



## International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

ISSN:2347-6567

IJAMSCR | Volume 7 | Issue 3 | Jul - Sep - 2019  
www.ijamscr.com

Research article

Medical research

### Bio medical waste management and its treatment

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#### ABSTRACT

Occurrence of Biomedical wastes (BMW) in India from hospitals, various chemical industries and from other surroundings is increasing day by day. BMW contains infectious and hazardous materials. It is crucial on the part of the employees to know the hazards of the biomedical waste at the work environment and make its disposition effective and in a scientific manner. Ministry of Environment & Forests regulates “Biomedical Waste Management and Handling Rules, 1998”. According to the amended rules, every hospital generating BMW needs to follow the protocol of BMW treatment facilities. There should no untreated BMW stored beyond a period of 48 hours. Effective BMW management is not only a legal necessity but also a social responsibility towards a clean and unpolluted environment. This article reviews the current perspectives on Bio Medical Waste Management and rules, conventions and the treatment technologies used worldwide. The study revealed gaps in the knowledge amongst all the organizations of the study respondents. The knowledge in relation to BMW Management including the hospital BMW protocols was more desirable among doctors, but practical facets were better in nurses and the lab technicians. Knowledge, Attitude and Practice amongst the different cadres of staff members were found to be significant statistically

**Keywords:** Biomedical waste, Knowledge, Segregation, Disposal, Treatment techniques

#### INTRODUCTION

Biomedical Waste is any kind of waste containing infectious materials. [1] It may also include waste associated with the generation of biomedical waste that visually appears to be of medical or laboratory origin (e.g., packaging, unused bandages, infusion kits, etc.), as well research laboratory waste containing biomolecules or organisms that are mainly restricted from environmental release. Biomedical waste may be solid or liquid. Examples of infectious waste include discarded blood, sharps, unwanted microbiological cultures and stocks, identifiable

body parts (including those as a result of amputation), other human or animal tissue, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids, and laboratory waste that exhibits the characteristics described above. Waste sharps include potentially contaminated used (and unused discarded) needles, scalpels, lancets and other devices capable of penetrating skin. [2]

## CLASSIFICATION OF BIOMEDICAL WASTE

### Non-hazardous waste

Nonhazardous waste comprises 85% it constitutes of food remnants, paper cartons, packaging material, fruit peels, wash water etc. this waste is free of any kind of Pharmaceutical product. The waste generated by Health care centers is usually Nonhazardous.

### Hazardous waste

These include infective medical waste, hazardous, red bag and contaminated, regulated and non-regulated medical waste. It adds up to 10% of the total waste which includes:

- Dressings and swabs infected with blood, pus or other body fluids.
- Laboratory waste having lab culture stocks of infectious reagents.
- Human Waste such as Excised tumors, organs, placenta etc.
- Potentially infected animals used for diagnostic purpose and research studies.
- Fine and sharp aids such as needle, syringes, blades etc.
- Blood and blood products.

### Potentially toxic waste

- Radioactive waste: It includes waste contaminated with radionucleode; it may wastes generated from in vitro analysis of body fluids and tissue.
- Chemical waste: It includes disinfectants, X-ray processing solutions, monomers and associated reagents, base metal debris like dental amalgam in extracted teeth.
- Pharmaceutical waste: It includes anesthetics, sedatives, antibiotics, analgesics etc.

## NECESSITY OF BIOMEDICAL WASTE MANAGEMENT

Improper management of waste generated in health care facilities causes a direct health hazards

on the society, the health care workers and on the surroundings. There is requirement for the management of biomedical waste to minimize the risk of infection outside the hospital for waste handlers, scavengers and those living in the vicinity of hospitals. Management is also needed due to the risk of air, water, and soil pollution, or due to improper incineration emissions and ash. It plays an important role in disposal of the discarded drugs that can be repacked and sold off.

## STEPS TOWARDS EFFECTIVE B.M.W MANAGEMENT

### Waste Survey

It is an important component of the waste management method. A survey helps in assessment of both the type and amount of waste generated. Waste survey is valuable in the aspect of:

- Make a distinction of types of waste.
- Enumerate the waste generated.
- Conclude the points of generation & type of waste generated at each point.

