BIO-MEDICAL WASTE MANAGEMENT DURING COVID-19

Abstract

The COVID 19 is also known as Corona virus pandemic; It is a global destruction which was caused by severe acute respiratory syndrome coronavirus 2(SARS-COV-2). During these prevalent times proper disposal of medicine waste is essential to minimize the spread as infection. People disposed these ways into regular trash can (i.e) along with household trash and was heated like any other domestic waste. The objective is to suggest the collection of these waste from domestic and protect their natural resources like water, soil and include animals from the effect of SARS. Different dimensions of biomedical waste (BMW) Management during COVID Pandemic including existing guidelines infrastructure operational practice and aspect of waste handles.

Keywords: Bio-Medical,M Waste Management.

Authors

Bhoomika. S
Department of Pharmaceutical Quality Assurance
SRM College of Pharmacy
Kattankulathur, Chennai, Tamil Nadu,India.

Jawahar Rohith. R
Department of Pharmaceutical Quality Assurance
SRM College of Pharmacy
Kattankulathur, Chennai, Tamil Nadu,India.

Mohammed Abbas. M
Department of Pharmaceutical Quality Assurance
SRM College of Pharmacy
Kattankulathur, Chennai, Tamil Nadu,India.

Abdul Kaleem. M
Department of Pharmaceutical Quality Assurance
SRM College of Pharmacy
Kattankulathur, Chennai, Tamil Nadu,India.

Kanaka Parvathi Kannaiah
Assistant Professor
Department of Pharmaceutical Quality Assurance
SRM College of Pharmacy
Kattankulathur, Chennai, Tamil Nadu,India.

I. INTRODUCTION

The covid 19 global pandemic had a very huge impact on everyone's life. During this. A lot of effort was taken by government and some other organization for continuously monitoring in every aspect of COVID 19 spread. Various studies have been found on this topic. According to WHO, BMW includes non-hazardous waste 85% and hazardous weighs 15% with infectious waste consisting of 10% and radioactive or chemical waste 5%[1]. Many deaths have been noticed in every year as a result of disease caused by medical waste. According to survey, nearly 5.3 million people including 4 million children die due to this condition[2]. This study showcases a fall of assessment as production, collection and management of BMW throughout the India. The amount of BMW obtained is very difficult to calculate, it was noticed in a study that increase in production of BMW is 6 times more, compared to a situation before the outbreak as COVID.

II. CONTENT

When Covid Scenario tightened up its hold on the country. Covid 19 was the most hazardous waste mentioned by central pollution control board.

III. SOURCES OF BMW

They classified into two main types

1. **Primary:** They consist of waste generated from hospital, nursing Centre, Medical, College, Research Lab, blood bank, immunization Centre, veterinary, Biotech Institution, Animal, Research center College.

2. **Secondary:** Include small clinics, ambulance, funeral service and educational institute.

IV. TREATMENT FOR BIOMEDICAL WASTE

There are many options available for the proper treatment of biomedical waste during COVID. They are;

1. **Chemical Process:** In this process chemicals like sodium, hypochlorite peracetic acid, hydrogen peroxide and ocean are used as disinfectant. All viruses and organic materials are effectively inactivated by running this process for a set amount of time inside a covered system. By utilizing high-efficiency particle absolute filters, the potential for chemical aerosol production throughout the process is reduced. The procedure' primary drawback is that it discharges a significant amount of Cl2 gas into the atmosphere. It is important to evaluate and properly dispose of both the process's residue and effluent. Additionally, it produces hazardous effluent that needs additional treatment, raising the entire process cost. For the complete destruction of BMWs, the technique is combined with a mechanical shredder. Although it is a straightforward cleaning method, the BMWs must first be properly destroyed before going through the chemical disinfection process.

