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A Reviw E: Biomedical Waste Management.

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ABSTRACT:
The management of biomedical waste is a vital aspect of healthcare industry, which encompasses the proper handling, segregation, transportation and disposal of various types of healthcare waste. The generation of biomedical waste is on the rise and the lack of proper management can lead to serious health and environmental hazards. This review article provides on overview of the current status of biomedical waste management practice, including the type of waste generated in healthcare settings, regulatory requirements, various steps of waste management and methods of waste treatment and disposal. The article highlights the importance of proper segregation of biomedical waste and utilization appropriate protective appliance to decrease the risk of infection during handling and disposal.

KEYWORDS: Biomedical, hazards, waste, management, healthcare.

I. INTRODUCTION:

Biomedical waste means any waste, which is generated during the laboratory diagnosis, treatment or immunization of human being or animals or research activities pertaining thereto or in the production or testing of biological or in health camps.[1] Management includes all steps required to ensure that biomedical waste is managed in such a manner as to protect health and environment against any adverse effects due to handling of such waste.[2]

Biomedical waste management is a critical issue that has a significant impact on public health and environmental safety. Healthcare facilities generate a variety of waste materials, including infections, hazardous and non-hazardous waste which require proper handling treatment and disposal to prevent the spread of diseases and minimize environmental pollution. The effective management of biomedical waste is essential to ensure that safety of healthcare workers, patients and the general public.

The objective of this review article is to provide a comprehensive overview of the current state of biomedical waste management Practices, including the types of waste generated in healthcare settings, regulatory requirements, various steps of waste management, methods of waste treatment and disposal. The article also highlights the challenges associated with biomedical waste management.

The article begins with the importance of biomedical waste management and its impact on public health and environmental safety. It then explores the different types of biomedical waste generated in healthcare facilities and their potential hazards. The regulatory requirements for biomedical waste management, then explain various methods of waste treatment and disposal, including incineration, autoclaving. chemical treatment and landfilling. Finally, the article concludes by emphasizing the need for improved biomedical waste management practices.

II. LITERARY REVIEW:

❖ IMPORTANCE OF BIOMEDICAL WASTE MANAGEMENT:

In 2010, unsafe injections were responsible for as many as 33800 new HIV infections, 1.7 million hepatitis B infection and 315000 hepatitis C infections. [3] [4]Improper management of biomedical waste poses a significant risk to public health as it may contain harmful microorganisms that cause diseases in humans and animals.Therefore, it is crucial to handle, collect, transport, treat, and dispose of biomedical waste properly to prevent the spread of disease and reduce the risk of infection. In addition to public health concerns, biomedical waste also contains hazardous materials that can pollute the environment, leading to serious environmental problems. To protect the ecosystem and minimize the impact of these substances, proper biomedical waste management is necessary. Furthermore, healthcare facilities must comply with regulations that require proper management and disposal of biomedical waste to avoid potential legal and financial consequences, including fines and legal action, which could damage their reputation. Finally, healthcare workers who handle biomedical waste are at risk of exposure to harmful substances

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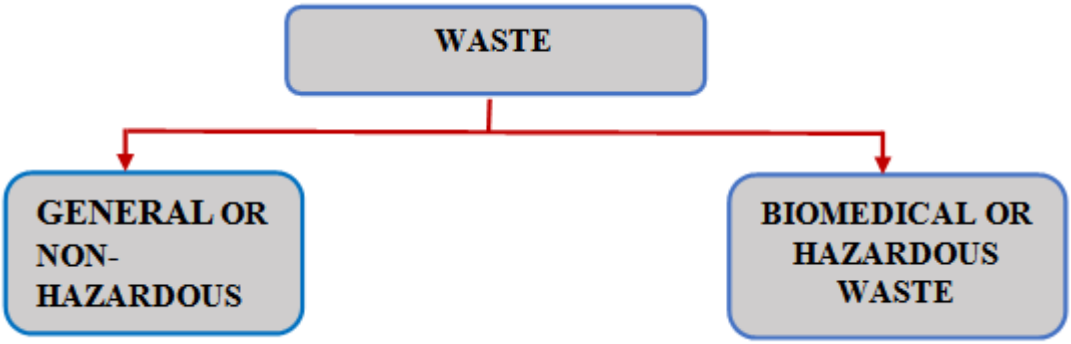
such as infectious agents, sharps, and chemicals. Proper biomedical waste management can protect their health and safety by reducing the risk of occupational exposure.[5]

