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Abhishek Saket
Research Scholar, Department of Environmental Biology, A.P.S. University, Rewa, Madhya Pradesh, India

Neeta Singh
Principal, Govt. Girls P.G. College, Rewa, Madhya Pradesh, India

Corresponding Author:
Abhishek Saket
Research Scholar, Department of Environmental Biology, A.P.S. University, Rewa, Madhya Pradesh, India

Biomedical waste and its management

Abhishek Saket and Neeta Singh

Abstract
Biomedical Waste, (BMW), is a potentially harmful substance, including solids, liquids, solids, and laboratory waste that poses a serious threat to human health and other organisms. And in some cases, it can be fatal as well. It is very important that this waste is properly managed and disposed of in order to prevent the spread of disease in the general public and to disrupt public health care facilities. About 57% of the total amount of waste generated by biomedical waste. It is important to understand what biomedical waste is, to classify and to manage it properly. In this paper, a brief effort is made to show the biomedical waste produced, its origin and how to deal with it effectively.

Keywords: Hazardous, infection, biomedical, management, health

Introduction
Biomedical Waste, (BMW) or bio waste are those potentially hazardous materials, including solid materials, liquids, solids, and laboratory waste. Organic waste is different from other hazardous wastes, such as industrial waste, because it comes from biological sources or is used for diagnosing, preventing, or treating disease. One of the major sources of biomedical waste hospitals and nursing homes. The hospital is one of the most visited centers for people of all walks of life without distinction between age, gender, race and religion. All of them produce waste that grows in value and type due to advances in scientific knowledge and creates its own impact. Hospital waste, in addition to the risk to patients and staff handling the waste poses a threat to public health and the environment.
According to the Department of Environment and Forestry (MoEF) the total BMW in India is 4,05,702 kg / day which is only 2,91,983 kg / day which is disposed of, which means that about 28% of the waste is left untreated and discarded to get your way in dumping sites or in dumping areas and re-entering our system. The indiscriminate dumping of natural waste by hospitals and nursing homes became a source of pollution that posed a threat to health and the environment. To overcome this problem, the Bio Medical Waste (Management and Management) Regulations were promulgated in July 1998. The legislation aims to introduce biomedical waste disposal procedures in India. The emphasis is on ensuring a systemic change that will enable health care facilities to manage their waste through proper training and capacity building.
These Rules are applicable to all persons who generate, collect, receive, store, transport, treat, dispose or handle biomedical wastes. This includes hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories and blood banks.
Although the Bio-Medical Waste (Management and Handling) Rules have already been introduced a few years back, not much attention has been paid to bio-medical waste management so far. Even if something is done, it is most of the times not properly done.

Material and Methods
The main sources of biomedical waste are hospitals, medical clinics, laboratories and pharmaceutical factories. Other sources include:

- Blood donation camps
- Slaughter houses
- Cosmetic services
- Vaccination centres
- Funeral services.

Management of Biomedical Waste

Due to the grave potential threats biomedical waste pose, managing and regulating its collection, storage, transportation, treatment and disposal method is essential. Safe disposal of biomedical waste is also a legal requirement in India [1]. The objectives of BMW management are:

- To prevent transmission and spreading of pathogens and diseases
- To prevent injury to people in health care services and workers who handle BMW
- To prevent general exposure to the harmful effects of the cytotoxic, genotoxic and chemical biomedical waste
- To prevent environmental degradation.

A. Handling Equipment

Protective gear must be used by the handling personnel to prevent any direct contact with the BMW.

1. **Gloves:** Heavy-duty rubber gloves should be used for waste handling by the waste retrievers. This should be bright yellow in colour. After handling the waste, the gloves should be washed twice. The gloves should be washed after every use with carbolic soap and a disinfectant. The size should fit the operator.
2. **Aprons, gowns, suits or other apparels:** Apparel is worn to prevent contamination of clothing and protect skin. It could be made of cloth or impermeable material such as plastic. People working in incinerator chambers should have gowns or suits made of non-inflammable material.
3. **Masks:** Various types of masks, goggles, and face shields are worn alone or in combination, to provide a protective barrier. It is mandatory for personnel working in the incinerator chamber to wear a mask covering both nose and mouth, preferably a gas mask with filters.
4. **Boots:** Leg coverings, boots or shoe-covers provide greater protection to the skin when splashes or large quantities of infected waste have to be handled. The boots should be rubber-soled and anti-skid type. They should cover the leg up to the ankle [2].

B. Storage and Containment

The key to reducing and effectively managing biomedical waste is separation and identification of waste. BMW must be separated from other types of waste where it was created. Direct contact with humans, animals, insects, and natural resources, such as rain and wind, must be avoided. Limited access should also be given to trained and authorized persons to manage this waste [3, 5].

