

### **3.3 Biomedical Wastes**

*Biomedical wastes* are defined as any solid, semi solid or liquid waste including containers, and any intermediate product which are generated during diagnosis, treatment or immunization of human beings, animals or in production and testing of biological parts. Among the biomedical wastes, approximately 10% to 15% of the wastes are generated from health care activities.

#### **3.3.1 Types of Biomedical wastes**

In general, these wastes include

- i. Needles
- ii. Scalpel blades
- iii. Syringes
- iv. Contaminated gloves
- v. Dishes used for microbiological cultures
- vi. Human anatomical wastes
- vii. Blood soaked items such as gauze pads and other absorbents
- viii. Wastes generated in the health center that are known to have been in contact with an infectious agent.

**Table 3.2 Categories of biomedical wastes**

<b>Category-1</b>	Human Anatomical	Human tissues. organs, body parts.
<b>Category-2</b>	Animal Wastes	Animal tissues, organs, body parts , carcasses, bleeding parts, fluid, blood wastes generated by veterinary hospitals and colleges, discharge from hospitals, animal houses.
<b>Category-3</b>	Microbiology & Biotechnological wastes	Wastes from laboratory cultures, stocks or specimen of micro organisms live or attenuated vaccines, human and animal cell cultures used in research and infectious agents from research and industrial laboratories.
<b>Category- 4</b>	Waste Sharps	Used and unused needles, syringes scalpels, blades, glass, etc.
<b>Category-5</b>	Discarded Medicine & Cytotoxic drug	Outdated, contaminated and discarded medicines.

<b>Category- 6</b>	Soiled Wastes	Items contaminated with body fluids and blood including cotton, dressings, soiled plaster casts, bedding, etc.
<b>Category-7</b>	Solid Wastes	Wastes generated from disposable item other than the waste sharps such as tubing, catheters, intravenous sets, etc.
<b>Category-8</b>	Liquid Wastes	Wastes generated from laboratory and washing, cleaning, housekeeping and disinfecting activities.
<b>Category-9</b>	Incineration Ash	Ash from incineration of any biomedical waste.
<b>Category-10</b>	Chemical Wastes	Chemicals used in production of biological chemicals used in disinfecting , as insecticides, etc

### 3.3.2 Generation of Biomedical Wastes

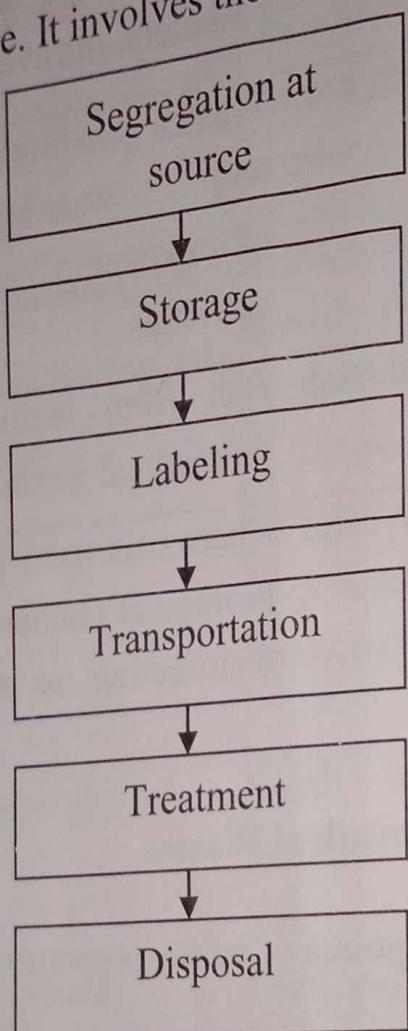
The different location or points of waste generation are

- a. Operation theaters/wards/labour rooms
- b. Injection rooms
- c. Intensive Care Units

- d. Dressing rooms
- e. Dialysis room
- f. Laboratory

### 3.3.3 Biomedical Waste Management

Management of biomedical waste is important because of its infectious nature. It involves the following steps.



#### (a) Segregation at Source

The first step in biomedical waste management is segregation of

wastes. Segregation at source is done in order to avoid mixing of infectious wastes with non-wastes as this would infect the entire waste. Only a small fraction of waste generated by health care institutions is actually infectious or hazardous. It is estimated about 80 to 85% is non-infectious, 10 % is infectious and 5% is hazardous.

Segregation of waste at the source is essential for safe and hygienic waste management. It prevents spread of infection, makes it easier to choose among the options of disposal. It can reduce the load on the incinerator and prevent injuries.

Infected waste can be segregated into the following categories:

- i. Organs and organ parts, associated body fluids (blood/pus or peritoneal fluids etc.)
- ii. Dressings
- iii. Microbiology wastes, non-reusable specimen containers
- iv. Needles, razor blades, scalpel blades, nails, pins, bones etc.
- v. Broken glass wares
- vi. Intact glass wares
- vii. General wastes

#### (b) Storage of Biomedical Wastes

Storage of biomedical wastes is the process of holding the

biomedical wastes temporarily at any location prior to transportation, treatments and disposal.

The containers used for storage must be rigid, leak proof, impervious to moisture, sufficiently strong to prevent tearing or bursting under normal conditions of use and handling. These containers must be sealed to prevent leakage. Sharps and any residual substances therein must be placed in containers that are puncture-resistant. Body fluids in quantities greater than 20 cubic centimeters must be placed in break-resistant containers and tightly lidded or stoppered.