### Segregation of Biomedical Waste

Segregation refers to the primary division of different categories of waste generated at basis and thereby dipping the risks as well as cost of handling and disposal. Segregation is the most essential step in bio-medical waste management. Effective segregation only can ensure useful bio-medical waste management. The BMWs have to be segregated in harmony to guidelines laid down under schedule 1 of BMW Rules, 1998.

This consists of placing different kinds of wastes in different containers or coded bags at the point of generation. It helps to decrease the bulk of infectious waste and treatment costs. Segregation also helps to hold the spread infection and reduces the probability of infecting other health care personnel. Table .2 describes the various color coding.

**Table 1. Various color coding for management of Biomedical waste**

Color coding	Type of container	Waste category
Yellow	Plastic bag	Cat 1 , 2 ,3 , 6 ( human anatomical waste, animal waste, microbiology & biotechnology waste , solid waste )
	Disinfected container /	Cat 3,6,7 (microbiology & biotechnology waste ,solid waste )

Red	Plastic bag	
Blue/white translucent	Plastic bag/puncture proof container	Cat 4,7 (waste sharps ,solid waste)
Black	Plastic bag	Cat 5,9,10 ( discarded medicine and cytotoxic drugs, incineration ash, chemicals)

## GUIDELINES FOR STORAGE & ACCUMULATION OF BIOMEDICAL WASTE

Healthcare facilities must provide a storage area for medical waste until it is collected for treatment and disposal. Storage area should be selected carefully and unapproachable to the general public. That area must exhibit warning symbols & signs with clear instructions written on it should be stored in a dry and secured area before being transported. The area must be protected from water, air, rodents, insects and other animals. Hazardous biomedical waste should not be stored for more than 3 months [4]. Waste accumulation and storage is generally done in the respective areas. Steps between the point of waste generation and location of waste treatment and disposal. Though accumulation refers to the temporary holding of small quantities of waste near the point of generation, storage of waste is categorized by longer holding periods and large waste volume. Storage areas are generally located near where the waste is treated. Any offsite holding of waste is also considered storage.

- Different types of containers must used for collection of different types of waste.
- The containers or bins should be positioned in a way, so that 100 % gathering should achieve.
- Sharp waste must be kept in puncture-proof containers to prevent employees injuries and infection while handling procedures.
- Once collection has done, then biomedical waste is should store in a appropriate place.
- Segregated wastes of dissimilar categories need to be collected in individual containers or bins.
- The period of storage should not more than 8-10 hrs in tertiary care hospital and in 24 hrs nursing care homes.
- Each container or bin should be clearly labeled with respective ward or room. This labeling is important to trace the waste back to its source.
- Besides this, storage site should be visible with a caution sign. [5]

## TREATMENT OF BIOMEDICAL WASTE

Biomedical waste treatment refers to the processes to eradicate the deleterious effects of the waste. It is mainly necessary to disinfect or decontaminate the waste, right at source so that it is no longer the source of pathogenic organisms. After appropriate treatment, the remains should be handling, transport and store safely. Treatment strategies of BMW management also reduce environmental hazards. Common methods used for treatment and decontamination of biomedical waste are-

### Incineration

It is a treatment process used to convert pathological and pharmaceutical waste into ash, gases and heat. Operating temperature for incineration should be in the range of 800-1400°C. It reduces the mass of waste by 90-95% and thus reduces adverse effects on the environment [6].

### Autoclaving

It is a process of steam sterilization and effective alternative to incineration. Autoclaving requires a temperature of 121°C and pressure of about 15 pounds per square inch (psi) for 20-30 minutes. The treatment is applied to inactivate the infectious agents/reagents and to sterilize the equipment used as medical aids. This method is cheap and has no negative health impacts [7].

### Chemical treatment

This treatment is often used to de-contaminate liquid waste, so that it can be disposed off locally. It makes use of several techniques such as oxidation, reduction, precipitation and pH neutralization to convert waste into less hazardous substances. Chlorine, sodium hydroxide or calcium oxide can be used according to the nature of waste [8].

