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IMPACTS OF COVID-19 ASSOCIATED WASTE ON COMPONENTS OF BIOSPHERE AND CHALLENGES IN INDIA-A REVIEW

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ABSTRACT
During past days, the pandemic COVID-19 had presented all together a very challenging scenario, where not only human health but the overall ecosystem was at stake and faced new challenges. Some reports had suggested that there was an increase in production of PPEs (Klemeš *et al.*, 2020) in 2020-2021. This will later lead to its higher utilization and, finally, result in colossal generation of wastes all around. The paper advocates about such challenges in India.

KEYWORDS: Waste Components, Challenges, COVID-19, Bio-medical Waste, Environmental Contamination.

INTRODUCTION

As we already know, the waste management system of developing countries like India is not much advanced to tackle any type of projected waste disaster (Srivastava *et al*. 2015), however the present Indian Government amended ehe bio-medical waste management rules time to time (1998, 2016) and follow the minute to minute guidelines of WHO. The term 'Health Care Waste' or 'Bio-Medical Waste' includes all the wastes from any medical procedure in healthcare facilities, research centres and laboratories (WHO, 2017). The activities generating bio-medical waste may be in healthcare, research or diagnostic facilities with one or more of the activities such as diagnosis, treatment, immunization of human beings and animals and production or testing of biological materials. The types and characteristics of the contents determine how hazardous is the waste. The classification is based on presence of infectious substances, radioactivity, presence of sharps, genotoxic, cytotoxic, other toxic chemicals and biologically aggressive pharmaceuticals (WHO, 2017). Management of Bio-Medical Waste in improper way result in several problems including spread of infectious diseases and different forms of environmental pollution. So there is a need to utilize the products in more sensible and sustainable manner to stop further environmental contamination and minimize the risk to mankind and biosphere components such as air, water, and soil are nowadays greatly influenced by COVID-19-associated waste.

MATERIALS AND METHODS

The research review paper is based on a systematic literature review of different old and new articles. A systematic investigation of all the scientific articles and reliable media articles available in web domain pertaining to the subject in the current context of COVID-19 pandemic has been done specially with reference to the same challenges in India.

RESULTS AND DISCUSSION

Bio-medical wastes are classified based on their source of generation which includes various risk factors related to their handling and final disposal. On this very basis bio-medical waste is divided into 07 waste categories which are as follows: 1. Human and Anatomical Waste 2. Animal Waste 3. Microbiology and Bio-technology Waste 4. Waste Sharps. 5. Discarded Medicines and Outdated Drugs. 6. Soiled Waste & 7. Liquid Waste. However, on the another basis biomedical waste is classified into two types: 1. Non hazardous waste 2. Hazardous waste. About 75% to 90% of biomedical waste characteristics were similar to that of domestic waste and are non- risky in nature. Color coding for biomedical waste management: yellow, red, white and blue bins which covers most types of biomedical waste. The bio-medical waste in red and blue bag or container which is for recycling will be sent only to an authorized recycler. This will keep the recycler in realm and in control of various government agencies.

