rest of the practices are insufficient and negligible in respect to the actual issue. Domestic Hazardous Waste should be collected timely as well as separately and provided to ULBs and further to common biomedical waste management facilities [6]. There should be a specific team & separate vehicle to collect COVID-19 wastes from various quarantine centers and should also be taken to nearby incineration centers rather than dumping in municipal solid waste disposal sites. Sanitary workers should be provided personal protective equipments and disinfectants as applicable as well as should

be provided proper training. Rag pickers play very important role in waste collection and also pose very high risk in spreading infection especially in lower sections of the society [9]. Thus each local authority should identify the local rag pickers and enlist them to keep an eye on their health time to time and also provide training and PPEs to them. PPEs waste should be kept indolent for 72 hrs before disposal to stop spreading infections from them [8]. Yellow bags and other means should be provided by Urban Local Bodies to the people those operate Quarantine Camp and homecare personnel. Geotag bags could be useful to identify covid-19 waste if mixed with municipal wastes.

Conclusion

This study has shared different aspects of waste generation, collection & waste management process during pre and post pandemic situations. The study also discussed various drawbacks of waste management strategies at different levels of the society. This study will help to identify the loop holes of the existing waste management strategies and to reduce the burden on each waste management facilities during the pandemic. The study will open new research ideas to improve various aspects of municipal as well as biomedical waste management practices in the country. Therefore, this research analysis emphasizes to show the requirement of rearrangement of waste management structure which will include the training of sanitation laborers as well as local rag pickers, increase of automated or mobile incinerators etc. for future crisis.

References

1. R. K. Ganguly, S.K. Chakraborty, Integrated approach in municipal solid waste management in COVID-19 pandemic: Perspectives of a developing country like India in a global scenario, Science Direct, 2021, 3, 1-2.

2. L.C. Malav, K.K. Yadav, N. Gupta et al, A review on municipal solid waste as a renewable source for waste-to-energy project in India: Current practices, challenges, and future opportunities, Science Direct, 2020, 277, 1-2.

3. B. N. Kulkarni, V. Anantharama, Repercussions of COVID-19 pandemic on municipal solid waste management: Challenges and opportunities, Science Direct, 2020, 743, 2-4.

4. A. Kumar, A. Agrawal, Recent trends in solid waste management status, challenges, and potential for the future Indian cities – A review, Science Direct, 2020, 2, 1-4.

5. S.M.Al-Salem, Y. Alosairi, A. Constantinou, Effect of COVID-19 lockdown measures on the plastic waste generation trends and distribution of microplastics in the Northwestern Arabian/Persian Gulf, Science Direct, 2022, 216, 2-4.

6. A. Tripathi, V. K. Tyagi, V. Vivekanand et al, Challenges, opportunities and progress in solid waste management during COVID-19 pandemic, Science Direct, 2020, 2, 1-3.

7. Ana L, P. Silvaa, Joana C et al, Rethinking and optimising plastic waste management under COVID-19 pandemic: Policy solutions based on redesign and reduction of single-use plastics and personal protective equipment, Science Direct, 2020, 742, 2-5.

8. V.K. Manupati, M. Ramkumar, V. Baba, Selection of the best healthcare waste disposal techniques during and post COVID-19 pandemic era, Science Direct, 2020, 281, 1-3.

9. H. Khandelwal, A. K. Thalla, S. Kumar, Life cycle assessment of municipal solid waste management options for India, Science Direct, 2019, 288, 1-3.

10. Y. Pujara, P. Pathak, A. Sharma, Management practices for reduction of environmental impacts to achieve sustainable development goals, Science Direct, 2019, 248, 1-2.