GAP iNTERDISCIPLINARITIES
A Global Journal of Interdisciplinary Studies
(ISSN – 2581-5628)
Impact Factor: SJIF - 5.363, IIFS - 4.875
Globally peer-reviewed and open access journal.

BIO MEDICAL WASTE IN INDIA: "GRAVE ASSESSMENT"

Dr. Harikishan B. Vakil

Assistant Professor
J G Institute of Law

Abstract:

All human activities produce waste. We all know that such waste may be dangerous and needs safe disposal. Industrial waste, sewage and agricultural waste pollute water, soil and air. It can also be dangerous to human beings and environment. Similarly, hospitals and other health care facilities generate lots of waste which can transmit infections

The nontoxic and justifiable management of biomedical waste (BMW) is social and legal responsibility of all people supporting and financing health-care activities. For healthy and cleaner environment effective BMW management (BMWM) is mandatory. This article reviews the recent 2016 BMWM rules, practical problems for its effective implementation, the major negative of conventional techniques, and the latest eco-friendly methods for BMW disposal.

The new rules are meant to improve the transportation, segregation, and disposal methods, to decrease environmental pollution so as to change the dynamic of BMW disposal and treatment in India.

For effective disposal of BMWM, there should be a collective teamwork with committed government support in terms of finance and infrastructure development, dedicated health-care workers and health-care facilities, continuous monitoring of BMW practices, tough legislature, and strong regulatory bodies. The basic principle of BMWM is segregation at source and waste reduction. In addition, a lot of research and development need to be in the field of developing environmental friendly medical devices and BMW disposal systems for a greener and cleaner environment.

Keywords: *Bio Medical Waste, Sustainable Development.*

INTRODUCTION:

Bio-medical waste is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological. It include wastes like human anatomical waste, animal waste, microbiology & biotechnology waste, waste sharps, discarded medicines& cytotoxic drugs, soiled waste, solid waste, liquid waste, incineration ash, chemical wastes. These wastes are potentially hazardous because of the potentially infectious in nature as it may pose a serious threat to human health, if its management is indiscriminate and unscientific. Earlier, bio-medical waste management was not an integral part of the health care programme. The negligence on the part of health care waste management programme, in the past, was reflected in various articles in the newspapers and public litigations in various Courts including in the Hon'ble Supreme Court and this is also evident from the sporadic epidemics experienced in different parts of the Country.

Definition. According to Biomedical Waste (Management and Handling) Rules, 1998 of India "Any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological.

RESEARCH METHODOLOGY:

The research methodology of the present paper is doctrinal type. The research aim to research regarding various laws regarding the bio medical waste. The aim of the researcher to know the various conventions and international agreements to save our country. The researcher are used various websites, books, research articles, national as well as international journal , past research papers etc. the research also discuss about the provision regarding.

RESEARCH OBJECTS

To know situation of bio medical waste in India
To know situation of bio medical waste outside India
To know what are the various agreements and international conventions
To know the latest bio medical rules

RESEARCH QUESTIONS:

- What are the various types of Bio medical waste?
- Which is the segregation system available in India?
- Alternative Technology for Biomedical Waste Disposal?

GAP iNTERDISCIPLINARITIES
A Global Journal of Interdisciplinary Studies
(ISSN – 2581-5628)
Impact Factor: SJIF - 5.363, IIFS - 4.875
Globally peer-reviewed and open access journal.

- Role of Government in bio medical waste?

WHAT IS BIOMEDICAL WASTE?

Biomedical waste is any waste containing infectious or potentially infectious materials. These wastes are generated during the diagnosis, treatment, and immunization of humans and animals.
Biomedical wastes can be in both solid and liquid forms. Examples of biomedical wastes include:

- Waste sharps such as needles, lancets, syringes, scalpels, and broken glass
- Human tissues or identifiable body parts (as a result of amputation)
- Animal tissues and waste from veterinary hospitals
- Used bandage, dressings, gloves, and other medical supplies
- Liquid waste from infected areas
- Laboratory wastes

Biomedical wastes are distinct from regular garbage and require particular disposal and treatment.