❖ **CURRENT STATUS:**

Worldwide, safe waste management services for healthcare waste are lacking, especially in least developed countries. The available data from 2019 indicate that one in three healthcare facilities globally do not safely manage healthcare waste.[6]According to Ministry of Environment, Forest and Climate change, gross generation of biomedical waste management in India is about 484 tons per day from 1,68,869 healthcare facilities. Unfortunately, only 447tons per day is treated and 37 tons per day that is approximately 8% is left untreated. (final and updated annual report-2013 central Pollution Control Board, hazardous waste management division)[7] At present, 550.9 tons of biomedical waste is generated daily and is likely to reach about 775.5 tons per day by 2022 in India. That means annual growth rate of biomedical waste is 7%. [8] [9]

CLASSIFICATION OF BIOMEDICAL WASTE:

There are two type of waste general or non- hazardous waste and biomedical or hazardous waste. biomedical waste (15%)which is classified into two categories that is infectious waste (10%) and chemical radioactive waste (5%).[10]Nearly 75-90% General waste that is non-hazardous healthcare waste and 10- 25% is hazardous. [11]It is important to realise that if both these types are mixed together then the whole waste become harmful. [12] The WHO has categorized the biomedical waste into eight categories includes, general waste, infectious or dangerous waste, radioactive chemical, pathological, pressurized containers, pharmaceuticals.[13]



1. GENERAL ORNON- HAZARDOUS WASTE:

Vast majority of waste falls in this category. They are not considered as a biomedical waste, therefore should not be mixed with biomedical waste.[14]

2. BIOMEDICAL OR HAZARDOUS WASTE:

The waste is generated during the laboratory diagnosis, treatment or immunization of human being or animals or research activities pertaining thereto or in the production or testing of biological or in health camps. Biomedical waste is the term used to describe all waste generated by healthcare facilities that could have negative consequences for the environment or human health if not disposed of appropriately. Such waste is categorized as infectious and must be managed in accordance with the regulations established by the biomedical waste management rules of 2016 to mitigate any harmful impacts.[15]

❖ **SOURCES OF BIOMEDICAL WASTE:**

Biomedical waste is generated primarily from health care establishment including Hospitals, Nursing home, Veterinary hospitals, Clinics and General practitioners, Dispensaries, Blood banks, Animal house and Research institutes. The other source of biomedical waste are Households, Industries, Education institutes and Research centres. [16]

❖ **WASTE MANAGEMENT HIERARCHY:**

The waste management hierarchy is a conceptual framework largely based on the '3Rs' that is Reduce, Reuse and Recycle and these all related to sustainable use of resources.[17] [18]

- Reduce: To prevent the production of waste as possible as which diminish the quantity of waste.
- Reuse or Recycle: To reuse or recycle after processing.

