

## Biomedical Waste and its Management: A Review

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### Abstract

Biomedical wastes (BMW) are wastes that are generated during diagnosis, treatment, or immunization of human beings or animals or in research activities. With increase in the healthcare facilities the amount of biomedical waste generated per day was also increased. They are very different from other house hold wastes or industrial wastes. Bio Medical Wastes are hazardous and can be injurious to humans or animals and deleterious to environment as it can transmit infections, particularly HIV, Hepatitis B and C and Tetanus, to the people who handle it or come in contact with it. Since it is hazardous in nature its management is extremely important and this is the biggest challenge in present day times. These wastes must be treated using adequate treatment method. The Ministry of Environment and Forests has published the Bio-Medical Waste Rules, 1998 to regulate the proper disposal and management of biomedical wastes. This review deals with various techniques used in the management of biomedical wastes.

**Keywords:** Classification; Conclusion and Suggestions; Definition; Effects of BMW; Sources; Treatment of BMWs.

### Biomedical Wastes

These are any wastes generated during the process of diagnosis and treatment or immunization of human beings or animals or in research activities contributing to the biological production or testing<sup>1,21</sup>.

### Classification:

According to World Health Organisation the biomedical wastes are classified into eight categories,

- i. General Waste
- ii. Pathological
- iii. Radioactive

- iv. Chemical
- v. Infectious to potentially infectious waste
- vi. Sharps
- vii. Pharmaceuticals
- viii. Pressurized containers.<sup>2</sup>

The hazardous biomedical wastes are classified into two types.

### Potentially Infectious Wastes:

- Dressings and swabs contaminated with blood, pus and body fluids.
- Laboratory waste including laboratory culture stocks of infectious agents.

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- Potentially infected material: Excised tumours and organs, placenta removed during surgery, extracted teeth etc.
- Potentially infected animals used in diagnostic and research studies.
- Sharps, which include needle, syringes, blades etc.
- Blood and blood products.<sup>3,23,24</sup>

### **Potentially Toxic Wastes**

- *Radioactive waste:*

They are contaminated radionuclides. These are obtained from in vitro analysis of body fluids and tissue, in vitro imaging and therapeutic procedures.<sup>4,25,26</sup>

### **Chemical Waste**

They are generally disinfectants, X-ray processing solutions, monomers and associated reagents, base metal debris (dental amalgam in extracted teeth).

### **Pharmaceutical Waste**

They are anaesthetics, sedatives, antibiotics, analgesics etc.<sup>5,27</sup>.

#### *Sources*

The major sources of biomedical wastes are,

1. Hospitals, Nursing homes, Primary health care centre.
2. Research centres and Laboratories.
3. Blood banks

*The other minor sources of biomedical wastes are,*

1. Ambulance services
2. Cosmetic piercings and acupuncturists
3. Funeral services
4. Vaccination centres.<sup>6,28,29</sup>

### **Effects of Biomedical wastes**

The inappropriate treated wastes generated in health care institutions which may be hazardous, infectious and non-infectious can cause a direct health impact on the health care workers and on the environment. Up to 85% of the wastes generated in hospitals are non-infectious.<sup>7,22,30</sup> But some of the infections like hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency (HIV) virus are commonly transmitted to the

community by biomedical wastes.<sup>8,31,32</sup> The wastes that are treated in a wrong method may pollute the environment that in turn affects the health of the community.<sup>9,33,34</sup>

### **Treatment of Biomedical Wastes:**

#### **1. Autoclave**

Autoclaves are used to sterilize medical equipments; it can apply both heat and pressure via steam, throughout the period of sterilization.<sup>10,35,36</sup> In biomedical waste treatment autoclaves are used to kill the microorganisms present in wastes that are disposed by landfills. Up to 90% of medical wastes are processed by autoclaves.<sup>11,37</sup> The reusable medical instruments are often sterilized by autoclaves. Steam is more efficient in sterilization of low-density materials like plastics, metal pans, bottles, and flasks.<sup>12,38,39</sup> High-density polyethylene and polypropylene plastics do not facilitate steam penetration thus should not be sterilized by steam. Infectious wastes and other hazardous wastes should be separated; infectious wastes that contain non-infectious hazards should not be sterilized in autoclave.<sup>13,40</sup>