BIOMEDICAL WASTE SITUATION IN INDIA:

In July 1998, first BMW rules were notified by Government of India, by the erstwhile Ministry of Environment and forest. In India, BMW problem was further compounded by the presence of scavengers who sort out open, unprotected health-care waste with no gloves, masks, or shoes for recycling, and second, reuse of syringe without appropriate sterilization.
During 2002–2004, International Clinical Epidemiology Network explored the existing BMW practices, setup, and framework in primary, secondary, and tertiary health care facility (HCF) in India across 20 states. They found that around 82% of primary, 60% of secondary, and 54% of tertiary HCFs in India had no credible BMWM system. In 2009, around 240 people in Gujarat, India contracted hepatitis B following reuse of unsterilized syringes. This and many more studies shows that despite India being among the first country to initiate measures for safe disposal of BMW, there is an urgent need to take action for strengthening the existing system capacity, increase the funding and commitment toward safe disposal of BMW.
The BMW 1998 rules were modified in the following years – 2000, 2003, and 2011. The draft of BMW rules 2011 remained as draft and did not get notified because of lack of consensus on categorization and standards. Now Ministry of Environment, Forest and Climate change in March 2016 have amended the BMWM rules
These new rules have increased the coverage, simplified the categorization and authorization while improving the segregation, transportation and disposal methods to decrease environmental pollution It has four schedule, five forms and eighteen rules.

BIOMEDICAL WASTE SITUATION OUTSIDE INDIA:

In many countries around the world, biomedical waste management is a critical concern due to the potential health and environmental risks associated with improper handling and disposal of medical waste. Some common challenges and approaches include

1. **Regulations and Guidelines**: Similar to India, many countries have established regulations and guidelines for the proper management of biomedical waste. These regulations often cover aspects such as waste segregation, storage, transportation, treatment, and disposal. These regulations may be influenced by international agreements such as the Basel Convention and WHO guidelines.
2. **Segregation and Collection**: Proper segregation of different types of medical waste at the source of generation is crucial. This helps prevent cross-contamination and ensures that waste is treated and disposed of appropriately. Many countries emphasize training healthcare workers to correctly segregate waste.
3. **Treatment and Disposal:** Biomedical waste typically undergoes treatment processes to reduce its infectious potential before final disposal. Common treatment methods include autoclaving, incineration, chemical treatment, and other advanced technologies. The choice of treatment method may depend on the waste's characteristics, volume, and available resources.
4. **Public Health Concerns:** Improper management of biomedical waste can pose serious public health risks, as infectious materials could lead to the spread of diseases. It's essential for countries to have robust systems in place to minimize these risks and protect both healthcare workers and the general population

VARIOUS INTERNATIONAL AGREEMENTS AND CONVENTIONS:

There are several international agreements and conventions related to biomedical waste management. These agreements aim to establish guidelines and regulations for the proper handling, treatment, and disposal of biomedical waste to protect public health and the environment. Please note that there might have been developments or changes since then. Here are a few key agreements and conventions:

1. **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal**: The Basel Convention, adopted in 1989, seeks to minimize the generation of hazardous waste and

ensure its environmentally sound management, including biomedical waste. It requires countries to manage hazardous waste within their borders and restricts its movement across national boundaries.

2. **Stockholm Convention on Persistent Organic Pollutants (POPs)**: Although not exclusively focused on biomedical waste, the Stockholm Convention addresses the disposal and management of some chemicals and compounds found in medical waste that can have long-term negative effects on health and the environment. This convention aims to eliminate or restrict the production and use of certain POPs.

3. **Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade:** This convention aims to promote shared responsibility and cooperative efforts among countries in managing hazardous chemicals and pesticides. While not solely focused on biomedical waste, it can have implications for the international trade of chemicals found in healthcare waste.

4. **World Health Organization (WHO) Guidelines**: The WHO provides guidelines and recommendations for the safe management of healthcare waste. These guidelines are regularly updated and cover various aspects, including waste segregation, handling, storage, treatment, and disposal.

5. **European Waste Catalogue (EWC):** While not a convention, the EWC is a classification system used in the European Union to identify and categorize waste streams, including biomedical waste. It helps in ensuring proper waste management practices.

6. **National Regulations and Guidelines:** Many countries have established their own national regulations and guidelines for the management of biomedical waste. These regulations may be in alignment with international agreements and conventions but can also address specific local concerns.

It's important to note that the regulations and conventions related to biomedical waste may vary from country to country. If you need specific and up-to-date information about a particular country's regulations or recent developments in international agreements, I recommend checking with relevant governmental and international organizations involved in waste management and environmental protection.