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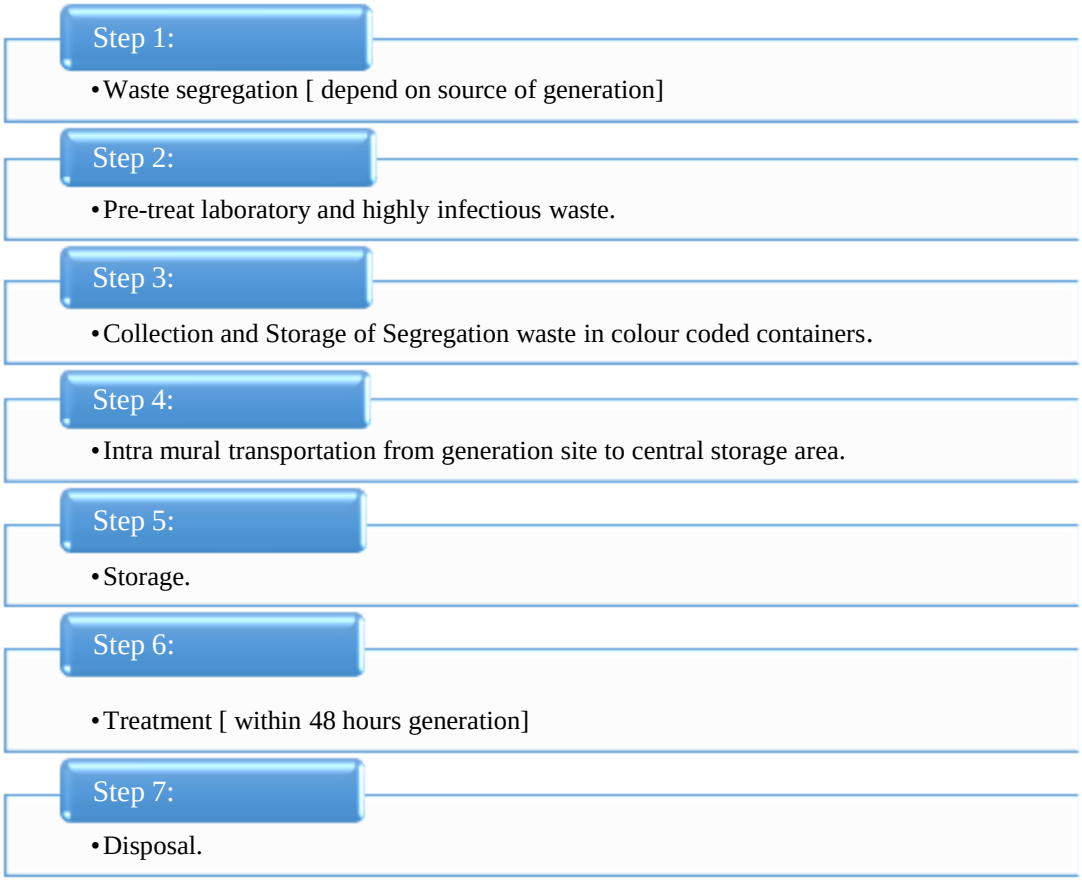
- Recover: When recycle not possible then waste is converted to fuel for generating electricity or direct heating.
- Treat: Waste cannot be recovered must then be deal with treatment like incineration, autoclave, hydroclaving, chemical disinfection etc.
- Dispose: The least preferable option is disposal in landfill or dump yard.

❖ **STEPS OF BIOMEDICAL WASTE MANAGEMENT:**[19] [20]



❖ **REGULATORY REQUIRMENTS:**[21]

Proper management of biomedical waste is a critical aspect of healthcare facility operations to prevent the spread of infectious disease and environmental pollution. Regulatory bodies such as the world Health Organization and United Sates Environmental Protection Agency. In India, the Ministry of Environment, Forest and Climate Change (MoEFCC) and the Central Pollution Control Board (CPCB) have established the biomedical waste management rules, 2016, which dictate the regulatory requirement for managing biomedical waste. These requirements apply to anyone who generates, collects, receives, stores, transports, treat, disposes or handles biomedical waste in any form. Some of the key regulatory requirements for biomedical waste management in India include:

1. Classification of biomedical waste: Biomedical waste classified bases on its unique attributes, which encompass a wide range of categories including infectious, pathological, sharps, chemical and pharmaceutical waste.
2. Collection and Storage: healthcare facilities must comply with regulation that mandate the segregation and separate storage of biomedical waste from other waste type to ensure safe disposal. Biomedical waste must be placed in container that are leak-proof, puncture-resistant, appropriately labelled and colour coded.
3. Transportation: Authorized persons with appropriate labelling, marking and documentation must transport biomedical waste in authorized vehicles.
4. Treatment and disposal: To minimize the risk of infection and environmental contamination,

it is essential to treat and dispose of biomedical waste appropriately. Treatment options such as autoclaving, microwaving, chemical disinfection or incineration can be used, while disposal methods may include landfilling or recycling.

5. Record- keeping: Records of the quantity type and treatment or disposal method of waste generated and disposed of must be maintained by all individuals involved in biomedical waste management.