2. **Thermal Process:** Here heat is used to disinfect. They are grouped into two types based on the temperature they operate

- **Low Heat System**

➢ **Autoclaves Technique:** BMWS are effectively get disinfected by this technique . In this technique infected BMWS disinfected by high heat and pressure to sterilize infected BMWS it is most used technique for treatment of hazardous biomedical waste and this technique does not require any expert. This process takes less amount of time and it is eco-friendly but cost of installation is high. This is not suitable for chemical and pharmaceutical waste as it produces unpleasant odour and toxic fumes.

➢ **Microwave Treatment:** This method operates between 200 to 1600̊ c for reverse polymerization and thermal depolymerization .It breakdown the organic substance of BMWS using high energy microwaves in nitrogen atmosphere. This is eco-friendly and it doesn't produce any by product or emission on this process. During covid pandemic micro wave devices are designed and many remote microwave devices are designed that is used to disinfect the covid virus . remote microwave has played more important role in on site treatment for BMWs [3]

- **High Level Systems**

➢ **Incineration:** Incineration is the most commonly used method for BMWS treatment .incinerator is mandatory in every hospital .According CPCB there are 232 incinerator plants available in india for treatment of BMWS .However this processes produces high toxic by product and this may cause risk to environment .combined effect of combustion efficacy and segregation system is used to minimize the byproduct of incineration.

3. **Encapsulation and Inertization:** It is only possible to use this as a disposal method once the BMWs have been thoroughly cleaned. This method involves using a crusher machine to grind or break the raw BMWs into small pieces, which are subsequently cleaned and sterilized. The cleaned pieces are placed in metal drums, shielded with polyethylene foam, and thrown into the trash after that. This method is only used when there are no other practical or suitable alternatives for disposal. For the limited number of BMWs, this is a practice. The cost of operation and the equipment are both straightforward and low. When the daily production of BMW surpasses the capability of treatment facilities, this procedure is frequently used during pandemic periods. Many nations experienced the pandemic while it

4. **Mechanical Process:** This method is used to change the physical form as the waste for their proper handling

Types:

- **Compaction:** Reduce Volume Waste is compacted during this process, which also results in a reduction in size. rubbish is compressed so that more of it can be kept in the same volume using garbage compactors and rubbish collecting vehicles. To preserve vital airspace and lengthen the life of the landfill, waste is compacted once more but this time more thoroughly.

- **Shredding:** Destroy Plastic and papers waste to prevent their reuse. By using this method, you can recycle plastic more easily and produce a lot less BMWs overall. Metal wastes must to be kept out of the shredders since they can harm the metal blades on them. The pre-treated BMWs are chopped into small pieces during this operation using a shredder. An experienced team should run the shredders. Shredders are typically integrated parts of a thermal or chemical disinfection system.

5. **Irradiation Process:** Wastes are exposed to UV/Ionizing radiation in an enclosed chamber. By subjecting garbage to gamma rays, which are toxic to germs, irradiation disinfects the waste. The use of a cobalt radioactive isotope is made. In irradiation, microorganisms are meant to be killed in order to sterilize equipment or treat trash. Some technologies for treating radiation employ electron beams. The garbage does not need to be taken out of the plastic bag before treatment because both gamma rays and electron beams can pass through them.[4]

   Process designers frequently incorporate mechanical grinding or shredding upstream because irradiation does not alter the look of the waste. Additionally, this reduces the size of the waste particles, which generally improves the treatment's effectiveness[5].

6. **Biological Process:** Enzymes are used in this method to treat medical waste.

V. MANAGEMENT

Home health care is a special condition. Medical waste at home without any guidance of nurse/healthcare profession. There was under no special regulation therefore it can be treated as a regular household waste[6].