### Irradiation

These systems are presently being used in waste treatment operations which include gamma,

electron-beam, ultraviolet and X-rays. Irradiation sterilizes waste in an enclosed chamber by exposing it to a radioactive cobalt-60 which gives out gamma rays that are lethal to micro-organisms. It is very expensive as compared to other methods and precautions must be taken to protect workers from harmful effects of radiations such as cancer, radiation sickness or even death [9].

### **Transportation of waste**

Transportation of Bio-Medical wastes can be done by Carts and containers basically selected for this purpose only. The trolleys must clean regularly. Offsite carrying vehicle should be marked with the name and address of transporter. Biohazard sign should be dyed with color ink.. Appropriate system for securing the weight during transport should be ensured. Such a means of transport should be easily cleanable with rounded corners. Disposable plastic should be subjected to shredding before disposing off to vendor. No unprocessed biomedical waste store more than 48 hours. [10]

### **Disposal and Minimization of waste**

Land disposal is typically used for remediation of waste which is decontaminated by above applicable treatment methods. This method is generally used in developing countries which involves the dumping of waste into a landfill. Land-filling should be done at locations where groundwater level is low and which are far from flooding sources. Radioactive wastes are generally dumped in the oceans far away from human habitations. Every state and local government has its own rules and regulations for disposal of disinfected waste. [11] Regular solid and liquid waste requires no treatment before disposal; virtually all contagious waste should treated first. The cost for disposal of infectious waste may be ten times of cost for disposal of ordinary waste. Any methods that reduce the quantity of infectious waste produced will at the same time decrease the cost of infectious waste disposal. [12]

### **BENEFITS OF BMW MANAGEMENT**

Planning the waste management and recycling for all of the waste generated in the health care facilities is a crucial task which plays an exceptionally important role in the worldwide cleanliness, public health, conservation of

resources and sustainability of the ecosystem. Recycling medical waste minimizes utilization of raw material it reduces the hazards and risks to the community which can be acquired by hospital. Reduction in the occurrence of HIV/AIDS, sepsis, hepatitis, and other diseases transmitted by infectious medical equipment's takes place by proper waste management [13]. Illegal trading of used syringes, injection needles and medical aids/tools or other equipments also is reduced by adherence to proper management strategies. Awareness about hazards of biomedical waste and its proper disposal is required for a safe and healthy future

### **CONCLUSION**

Biomedical waste management is as important as treatment plan for medical professionals. Waste generation should be minimized to protect environment and general public health from life threatening issues. There must be awareness among people regarding to the issues related to biomedical waste and should participate in the programs organized for waste minimization. The medical employees must train to create awareness and foster responsibilities for prevention of exposure and unsafe disposal to the waste. Every member of the community has the right to be informed about harmful effects of health care waste. Hence the public has to be educated in a using mass media, pictorial aids or other awareness methods. To achieve quality in disposal of health care waste of the health care centers/units should have a transparent holistic approach in medical services. This should include management of their waste in an environmentally friendly manner.

### **RECOMMENDATION**

- Biomedical waste should not mixed with other type of noninfectious waste.
- If segregation is done at the point of generation or collection then further treatment will be one step less.
- Hand washing and proper drinking water facility must be available at all necessary areas.
- Health care organization should take all the responsibility for maintenance and proper management of their generated waste.

- Containers in which collection or segregation is done should have clear labeling with non-washable and easily visible BMW or Hazardous symbol.
- All plastic bags, glass wares, equipment, machines, containers should be as per BIS standards.
- Untreated anatomical waste (humans and animals), solid and biotechnological waste should not be kept more than 48 hours. But if it stored more time then prescribed, then handler should take appropriate steps so that this waste will not affect the surroundings.

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**How to cite this article:** Harsh Chaudhary, Rakhi Ahuja and Pooja Sharda Janardan. Bio medical waste management and its treatment. Int J of Allied Med Sci and Clin Res 2019; 7(3): 740-744.

**Source of Support:** Nil. **Conflict of Interest:** None declared.