In 2016, Biomedical waste management published new guidelines aimed at simplifying the categorization of their vehicles and improving the ease of their segregation, transportation and disposal. An amendment was added to the guidelines in 2018 to further improve their effectiveness.[22] [23]

❖ **CATEGORIES OF BIOMEDICAL WASTE:**[24] [25] [26]

Category	Waste Content	Components	Method of treatment and disposal
Category No. 1.	Human Anatomical Waste.	Human tissues, organs, body parts.	Incineration or Deep burial.
Category No. 2.	Animal Waste.	Animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animal used in research, waste generated by veterinary hospital colleges, discharge from hospitals, animal houses	Incineration or Deep burial.
Category No. 3.	Microbiology and Biotechnology Waste.	Waste from laboratory cultures, stocks or specimens of micro-organisms love or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer to cultures.	Local autoclaving or microwaving or Incineration.
Category No. 4.	Waste sharps.	This included both used and unused Needles, syringes, scalpels, blades, glass etc. that may cause puncture and cuts.	Disinfection by Chemical treatment, autoclaving or microwaving.
Category No. 5.	Discarded Medicine and Cytotoxic Drugs	Wastes comprising discarded, outdated and contaminated medicines.	Incineration. or Destruction and Drug disposal in secured landfills.
Category No. 6.	Soiled Waste.	Items contaminated with blood and body fluids including cotton, dressings, soiled plaster casts, lines, beddings, other material.	Incineration or autoclaving or microwaving.
Category No. 7	Solid Waste.	Wastes generated from disposable items other than the waste sharps such as tubing's, catheters, intravenous sets etc.	Disinfection by Chemical treatment, autoclaving or microwaving.
Category No. 8.	Liquid Waste.	Wastes generated from laboratory and washing, cleaning, house kipping and disinfecting activities.	Disinfection by Chemical treatment,.
Category No. 9.	Incineration Ash.	Ash from incineration of any biomedical waste.	Disposal in municipal landfill.
Category No. 10.	Chemical Waste.	Chemical used in production of biologicals, chemicals used in disinfection , as insecticides, etc.	Chemical discharge into drains for liquids and secured landfill for solids.

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❖ **METHODS OF WASTE TREATMENT:**

Biomedical waste management is a hazardous waste that arises from healthcare facilities, including hospital, clinics and laboratories, which could contain infectious agents or other hazardous substances. Adequate treatment and disposal of biomedical waste are crucial in preventing the transmission of diseases and safeguarding the environment. Here are some common methods of treatment for biomedical waste.

1. **Autoclaving:** Autoclaving is a sterilization method that employs high pressure (15 pound per square inch) and temperature (121^{o} C)for 60 Minutes to eliminate waste. The process entails confining the waste in a closed chamber and exposing it to.[27] [28]
2. **Incineration:** Incineration is a waste management technique that entails the use of high temperature (800-1400^{o} C) combust waste, resulting in the destruction of pathogens and hazardous substances. The residue, which is in the form of ash, is generally discarded in a landfill.[29]
3. **Chemical Disinfectant:** Chemical disinfectant is commonly employed for liquid waste treatment, utilizing agents like chlorine or hydrogen peroxide to eliminate harmful pathogens. Several techniques such as oxidation, reduction, precipitation and pH neutralization are utilized to convert waste into less hazardous substances.[30] [31]
4. **Microwave Treatment:** Microwave have the potential to sterilize waste through a process of exposing the waste to high-frequency radiation within a microwave unit, which effectively eliminates any microorganism present, but shall not be used for cytotoxic, radioactive wastes, contaminated animal carcasses and large metal items.[32]
5. **Hydroclaving:**Hydroclaving is a type of sterilization method that uses high pressure and high temperature to process and sterilize biomedical waste. It is also known as autoclaving or steam sterilization. This process is commonly used in healthcare facilities to safely dispose of medical waste, including items such as sharps (needles, scalpels, etc.), laboratory cultures, and biological waste.[33]
6. **Deep Burial:** The waste materials are usually buried at a depth of two meters or more, in order to prevent their release into the environment and minimize potential harm to human health and ecosystem. It Should be half filled with waste then covered with lime within 50cm of the surface and rest of the pit filled with soil. [34]
7. **Sharp pit:** A sharp pit must be constructed within the hospital premise.[35] It is used for the safe and effective management of sharp medical waste, such as needles syringes and scalpels. [36]
8. **Encapsulation:**This process typically involves placing the waste material into bag or container made polymer and then using heat, pressure or a combination of both to seal it.[37]
9. **Inertization:** Inertization is a waste management technique that involves mixing the waste with cement and other materials before disposal, in order to reduce the risk of hazardous substances in the waste leaching into surface or ground water.[38]
10. **Plasma Pyrolysis:** Plasma pyrolysis utilizes high temperature ionized gas, known as plasma, to break down the complex molecules found in biomedical waste into their constituent parts, rendering it highly efficient in destroying a wide range of biomedical waste, including infectious materials, sharps and chemical waste.[39]
11. **Landfill:** A landfill is a commonly used method for disposing of large quantities of solid waste, including the ashes resulting from incineration, which represent the final step in this process. [40]