LATEST RULES REGARDING BIO MEDICAL WASTE

1. The scope of the rules have been expanded to include various health camps such as vaccination camps, blood donation camps, and surgical camps
2. Duties of the occupier of HCFs have been revised. Occupier is the person having administrative control over the HCF that is generating BMW
   a. Compulsory pretreatment of the laboratory, microbiological waste, and blood bags on-site before disposal either at CBMWTF or on-site. The method of sterilization/disinfection should be in accordance with National AIDS Control Organization (NACO) or WHO
   b. The use of chlorinated plastic bags, gloves, blood bags, etc. should be gradually stopped and this phasing out should be within 2 years from the date of notification of these rules
   c. To provide training to all its HCWs and protect them against diseases such as hepatitis B and tetanus by immunization
   d. Liquid waste to be separated at source by pretreatment before mixing with other liquid waste
   e. To set up a barcode system for BMW containing that is to be sent out of the premises for treatment and disposal
   f. All major accidents including accidents caused by fire hazards, blasts, during handling of BMW, and remedial action taken by the prescribed authority should be reported
   g. The existing incinerator should be upgraded/modified to achieve the new standard within 2 years from the date of this notification
   h. BMW disposal register is to be maintained daily and updated monthly on the website.
3. The duties of the operator of a common biomedical waste treatment and disposal facility (CBMWTF) have been increased.[13] They should assist in training of HCW from where the waste is being collected. Furthermore, there should be barcoding and global positioning system established for handling of BMW within 1 year. Maintain all records for operation of incineration/hydroplaning/autoclaving for a period of 5 years
4. The segregation, packaging, transportation, and storage of BMW have been improved. Biomedical waste has been classified into four categories based on color code-type of waste and treatment options. In addition, untreated human anatomical waste, animal anatomical waste, soiled waste, and biotechnology waste should not be stored beyond a period of 48 h. In case, there is a need to store beyond 48 h, the occupier should take all appropriate measures to ensure that the waste does not adversely affect human health and the environment (no permission to be obtained).
5. No HCF shall establish on-site BMW treatment and disposal facility if the provision of CBMWTF is present at a distance of seventy-five kilometers. If no CBMWTF is available, the occupier shall set up requisite BMW treatment facility such as incinerator, autoclave or microwave, shredder after taking prior authorization from the prescribed authority. After confirming treatment of plastics and glassware by autoclaving or microwaving followed by mutilation/shredding, these recyclables should be given to authorized recyclers

GAP iNTERDISCIPLINARITIES
A Global Journal of Interdisciplinary Studies
(ISSN – 2581-5628)
Impact Factor: SJIF - 5.363, IIFS - 4.875
Globally peer-reviewed and open access journal.

6. Authorization for BMW disposal for no bedded HCFs is granted to the occupier at one time only. The validity of authorization shall be synchronized with validity of consent orders for bedded HCFs
7. Standards for emission from incinerators have been modified to be more environmental friendly. These are permissible limit for SPM-50 mg/nm3; residence time in secondary chamber of incinerator – two seconds; standard for dioxin and furans – 0.1 ng TEQ/Nm3
8. Ministry of Environment, Forest, and Climate change will monitor the implementation of rules yearly. The responsibility of each state to check for compliance will be done by setting up district-level committee under the chairpersonship of District Collector or District Magistrate or Additional District Magistrate. In addition, every 6 months, this committee shall submit its report to the State Pollution Control Board.

BENEFITS OF THE NEW BIOMEDICAL WASTE RULES

The new rules are stringent and elaborate and should bring about a change in the way, the BMW is being managed in India. Under the new rules, coverage has increased to include various health-care related camps such as vaccination camps, blood donation camps, and surgical camps.

Another distinction is in the segregation, packaging, transport, and storage of BMW waste. The categories have been reduced to four to bring about ease of segregation. One of the main principles of disposal of BMW is that segregation has to be done at the source of generation of the waste. To overcome confusion created by large number of categories, this has been simplified to make it convenient and manageable for all HCWs. Now, the color coding (i.e., yellow, red, white, and blue) of the bags/containers is linked to a particular type of waste and its specific treatment option. For example, the disposal of chemical solid waste and cytotoxic waste to be done in yellow bag which goes for incineration/plasma pyrolysis/deep burial.