According to biomedical waste (management and handling rules, 1998 of India). Waste which is generated during the diagnosis treatment or immunization as human beings or animals or in research activities pertaining There to or in the production or testing of biologicals.[7]

During pandemic a huge amount of medicinal product was used by people which in turn becomes household waste like medicine, wrappers, hand gloves and sanitizers, Shield, mask, tissues, were among the things discarded in huge amount. The most important primary components of these waste are[8]:

- Plastic - 40-50%
- Textile – 15-30%
- Paper - 10-15%
- Glass – 5-15%
- Woodware- 3-10%
- Rubber- 3-7%
- Metal- 0.5-5%
- Others- 10-15%

These waste materials may have viruses and they are capable of transmitting the infection To living beings. Colour coded criteria for the correct disposal of biomedical waste:[9]

- Yellow
- Red
- Blue
- White
- Black
- Green

Table 1: Colour Coded Criteria

S.No	Colour Coding	Waste Content	Components	Methods and Treatment of Disposal
1	Yellow	Animal waste	It consist of body parts,tissues and bleeding parts	Deep burial/incineration
2	Yellow	Biotechnology and microbiology waste	Laboratory waste such as cultures and microoraganisms specimen	Micro waving/ local autoclaving
3	Yellow	Human Anatomical waste	Human oragns,tissues and body parts	Deep burial/incineration
4	Blue	Solid waste	Wastes other than waste sharps such as I.V set	Chemical treatments/Disinfectants
5	White	Liquid waste	Waste from laboratories and research labs	Disinfection by chemical treatment and disposal into drains
6	Black	Chemical waste	Chemicals which was used in disinfection ,insecticides	Disposed into drains after chemical treatment
7	Red	Plastic waste	Syringe ,gloves and infected plastics	Deep burial/secured land filling

VI. DUTIES OF GOVERNING BODIES IN WASTE MANAGEMENT DURING COVID-19

Governing bodies such as:

- CBWTF(Common biomedical waste treatment and disposal.facility.CO)
- SPCB(State pollution control board)
- ULB(Urban local body)

These bodies play a vital role in management of biomedical waste in pandemic and their functions are mentioned below[10]:

1. **CBWTF:** The sanitation worker should receive sufficient instruction and safety equipment. Work with non-COVID garbage should be the sole responsibility of sanitation workers over 50 years. There must be a strict record of every COVID-19 trash that is gathered and treated. The same day that waste is collected, COVID-19 waste must all be processed or treated. Daily cleaning with 1% sodium hypochlorite is required for all vehicles, trolleys, and storage areas. The COVID-19 tracking app should receive daily report updates.

2. **SPCB:** SPCB has a responsibility to make operating care homes and quarantine facilities easier by easing the certification process. All isolation/quarantine households must establish and maintain communication with the CBWTF. The 2016 revised version of the BMWM regulations govern how violations by any participant are handled.[11]

3. **ULB:** All garbage must be safely collected and transported by ULBs from the waste generation facility to the CBWTF. For the BMW doorstep collection, they must form distinct teams to avoid any COVID19 waste and nonCOVID19 rubbish from being mixed together. Sanitation personnel must receive the necessary instruction and safety equipment.

VII. DISPOSAL OF UNIDENTIFIED, SUSPECTED, AND CONFIRMED COVID19 PATIENT CASES' DECEASED BODIES IN A SAFE MANNER

Patients with COVID19 are not required to burn dead bodies in an incinerator. There hasn't yet been any proof that patients have been exposed to a confirmed COVID19 patient's dead body. Although handling dead bodies safely is advised, there may not be much risk of infection. The exterior of the body bag should be sterilized with 1% hypochlorite to prevent bacterial growth. When handling dead people, PPE, including gloves, a mask, a gown, and goggles, must be used. Burial poses no additional environmental risk. Ashes left over from cremations can be gathered by the relatives because they pose no more risk. Use 1% hypochlorite to sanitize transportation vehicles for the morgue.[12][13]