III. DISCUSSION:

❖ **IMPORTANCE OF PROPER SEGREGATION OF BIOMEDICAL WASTE AND UTILIZATION APPROPRIATE PROTECTIVE APPLIANCE:**

Proper segregation of biomedical waste is essential as it can significantly impact public health and the environment. Proper segregation of biomedical waste is of utmost importance due to minimize the risk of infection spread, it is essential to handle and dispose of biomedical waste separately from other type of waste and this can be achieved through proper segregation.[41] Biomedical waste contains hazardous materials that can be harmful to the environment and wildlife, which is why it is essential to ensure proper segregation to prevent any potential harm. Proper segregation makes it easier to manage and dispose the waste and also reduce the risk of injury and illness among workers.

Improper handling and disposal of biomedical waste and other waste can pose a significant risk of infection. To mitigate this risk, healthcare workers should use protective appliances such as disposable gloves, masks,

gowns, eye protection and footwear covers. It is also crucial to use sharps containers for the safe disposal of sharp items and place biomedical waste in leak-proof, strong biohazard bags marked with the biohazard symbol. Using protective appliances can help healthcare workers accomplish proper handling and disposal of biomedical waste.[42]

❖ **CHALLENGES ASSOCIATE WITH BIOMEDICAL WASTE MANAGEMENT:**

The implementation of the biomedical waste management 2016 rules presents a major hurdle for government hospitals and other small healthcare facilities, as they struggle to secure adequate funding for the adoption of new procedures. The high cost of eliminating chlorinated plastic bags, gloves, blood bags and establishment of a bar code framework for bags and containers, along with the strict two-year timeline for implementation, have severely limited their capacity to conform to the regulations.[43] The deadline for phasing out these waste materials has been extended until 2019, and the new biomedical waste management rules 2018 have excluded blood bags. Due to the vast amount of biomedical waste generated, the limited number of Common Biomedical Waste Treatment and Disposal Facility (CBMWTF) needs to be developed further. Eight states and Union Territories in India are yet to establish CBWTF, and several facilities have not followed schedule II of biomedical waste management Rule 2016 by installing Effluent Treatment Plants or Sewage Treatment Plants for liquid waste disposal. Although the acceptable Suspended Particulate Matter emissions limit from incinerators has been reduced, they still emit toxic air pollutants, and incinerator ash is potentially hazardous.[44]

IV. CONCLUSSION:

The proper management of biomedical waste is a critical aspect of modern healthcare systems. With the increasing prevalence of infectious diseases and the growing demand for medical services, it is more important than ever to adopt sustainable and effective waste management practices. Through the implementation of comprehensive waste management policies and protocols, healthcare facilities can minimize the risk of contamination and environmental harm, while also promoting public health and safety. The challenges of biomedical waste management are many, but by working together and leveraging the latest technologies and best practices, we can create a healthier and more sustainable future for generations to come.

REFERANCES:

[1]. CPCB (2020) Pictorial guide on biomedical waste management rules 2016 (Amended in 2018 and 2019). Central Pollution Control Board. https://cpcb.nic.in/uploads/projects/biomedicalwaste

[2]. Central Pollution Control Board. Guidelines for Management of waste as per Biomedical Waste Management Rules, 2016 https://cpcb.nic.in/uploads/projects/biomedicalwaste

[3]. Pépin J, Abou Chakra CN, Pépin E, Nault V, Valiquette L. Evolution of the global burden of viral infections from unsafe medical injections, 2000-2010.PLoSOne. 2014 Jun 9;9(6):e99677.

[4]. World Health Organization Available at: https://www.who.int/news-room/fact-sheets/detail/health-care-waste

[5]. Renju Rajan, Delvin T. Robin, Vandanarani M. Biomedical waste management in Ayurveda hospital- current practices and future prospective. Journal of Ayurveda and Integrative Medicine 10 (2019) 214-221.