In addition, the HCF has to do pretreatment of various laboratory waste and blood bags according to guidelines of WHO and NACO, to decrease chances of infections being transmitted to HCWs handling waste at treatment stage. Within 2 years, plastic bags, gloves, and blood bags have to be phased out to eliminate emissions of dioxins and furans during their burning into the environment. The new rule also calls for a bar code system for all bags/containers used for BMW treatment and disposal. This step will help in tracking and identifying bags during inspection for quality control and also quality assurance.

The BMW in red/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. Greater emphasis has been given to recycling of waste to conserve resources as well as decrease pollution.

The 2016 guidelines are more specific regarding the dependence of HCFs on CBMWTF and who will provide land for setting up CBMWTF. State government or UT government will provide land for setting up CBMWTF and no occupier of an HCF shall establish an on-site treatment and disposal facility if a CBMWTF is available within 75 kms. This has several advantages as installation and functioning of individual BMW treatment facility as well as recruiting separate, dedicate, and skilled workforce require high capital investment. CBMWTF is a popular concept in developed countries because by operating it at its full potential, the cost of treatment/kg BMW gets significantly reduced. Further, this makes control and checking of various waste disposal plants less tedious. Furthermore, maintaining records and log book will streamline the documentation.

The emission standards for incinerator has been made more stringent (acceptable SPM reduced to 50 mg/nm3, retention time in secondary camber lowered to 2 s). This will reduce dioxins and furans release (which are produced at temperature greater than 600°C) and lead to production of carbon dioxide and water.

The new rules lays down new criteria for authorization of an HCF and have made the procedure for getting authorization very simple. Bedded hospitals will get automatic authorization and no bedded HCFs will get a one-time authorization.

Another improvement in the new rules is in the monitoring sector. The MoEF (Ministry of Environment, Forest, and Climate change) will review HCFs once a year through state health secretaries and the SPCB (State Pollution Control Board). Moreover, according to the new rules, the advisory committee on BMWM is now mandated to meet every 6 months.

TYPES OF BIOMEDICAL WASTE

The World Health Organization (WHO) has categorized biomedical waste into eight categories. They are:

1. **Infectious Waste –** Any biomedical waste that is infectious or contaminated.
2. **Sharps –** Sharps objects like needles, scalpels, broken glass, and razors.
3. **Pathological Waste –** Body parts of humans or animals, including tissues, fluids, or blood.
4. **Pharmaceutical Waste –** Unused drugs, medicine, or creams that are expiring.
5. **Genotoxic Waste –** Toxic drugs and hazardous toxic waste
6. **Radioactive Waste –** Any waste containing potentially radioactive materials
7. **Chemical Waste –** Liquid waste from machines, batteries, and disinfectants is chemical.
8. **General/Other Waste –** All other non-hazardous waste.

GAP iNTERDISCIPLINARITIES
A Global Journal of Interdisciplinary Studies
(ISSN – 2581-5628)
Impact Factor: SJIF - 5.363, IIFS - 4.875
Globally peer-reviewed and open access journal.

SEGREGATION SYSTEM IN BIO MEDICAL WASTE

This system categorizes biomedical waste into different categories based on their potential risks and characteristics. The color coding helps ensure proper identification, segregation, and safe handling of different types of waste. The color codes used in India are as follows:

1. **Yellow**: Yellow bags or containers are used for the collection of infectious waste. This includes items such as used dressings, bandages, cultures, and swabs.
2. **Red:** Red bags or containers are used for anatomical waste, which includes body parts, organs, and tissues.
3. **Blue**: Blue bags or containers are designated for sharps waste, such as needles, syringes, broken glass, and other items that could cause injury if mishandled
4. **White**: White bags or containers are used for discarded items that are not contaminated or hazardous, such as waste paper and cardboard
5. **Black**: Black bags or containers are used for general non-biodegradable waste.
6. **Green**: Green bags or containers are used for waste that has been treated and rendered non-infectious. This waste can include items like soiled or discarded personal protective equipment (PPE) that have been properly treated.