The requirements for storage of biomedical wastes are as follows:

- i. The storage yard must be located in order to maintain the integrity of its packaging.
- ii. These wastes must be stored in a manner which provides protection from animals and does not provide a breeding place or food source for insects or rodents.
- iii. It must be protected from water, precipitation and wind.
- iv. The storage yard must be constructed of finished materials that are impermeable and capable of being easily maintained in a sanitary condition.
- v. Biomedical wastes must be stored only in a non-putrescent state. These wastes may be refrigerated during storage.
- vi. A sign displaying the universal biohazard symbol must be posted wherever biomedical waste is stored.
- vii. Biomedical wastes should not be compacted or subjected

- to violent mechanical stress during storage.
- viii. Leak proof unbreakable containers should be used. The inner polythene bag should fit into the container with one-fourth of the polythene bag turned over the rim.
- ix. The containers are then to be transported in closed trolleys or wheeled containers which should be designed for easy cleaning and draining.

### (c) Labeling

In biomedical waste management, it is essential to affix or otherwise imprint water-resistant label on the outside of each container indicating contents of the container before the transportation process.

The label must be at most three inches by five inches and it shall be non-washable and shall be prominently visible. Each label over the container must specifically contain universal biohazard symbol or the words '*medical waste*' or '*infectious waste*'. The label must contain the following details:

1. The type of waste
2. The site of generation
3. The generator's name and address

### (d) Transporting Biomedical Waste

The collection and the transportation of biomedical waste should

be carried out in such a manner that there will no hazard to the human health and environment. Specially designed vehicles are used for transporting such wastes. After unloading, the vehicle should be washed properly and disinfected.

### (e) Treatment of Biomedical wastes

The different types of treatments given for the processing of biomedical wastes are

- a) Incineration
- b) Autoclaving
- c) Microwaving
- d) Hydroclaving
- e) Chemical Disinfection
- f) Shredding.

#### **Incineration**

Incineration is a controlled combustion process where the waste is completely oxidized and harmful microorganisms present in it are destroyed under high temperature. Suitably designed pollution controlled devices should be installed. Care should be taken to see that the wastes to be incinerated are not chemically treated with any chlorinated disinfectants.

## **Autoclaving**

Autoclaving is a method of low heat thermal process. In this process, low heat steam is allowed to have direct contact with waste in a controlled manner.

## **Microwaving**

Microwaving is an intermolecular heating process with electromagnetic radiation between 300 to 30000 mHz. The heating occurs inside the waste material in the presence of steam. Microwaving treatment should not be used for hazardous or radioactive waves, contaminated animal care cases, body parts and large metal items.

## **Hydroclaving**

Hydroclaving is similar to that of autoclaving, the only difference is that waste is subjected to indirect heating by applying steam in the outer jacket.

## **Chemical Disinfection**

Chemical Disinfection is done by using 1% hypochlorite solution or any other equivalent chemical reagent.

## **Shredding**

Shredding is the process by which the wastes are reshaped or broken into smaller species so as to make the waste unrecognizable. It helps in prevention of reuse of biomedical wastes.

Non-infectious human or animal blood and body liquids need not be disinfected before being poured down the drain. The sink should be rinsed well and disinfected after the disposal procedure.

The sanitary land fill pits sites should be distant from habitation to ensure that no contamination occurs in any surface water or ground water. The area should not be allowed to flooding or erosion. It must be ensured that animals do not have access to burial sites. Covers of galvanized iron/wire meshes may be used. On each occasion, when wastes are added to the pit, a layer of 10 cm of soil be added to cover the wastes.

The treated waste may finally be sent for disposal in a landfill or for recycling purposes.

Table No. 3.3 Different modes of disposal of biomedical wastes

Waste Category	Types of waste	Types of Treatment	Mode of disposal
Category-1	Human anatomical waste	Incineration	Deep burial
Category-2	Animal waste	Incineration	Deep burial
Category-3	Microbiology & Biotechnological wastes	Autoclaving/ Microwaving	Incinerations

<b>Category- 4</b>	Waste sharps	Autoclaving/Microwave/Chemical disinfections	Shredding
<b>Category-5</b>	Discarded medicine & cytotoxic drug	Incineration	Secured land fill
<b>Category- 6</b>	Soiled wastes	Autoclaving/Microwave/ Incineration	Shredding
<b>Category-7</b>	Solid wastes	Autoclaving/Microwave/Chemical disinfections	Land fill
<b>Category-8</b>	Liquid wastes	Chemical	Discharge into disinfection drains
<b>Category-9</b>	Incineration ash	Chemical disinfections	Secured landfills for solids and discharge into drains for liquids

**1) What are solid wastes?**

The wastes generated and discarded from human and animal activities that are normally solid are called as solid wastes.

**2) What do you know about on-site handling?**

The activities involved in handling of solid wastes, at the point of generation, until they are placed in the containers used for their storage before collection are called as on-site handling. Handling requires to move the filled containers to the collection point and to return the empty containers to the generation point for the next collection.

**3) Name any three on-site processing methods.**

- 1) Manual sorting
- 2) Compaction
- 3) Incineration

**4) What are the main purposes of processing techniques used in solid waste management?**

1. To improve the efficiency of solid waste management systems
2. To recover the usable materials for reuse
3. To recover conversion products and energy.
- 4.

5) List out the techniques of processing of solid wastes.

1. Compaction (Mechanical volume reduction)
2. Incineration (Chemical volume reduction)
3. Shredding (Mechanical size reduction)
4. Component separation
5. Drying and Dewatering (Moisture content reduction).

6) What are biomedical wastes?

*Biomedical wastes* are defined as any solid, semi solid or liquid waste including containers and any intermediate product which are generated during diagnosis, treatment or immunization of human beings and animals or in production and testing of biological parts.

7) What are the types of biomedical wastes?

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