[6]. World Health Organization.Global Analysis of Health Care Waste in the context of Covid-19: status, impacts and recommendations. Available at: https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health

[7]. Dr. Apurba S Sastry, Dr. Deepashree R. Essentials of Hospital Infection Control: Waste Management in Healthcare Facility. 1st Eidition.Jaypee Brothers Medical Publisher:Kathmandu, Nepal; 2019. Page no. 400.

[8]. World Health Organization. Modes of transmission of virus causing COVID-19: implications for IPC precautions recommendation (COVID-19). Available at: https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations.

[9]. Singh A, Unnikrishnan S, Dongre S. Biomedical waste management in India: awareness and novel approaches. Biomed J Sci Tech Res. 2019;13(04):10089-10091.

[10]. Dr. Apurba S Sastry, Dr. Deepashree R. Essentials of Hospital Infection Control:

Waste Management in Healthcare Facility. 1st Eidition.Jaypee Brothers Medical Publisher:Kathmandu, Nepal; 2019. Page no. 399.

[11]. Anju Singh, Seema Unnikrishnan, Samriddhi Dongre. Biomedical Waste Management in India: Awareness and Novel Approaches. Biomed J Sci & Tech Res 13(4)- 2019. BJSTR MS.ID.002424. DOI: 10.26717/ BJSTR-2019.13.002424.

[12]. Palanisamy Pasupathi, Sivaraman Sindhu, Babu Shankar Ponnusha, Athimoolam Ambika. Biomedical waste management for health care industry. Int J Bio Med Res.2011;2(1):472-486.

[13]. Aravindan Achutan, Vasumathi Ayyallu Madangopal. A Bio Medical Waste Identification and Classification Algorithu Using Mltrp and Rvm. Iran J Public health. 2016 Oct; 45(10):1276-1287.

[14]. Dr. Apurba S Sastry, Dr. Deepashree R. Essentials of Hospital Infection Control: Waste Management in Healthcare Facility. 1st Eidition.Jaypee Brothers Medical Publisher:Kathmandu, Nepal; 2019. Page no. 399.

[15]. Central Pollution Control Board. Guidelines for Management of waste as per Biomedical Waste Management Rules, 2016: page no.2. Available at: https://cpcb.nic.in/uploads/projects/biomedicalwaste

[16]. B. Ramesh Babu, A.K. Parande, R. Rajalakshmi, P. Suriyakala, M. Volga. Management of Biomedical Waste in India and Other Countries: A Review. J. Int. Environmental Application & Science, Vol. 4 (1): 65-78 (2009).

[17]. Chartier Y, Emmanuel J, Pieper U, Pruss A, Rushbook P, Stringer R. Safe Management of Waste from Health- Care Activities, 2nd edition. Geneva, Switzerland: WHO Blue Book, 2014.

[18]. Datta P, Mohi GK, Chander J. Biomedical waste management in India: Critical appraisal. J Lab Physicians 2018;10:6-14.

[19]. Dr. Apurba S Sastry, Dr. Deepashree R. Essentials of Hospital Infection Control: Waste Management in Healthcare Facility. 1st Eidition.Jaypee Brothers Medical Publisher:Kathmandu, Nepal; 2019. Page no. 404.

[20]. Dr. Navpreet, Govt. Medical College & Hospital, Chandigarh. Biomedical Waste management. https://gmch.gov.in

[21]. Palanisamy Pasupathi, Sivaraman Sindhu, Babu Shankar Ponnusha, Athimoolam Ambika. Biomedical waste management for health care industry. Int J Bio Med Res.2011;2(1):472-486.

[22]. Anju Singh, Seema Unnikrishnan, Samriddhi Dongre. Biomedical Waste Management in India: Awareness and Novel Approaches. Biomed J Sci & Tech Res 13(4)- 2019. BJSTR MS.ID.002424. DOI: 10.26717/ BJSTR-2019.13.002424.

[23]. Ministry of Environment, Forest and Climate Change (2018) Biomedical waste management rules.