There are several alternative technologies for the disposal of biomedical waste that aim to provide safer and more environmentally friendly options compared to traditional methods. These technologies focus on reducing the potential risks associated with biomedical waste, including infectious materials and hazardous substances. Please note that advancements and new technologies may have emerged since then. Here are some alternative disposal technologies:

ALTERNATIVE DISPOSAL TECHNOLOGY FOR BIO MEDICAL WASTE

There are several alternative technologies for the disposal of biomedical waste that aim to provide safer and more environmentally friendly options compared to traditional methods. These technologies focus on reducing the potential risks associated with biomedical waste, including infectious materials and hazardous substances. Please note that advancements and new technologies may have emerged since then. Here are some alternative disposal technologies:

1. **Autoclaving**: Autoclaving involves subjecting biomedical waste to high temperatures and pressure to sterilize it. This process helps in killing pathogens and rendering the waste safe for disposal. The treated waste can then be disposed of as regular solid waste.
2. **Microwave Treatment**: Microwaves can be used to heat and disinfect biomedical waste. This technology is capable of effectively reducing microbial contamination and rendering waste non-infectious**.**
3. **Chemical Disinfection:** Chemical disinfection involves using chemical agents to neutralize pathogens in biomedical waste. This can include using chlorine-based solutions or other approved disinfectants.
4. **Plasma Gasification:** Plasma gasification is a high-temperature process that converts waste into a synthetic gas (syngas) and inorganic solids. This technology can be used to treat a wide range of waste types, including biomedical waste.
5. **Microwave Irradiation:** This technology uses microwave energy to disinfect and sterilize biomedical waste. It can be effective in reducing microbial load and rendering the waste safe for disposal.

It's important to note that the suitability of these technologies can depend on factors such as the type and volume of waste, available resources, regulatory requirements, and environmental considerations. Before implementing any alternative disposal technology, thorough testing, validation, and compliance with local regulations are essential.

For the most current information on alternative technologies for biomedical waste disposal, I recommend consulting relevant government agencies, waste management experts, and scientific publications in the field of waste management and environmental health.

Role Of The Government

The Indian government plays a significant role in the management of biomedical waste to ensure its safe handling, treatment, and disposal. The management of biomedical waste is crucial to protect public health, prevent environmental contamination, and maintain overall sanitation. The key roles and responsibilities of the government in this regard include:

1.Regulation and Legislation: The government establishes and enforces regulations, guidelines, and legal frameworks for the management of biomedical waste. These regulations define the categories of waste, segregation practices, treatment methods, transportation requirements, and disposal options.

2. Central Pollution Control Board (CPCB): The CPCB is the central regulatory authority responsible for formulating and implementing policies and regulations related to environmental protection, including biomedical waste management. It issues guidelines and sets standards for biomedical waste management practices in India.

3.**State Pollution Control Boards (SPCBs):** Each state has its own SPCB responsible for implementing the guidelines and regulations set by the CPCB at the state level. SPCBs issue licenses, monitor compliance, and oversee the proper functioning of biomedical waste treatment facilities within their respective states.

4.Issuing Licenses and Authorizations: The government issues licenses, permits, and authorizations to healthcare facilities, waste generators, and waste treatment facilities involved in the generation, collection, transportation, and disposal of biomedical waste.

5. Promoting Awareness and Education: Government agencies, along with NGOs and other stakeholders, work to raise awareness among the general public, healthcare professionals, and waste handlers about the importance of proper biomedical waste management practices.

CONCLUSION

BMWM should be a shared teamwork with committed government backing, good BMW practices followed by both health-care workers and HCFs, continuous monitoring of BMW practices, and strong legislature. It is our fundamental right to live in clean and safe environment. The pillar of BMWM is segregation of waste at source and WR. The current BMWM 2016 rules are an improvement over earlier rules in terms of improved segregation, transportation, and disposal methods, to decrease environmental pollution and ensure the safety of the staff, patients, and public. Moreover, more use of non-PVC medical devices and development of newer novel, eco-friendly systems for disposal of BMW should be encouraged. All participants in BMWM should pledge to guarantee a cleaner and greener environment.

REFERENCES

[1] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5784295/
[2] https://cpcbenvis.nic.in/Bio_Medical_waste.html
[3] https://tspcb.tripura.gov.in/bio-medical-waste-management/
[4] https://byjus.com/current-affairs/biomedical-waste/
[5] http://deskuenvis.nic.in/convensions.asp
[6] https://www.epa.gov/hwgenerators/international-agreements-transboundary-shipments-hazardous-waste
[7] Walkinshaw E. Medical waste-management practices vary across Canada. CMAJ. 2011;183:E1307–8.
[8] Bio-Medical Waste Management Rules. 2016 Published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-Section (i), Government of India Ministry of Environment, Forest and Climate Change. Notification; New Delhi, the 28th March, 2016.