#### **Incineration**

Increased temperature cause dry oxidation. This reduces organic combustible wastes to inorganic incombustible wastes and decrease the volume and weight of the wastes that are disposed in outer land fields.<sup>14,41</sup> The advantage of incineration is it does not require any pre-treatment. The major disadvantage of incineration is it requires large capital for modern technologies.<sup>15,42</sup>

#### **Microwave Irradiation**

In this method, the microbes are killed by the heat produced from electromagnet rays. Its frequency lies between 300 and 300,000 MHz and most of the microorganisms are killed in the frequency of about 2450 MHz. Limitation: It should not be used for the treatment of cytotoxic, hazardous and radioactive waste.<sup>16,43</sup>

#### **Deep Burial**

A pit of about 2 m is dug. It is first half filled with wastes, and then it is covered with lime within 50 cm of the surface and the rest of the pit is filled with soil.

### Disposal of sharps:

The discarded needles and lancets that have been used either in animal or in human are called sharps. The sharps after disinfection are disposed in a pit lined with brick concrete which is covered by a concrete slab with a steel pipe.<sup>17</sup>



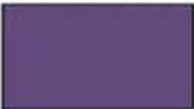





### Conclusion and Suggestion

Healthcare facilities which generate biomedical wastes should have treatment facilities and ensure the proper disposal of treated wastes.<sup>18,44</sup>

Some suggestions are given below:

- ❖ Biomedical wastes marked vehicles should be increased.

- ❖ The leakage of biomedical wastes should be prevented during any transshipment.
- ❖ Biomedical wastes should not be mixed with other hazardous wastes.
- ❖ Awareness about the colour code about biomedical wastes must be created and followed. Fig. 1 shows the colour coding for the containers of the healthcare wastes.
- ❖ All the staffs dealing with biomedical wastes in any of its state should be trained regularly in order to prevent their hazardous consequences.
- ❖ Each district should be constituted with a biomedical wastes management board (BMW Management board).<sup>19</sup>

Bag Colour	Description
 Yellow	<b>Infectious waste contaminated with chemicals</b> Clinical waste, infectious, containing chemicals from healthcare For clinical waste incineration only Classed as <b>Hazardous waste</b>
 Orange	<b>Infectious waste (not containing chemicals or medicinal contamination)</b> Clinical waste, infectious, containing chemicals from healthcare Suitable for alternative treatment or clinical waste incineration Classed as <b>Hazardous waste</b>
 Purple	<b>Cytotoxic and cytostatic waste</b> Clinical waste, cytotoxic and cytostatic waste, infectious For incineration only Classed as <b>Hazardous waste</b>
 Yellow & Black	<b>Offensive/hygiene waste</b> Offensive waste, municipal or from healthcare For incineration, landfill, energy from waste or other authorised disposal/recovery Classed as Non-hazardous waste
 Red	<b>Anatomical waste for incineration</b> Indicative treatment/disposal required is <b>incineration</b> in a suitably permitted facility. For clinical waste incineration only Classed as <b>Hazardous waste</b>
 Blue	<b>Medicinal waste for incineration</b> Indicative treatment/disposal required is <b>incineration</b> in a suitably permitted facility. Can be classed as <b>Hazardous waste</b>
 Black	<b>Domestic (municipal) waste</b> Mixed municipal waste Classed as Non-hazardous waste
 White	<b>Dental Amalgam</b> Dental amalgam and mercury including spent and out-of-date capsules, excess mixed amalgam and contents of amalgam separators For recovery Classed as <b>Hazardous waste</b>

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