[24]. Dr.P Kumar, DR. K Reddy Manual for Biomedical Waste Management. All India Institute of Medical Sciences, Delhi. https://www.aiims.edu

[25]. Singh H, Rehaman R, Bumb SS. Management of biomedical waste: a review. Int J Dent Med Res 2014;1(1):14-20.

[26]. https://gmch.gov.in

[27]. Medical waste Management. International Committee of the Red Cross 19, Avenue de la Paix 1202, Nov 2011: page no. 71. Available at: https://www.icrc.org

[28]. Rekha Trivedi. Biomedical Waste Management, Meaning, Methods of Disposal, and Scope by Handling Rules: A Review. Biomed J Sci & Tech Res 43(5)-2022. BJSTR. MS.ID.006963.

[29]. Ferdowsi A, Ferdosi M, Meharani MJ (2013) Incineration or autoclave? A comparative study in Isfahan hospitals waste management system. Mat Soc Med 25(1): 48-51.

[30]. Ananthanarayan, Paniker's. Textbook of Microbiology. Clinical Microbiology as Applied to Infectious Diseases: Biomedical Waste Management. 11th Edition, Universities Press (India) Private Limited, Himayatnagar, Hyderabad, Telangana; 2020. Page no. 624.

[31]. Rekha Trivedi. Biomedical Waste Management, Meaning, Methods of Disposal, and Scope by Handling Rules: A Review. Biomed J Sci & Tech Res 43(5)-2022. BJSTR. MS.ID.006963.

[32]. Central Pollution Control Board. Guidelines for Management of waste as per Biomedical Waste Management Rules, 2016: page no.30. Available at: https://cpcb.nic.in/uploads/projects/biomedicalwaste

[33]. Dr. Apurba S Sastry, Dr. Deepashree R. Essentials of Hospital Infection Control: Waste Management in Healthcare Facility. 1st Eidition.Jaypee Brothers Medical Publisher:Kathmandu, Nepal; 2019. Page no. 409-410.
[34]. Central Pollution Control Board. Guidelines for Management of waste as per Biomedical Waste Management Rules, 2016: page no.31. Available at: https://cpcb.nic.in/uploads/projects/biomedicalwaste
[35]. Central Pollution Control Board. Guidelines for Management of waste as per Biomedical Waste Management Rules, 2016. Available at: https://cpcb.nic.in/uploads/projects/biomedicalwaste
[36]. Mimistry of Environment, Forest and Climate Change (2018). The Bio-Medical Waste Management (Amendment) Rules. Available at http://www.indiaenvronmentportal.org.in/files/file/Bio%20medical%20waste%20management%20 (amendment) 183847.
[37]. Medical waste Management. International Committee of the Red Cross 19, Avenue de la Paix 1202, Nov 2011: page no. 76. Available at: https://www.icrc.org
[38]. Apurba S Sastry, Sandhya Bhat. Essentials of Medical Microbiology. Hospital Infection Control: Biomedical Waste Management. 2nd edition. Jaypee Brothers Medical Publishers, Kathmandu, Nepal; 2019.Page no.619.
[39]. Dr. Apurba S Sastry, Dr. Deepashree R. Essentials of Hospital Infection Control: Waste Management in Healthcare Facility. 1st Eidition.Jaypee Brothers Medical Publisher:Kathmandu, Nepal; 2019. Page no. 411.
[40]. Renju R, Delvin TR, Vandanarani M. Biomedical waste management in Ayurveda hospitals- current practice and future prospective. Journal of Ayurveda and Integrative Medicine 10 (2019) 214-221.
[41]. Bagali , S.S., Gowrishankar, B.S., Sachin Shrimant Bagali, S.S. (2021). A Review on Biomedical Waste Management. Waste Technology, 9 (2), 1-5 doi: http://dx.doi.org/10.14710/wastech.9.2.1-5.
[42]. Palanisamu Pasupathi et al / Int Bio Med Res. 2011;2(1): 472-486.
[43]. Datta P, Mohi GK, Chander J. Biomedical waste management in India: Critical appraisal. J Lab Physicians 2018; 10:6-14.
[44]. Anju Singh, Seema Unnikrishnan, Samriddhi Dongre. Biomedical Waste Management in India: Awareness and Novel Approaches. Biomed J Sci & Tech Res 13(4)- 2019. BJSTR MS.ID.002424. DOI: 10.26717/ BJSTR-2019.13.002424.