Problems and Challenges of Bio-medical Waste during
COVID-19 pandemic in India

In India, the most populous cities like Delhi, Mumbai, Bangalore, Chennai, Hyderabad, etc. are the most affected cities by COVID-19 during 2019-2021(Shashi, 2020, 2020, 2021, 2021 & Shekhar, 2020) According to data published by NDTV on September 18, 2020, the country is generating a considerable amount (Above 100 tonnes/day) of COVID-19 related bio-medical waste in the country. Maharashtra contributes for approximately 17% of total COVID-19 related bio-medical waste. The national daily waste generation was reached around 850 tonnes/day. The details on the monthly generation of COVID-19 related BMW across several state of India (From June 2020-December 2020). The country did not had sufficient infrastructure and human resources to handle this huge amount of bio-medical waste. The presence of 198 CBMWFs and 225 captive incinerators was insufficient to dispose off 700 tonnes of waste generated in a day. This additional bio-medical waste stirred up havoc in the disposal of bio-medical waste. The workers involved in bio-medical waste management were pitching in extra hours to cater to this need. According to the Supreme Court report, there is an increment in the quantity of bio-medical waste ranging from 25 to 349 tonnes/day during the month of May-July and it was expected to have doubled during the months of August-October (World meter, 2020). At that time, there was a poor practice of segregation at the site of generation due to the exponential rise in the generation, thus elevating the risk to the environment. Additionally, inadequate safety measures for the bio-medical waste workers continued to remain another major challenge in the Indian context. On the other side, around five million sanitation workers were performing their duty and cleaning the country and these laborers are simultaneously handling the biomedical waste as well. Sadly, they was not provided with the necessary personal protective equipment. These workers were at high risk and subsequently pose a threat to the residing community. According to the evidence from scientific literature, the virus might stay for more than 24 h within the cardboard, boxes, other rigid substances and around 72 h on the surfaces of metals and sharps, which was a significant threat for the workers collecting the waste for their daily survival. There was an estimated two to four million rag pickers or korales in India. However, they did not had sufficient information and adequate awareness about the necessary precautions to be taken. Consequently, the pandemic had recorded that more than thousands of waste workers have contracted the virus and hundreds of them have lost their lives. The pandemic scenario added to an unexpectedly high bio-medical waste amount from the hospitals, testing laboratories, and quarantine centers (Klemes *et al*, 2020). The calculation of the exact amount of bio-medical waste was challenging, although a study has suggested the increment in bio-medical waste generation to be as high as six-fold in comparison to the pre-pandemic situation. (Roohi *et al*., 2017). This increment in the volume and quantity placed a high demand for additional resources and training. There was an urgent requirement for additional personal protective equipment and workers to manage biomedical waste safely. A lack of sufficient data and accurate information on bio-medical waste during COVID-19 exaggerated the problem further. The unexpected rise in biomedical waste during the pandemic had raised fear among biomedical waste handlers 13, 14, 15 because the virus created an uncertain work environment and increased the occupational risk of exposure, leading to occupational stress. After that new materials wewe added to the biomedical waste generated during the pandemic, especially from the quarantine centers. To overcome this panic situation, the central pollution control board and the All India Institute of Medical Sciences (AIIMS) New Delhi, framed new guidelines for the safe handling and disposal of bio-medical waste. The state and central pollution control board suggested strict adherence to all the guidelines laid previously in bio-medical waste rules 2016-2020 after 1998 and adopted additional precautionary measures. bio-medical waste rudimentary disposal and the lack of a proper system heightened the risk of hospital-acquired infection and several other environmental hazards. The likelihood of health hazards has seen an increase by many folds during the pandemic due to the high infectivity of the virus (WHO, 1998, 2014, 2016, 2017 & 2020) Additional precautionary measures and amendments to lessen the probable transmission of COVID-19 via biomedical waste are explained below.

CONCLUSION

The new biomedical waste management rules have been notified to efficiently manage bio-medical waste in the country. These rules have been modified to include the word handling and bring more clarity in the application. In addition, strict rules have been made to ensure no pilferage of recyclables item, no secondary handling or in advent scattering or spillage by animals during transport from the HCFs to the common bio-medical waste treatment facility (CBMWTF). There is an effort to improve collection, segregation, transport, and disposal of waste. Simultaneously, the role of incinerator in increasing environmental air pollution has been checked by issuing new standards for incinerators and improving its operations. Most recently a strain called JN.1 moved swiftly to become the most widely circulating variant in the United States, making up more than 60% of cases in early January 10, 2024. Key features of Bio-Medical Waste Management (Amendment) Rules 2018. Now we should follow the highlights of the Second E-Waste Management Amendment Rules 2023, *i.e.*, rules pertaining to Refrigeration and Air Conditioning Equipment, Conversion Factor for the Generation of EPR Certificates, Alteration in the RoHS Compliance and Addition and Elaboration of Medical Devices (Goswami *et al*., 2021).

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