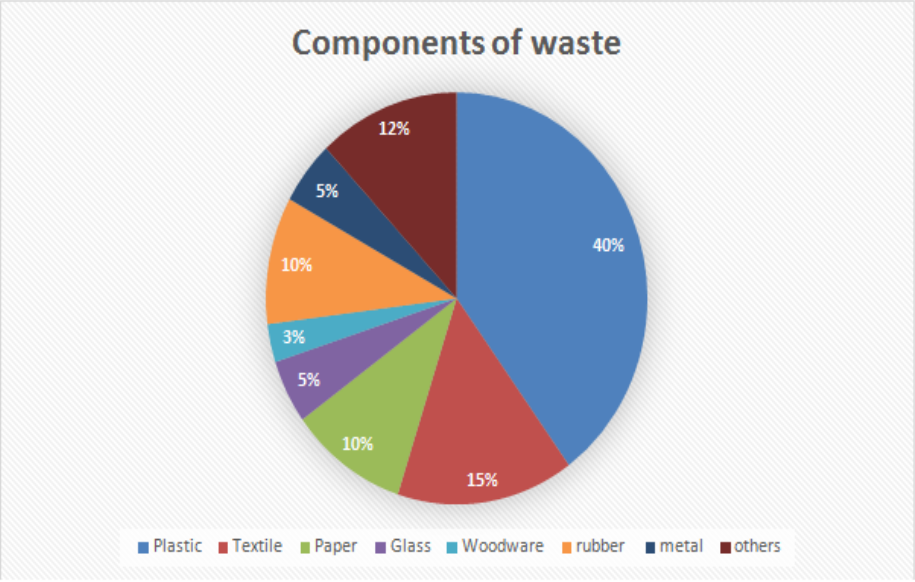

Figure 1: Components of Waste

VIII. RESULTS OF NEGLIGENCE IN THE TREATMENT OF BIOMEDICAL WASTE

If BMW is not handled appropriately, it may be to blame for producing numerous, large-scale vectors that hasten the spread of vector-borne diseases. Additionally, it pollutes land and water and spreads pandemics and diseases like AIDS through contaminated syringes and needles. COVID-19.[14]

BMW management issues and garbage mixing lead to soil, water, and air pollution. Thus, it breeds infectious diseases and poor health. Today, the relationship between BMW generation and therapy is inverted. Such a scenario suggests that our nation will soon drown in its own rubbish. negligence in bio medical waste results in causing various health issue to humans and animal in order to avoid this awareness program should be conducted and education to rural people[15]

IX. LOCATION OF TREATMENT

An key consideration in BMW management is the distance between hospitals and the facilities used for their treatments. Typically, BMW transit trucks or trolleys are used to transfer the separated BMWs to the treatment facilities in various bags with labels on them. Dragging the loaded BMW baggage is not permitted under any circumstances. Reaching the destinations requires a lot of time if the distance is greater. Durable transportation raises the potential of baggage breaking, which results in a foul smell and a modest mass loss along the road without the driver's knowledge. Therefore, BMW treatment facilities should be established in an appropriate area close to the hospitals.[16]

X. CONCLUSION

Comparing to other nations India has reported highest number of covid 19 cases which respectively contributed a enormous amount of biomedical waste such as gloves mask sanitizers syringe needle and shields and vaccination discards. Improper disposal of these waste lead to detoriation of environmental bodies .various management techniques were introduced by the government of India and positive response was absorbed .the main objective of this management technique is segregate the waste based on colour coded criteria and appropriate treatment were executed. Future of biomedical waste management include turning waste into energy , improvement in monitoring systems, data collection and much more technology based advancement .

REFERENCE

[1] P. Saxena, I.P. Pradhan, D. Kumar, Redefining bio medical waste management during COVID- 19 in india: A way forward, Mater. Today Proc. 60 (2022) 849–858. https://doi.org/10.1016/j.matpr.2021.09.507.
[2] K. Kathiravan, A. Vidyasakar, C. Pradeep, U. Natesan, K. Ajith Kumar, V. Arun Bharathi, G. Nantha Kumar, S.D. Arun Prakash, Chorographic assessment on the overburden of single-use plastics bio-medical wastes risks and management during COVID-19 pandemic in India, Total Environ. Res. Themes. 7 (2023) 100062. https://doi.org/10.1016/j.totert.2023.100062.
[3] V. Gautam, R. Thapar, M. Sharma, Biomedical waste management: Incineration vs. environmental safety, Indian J. Med. Microbiol. 28 (2010) 191–192. https://doi.org/10.4103/0255-0857.66465.
[4] R.I. Masud, K.H. Suman, S. Tasnim, M.S. Begum, M.H. Sikder, M.J. Uddin, M.N. Haque, A review on enhanced microplastics derived from biomedical waste during the COVID-19 pandemic with its toxicity,

health risks, and biomarkers, Environ. Res. 216 (2023) 114434. https://doi.org/10.1016/j.envres.2022.114434.