- Sharps must be contained in leak-proof, rigid, puncture-resistant, break-resistant containers which are labelled and tightly lidded during storage, handling, and transport.
- For biomedical waste, excluding sharps, dispose of the waste in leak-proof plastic bags strong enough to prevent ripping, tearing, breaking, or bursting under normal conditions of use. Rigid plastic, single-use, or approved multiple-use marked containers may also be used. Biomedical waste that is held in plastic bags should additionally be placed in another leak-proof container such as disposable or reusable pails, drums, or bins during storage or transport.
- Secure bags or containers to prevent leakage or expulsion during storage.
- The container holding the biomedical waste should be conspicuously labelled with the international biohazard symbol and the words "Biomedical Waste" (or words that clearly denote biomedical waste).
- Biomedical waste contained in disposable containers as prescribed above, shall be placed for storage, handling, or transport in disposable or reusable pails, cartons, boxes, drums, dumpsters, or portable bins. The containment system shall have a tight fitting cover and be kept clean and in good repair.
- These containers shall not be used for other purposes even after the biohazard symbol is removed.

C. Transportation of BMW

Garbage should be transported for treatment by truck or with a covered barrow. Personal loading should be avoided as much as possible. The container containing the BMWs must be closed before departure. Before transporting a bag containing BMW, it must accompany the document signed by the Nurse / Doctor stating the date, shift, amount and destination [4]. Special vehicles must be used to prevent direct contact with waste by transport drivers, fishermen and the public. Transport containers should be tightly closed. The consequences of road accidents should be taken into account in its construction, and the driver should be trained in the procedures to follow in the event of an accidental fall. It should also be possible to wash the interior of the dishes thoroughly.

D. Handling devices

1. **Trolleys:** The use of trolleys will facilitate the removal of infectious waste at the source itself, instead of adding a new category of waste.
2. **Wheelbarrows:** Wheelbarrows are used to transfer waste from the source to the collection points. There are two types of wheels - covered and open. The wheels are made of steel and are provided with two wheels and a handle. Care should be taken not to throw rubbish in it. Only packaged waste (plastic bags) should be carried. Care should also be taken not to allow liquid waste to spill onto the wheelbarrow, as it will rust. These are ready to move garbage inside the facility. Wheel wheels also come in a variety of sizes depending on how they are used.
3. **Chutes:** Chute is a straight line provided for easy transport of garbage when there are more than two floors. The chute should be made of stainless steel. It should have a lid on itself. These chute should be sprayed daily with formaldehyde vapor. Dirty linen (contaminated with blood and other body fluids) from each floor should be wrapped in dirty linen or plastic bags before being released into the chute. Alternatively, elevators with mechanical wires or electrical wiring can be provided to reduce waste containers from each floor. Chutes are needed to avoid horizontal waste disposal and thus reduce the amount of waste inside the buildings and thus reduce the risk of secondary contamination.

E. Treatment

1. **Chemical processes:** These processes use chemical that act as disinfectants. Sodium hypochlorite, dissolved

chlorine dioxide, per acetic acid, hydrogen peroxide, dry inorganic chemical and ozone are examples of such chemical. Most chemical processes are water-intensive and require neutralizing agents.

2. **Thermal processes:** These processes utilize heat to disinfect. Depending on the temperature they operate it is been grouped into two categories, which are Low-heat systems and High-heat systems. Low-heat systems (operates between 93-177 °C) use steam, hot water, or electromagnetic radiation to heat and decontaminate the waste. Examples are:
   - Autoclaving is a low heat thermal process and it uses steam for disinfection of waste. Autoclaves are of two types depending on the method they use for removal of air pockets are gravity flow autoclave and vacuum autoclave.
   - Microwaving is a process which disinfects the waste by moist heat and steam generated by microwave energy. High-heat systems (operates between 540-8,300 °C) employ combustion and high temperature plasma to decontaminate and destroy the waste. Examples are:
   - Hydroclaving - steam treatment with fragmentation and drying of waste.
   - Incineration is a burn technology. It is a controlled combustion process where waste is completely oxidized and harmful microorganisms present in it are destroyed/denatured under high temperature.

3. **Mechanical processes:** These processes are used to change the physical form or characteristics of the waste either to facilitate waste handling or to process the waste in conjunction with other treatment steps. The two primary mechanical processes are Compaction - used to reduce the volume of the waste Shredding - used to destroy plastic and paper waste to prevent their reuse. Only the disinfected waste can be used in a shredder.
4. **Irradiation processes:** These processes expose wastes to ultraviolet or ionizing radiation in an enclosed chamber. These systems require post shredding to render the waste unrecognizable.
5. **Biological processes:** These processes use biological enzymes for treating medical waste. It is claimed that biological reactions will not only decontaminate the waste but also cause the destruction of all the organic constituents so that only plastics, glass, and other inert will remain in the residues.

Benefits of Biomedical Waste Management

BMW management plays a vital role in preventing any outbreak of infectious diseases and protecting the society from transmission of these diseases. Here are few benefits that biomedical waste management programs provide [5-6].

- Reduction in the cost of medical expenses due to reduced cases of infections - Hygienic and healthy environment in medical centres.
- Low incidence of community and occupational health hazards
- Low impact on ecological system
- Potential epidemics are prevented
- Low incidence of community and occupational health hazards
- Improved public health and cleaner environment
- Improved image of the healthcare establishment and increased quality of life.

Conclusions

Organic waste should be safely and effectively identified, separated, stored, transported and disposed of after appropriate treatment. Its successful implementation in our society is critical to protecting public health and the environment. With population growth, biological waste is also increasing in our country. Waste management is a growing problem in India. The division of BMW from its origins is key to the efficiency of waste management. Adherence to the principles and scientific management of BMW is for the benefit of society and the environment.

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