[5] M. Achak, S. Alaoui Bakri, Y. Chhiti, F.E. M'hamdi Alaoui, N. Barka, W. Boumya, SARS-CoV-2 in hospital wastewater during outbreak of COVID-19: A review on detection, survival and disinfection technologies, Sci. Total Environ. 761 (2021). https://doi.org/10.1016/j.scitotenv.2020.143192.

[6] V.K. Parida, D. Sikarwar, A. Majumder, A.K. Gupta, An assessment of hospital wastewater and biomedical waste generation, existing legislations, risk assessment, treatment processes, and scenario during COVID-19, J. Environ. Manage. 308 (2022) 114609. https://doi.org/10.1016/j.jenvman.2022.114609.

[7] A. Nabavi-Pelesaraei, N. Mohammadkashi, L. Naderloo, M. Abbasi, K. wing Chau, Principal of environmental life cycle assessment for medical waste during COVID-19 outbreak to support sustainable development goals, Sci. Total Environ. 827 (2022). https://doi.org/10.1016/j.scitotenv.2022.154416.

[8] M.R. Capoor, A. Parida, Current perspectives of biomedical waste management in context of COVID-19", Indian J. Med. Microbiol. 39 (2021) 171–178. https://doi.org/10.1016/j.ijmmb.2021.03.003.

[9] P. Sharma, A Review on Biomedical Waste and its Management, Significances Bioeng. Biosci. 1 (2018). https://doi.org/10.31031/sbb.2018.01.000522.

[10] L. Joseph, H. Paul, J. Premkumar, Rabindranath, R. Paul, J.S. Michael, Biomedical waste management: Study on the awareness and practice among healthcare workers in a tertiary teaching hospital, Indian J. Med. Microbiol. 33 (2015) 129–131. https://doi.org/10.4103/0255-0857.148411.

[11] P. Agrawal, G. Kaur, S.S. Kolekar, Investigation on biomedical waste management of hospitals using cohort intelligence algorithm, Soft Comput. Lett. 3 (2021) 100008. https://doi.org/10.1016/j.socl.2020.100008.

[12] S. Ilyas, R.R. Srivastava, H. Kim, Disinfection technology and strategies for COVID-19 hospital and bio-medical waste management, Sci. Total Environ. 749 (2020). https://doi.org/10.1016/j.scitotenv.2020.141652.

[13] S. Saha, R. Chaki, IoT based smart waste management system in aspect of COVID-19, J. Open Innov. Technol. Mark. Complex. 9 (2023) 100048. https://doi.org/10.1016/j.joitmc.2023.100048.

[14] A.D. Igalavithana, X. Yuan, C.P. Attanayake, S. Wang, S. You, D.C.W. Tsang, A. Nzihou, Y.S. Ok, Sustainable management of plastic wastes in COVID-19 pandemic: The biochar solution, Environ. Res. 212 (2022). https://doi.org/10.1016/j.envres.2022.113495.

[15] S. Shekoohiyan, F. Parsaee, S. Ghayour, Assessment of knowledge, attitude and practice about biomedical waste management among healthcare staff of Fasa educational hospitals in COVID-19 pandemic, Case Stud. Chem. Environ. Eng. 6 (2022) 100207. https://doi.org/10.1016/j.cscee.2022.100207.

[16] P.C. Ojha, S.S. Satpathy, A.K. Ojha, L.B. Sukla, D. Pradhan, Overcoming challenges due to enhanced biomedical waste generation during COVID-19 pandemic, Sci. Total Environ. 832 (2022) 155072. https://doi.org/10.1016/j.scitotenv.2022.155072.

