

An overview on biomedical waste and its management

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Bio-medical waste is a hazardous waste produced from various health care units. The quantity of these waste produced is very large. An alarming quantity of these wastes disposed off in open and poses serious health hazard for public as deadly pathogenic microorganisms breeds freely. Managements of bio-medical waste is a global problem because deleterious effect and mismanagement of biomedical waste can affect the individual and environment.

Key words : Biomedical waste, Management.

INTRODUCTION

IN the present paper various aspect of biomedical waste, its classification, handling and management procedures are discussed.

What is biomedical waste

Biomedical waste or the hospital Waste has been defined as "any waste which is generated during diagnosis, treatment or immunization of human beings or animals or any research activities pertaining to or in the production of testing of biological and may include infectious agents." Health care waste includes all the waste generated by health care establishments, research facilities and laboratories. In addition, it includes the waste originating from minor or scattered sources, such as that is produced in the course of health care undertaken in home.

The biomedical waste generally consists of human anatomical waste, animal tissue waste, bandage, linen and other infectious waste, plaster, disposal syringes, glasses, solid waste, liquid waste and other related materials.

Management of biomedical waste is a global problem and its utmost importance needs not be over emphasized as the deleterious effect of mismanagement of hospital waste can affect the individual and the environment. Biomedical waste generated by various hospitals

in our country runs into many hundred thousands of kilograms and proper disposal of it is a Herculean task. The establishment of health care is as basic requirement of every civilized society. Food, medicines, chemical equipment and instrument are used while treating out patient and patient admitted into hospital producing a variety of waste. The waste generated from the treatment of patients suffering from infectious diseases may spread infection either through direct contact or indirectly through the environment.

Bio-Medical waste (Management & Handling) Rule-1998

Bio-medical waste of generated primarily from health care establishments is a relatively recent issue and there are a lot gaps in information. The management of biomedical waste still in its infancy all over the world. There is a lot of confusion and problems among the generators, operator decision makers and general community about the safe lack of awareness. Hence resource material on the environment for hospital administration, surgeons, doctor, nurses, paramedical staff and waste retrievers is the need of the hour.

BIO-MEDICAL WASTE (Management And Handling) RULES, 2000

S.O.630 (E). Whereas a notification in exercise of the powers conferred by section 6, 8 and 25of the environment (protection)

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act, 1986 (29of 1986) was published in the gazette vides. S.O. 746(E) dated 16 October, 1997 inviting objection from the public within 60 days from the date of the publication of the bio-medical waste (management and handling) rules, 1998 and where all objections received were duly considered.

Now, therefore, in exercise of the powers conferred by section6, 8 and 25 of the environment (Protection) Act, 1986 the central government hereby notifies the rules for the management and handling of biomedical waste.

CATEGORIES OF BIOMEDICAL WASTE

Ten Categories of Biomedical waste have been described in schedule of BMW rules 1998(Table).Human Anatomica waste **Category 1** is usually generated in operation theatres but a number of specimens are sent to the pathology department for diagnosis. Hence it is a liability of the laboratory to dispose the tissues as biomedical waste. **Category 2** (animal waste), **category 5** (discarded medicines and cytotoxic drugs) and. Microbiology waste **Category3** generated in the form of specimen, cultures, tubes and plates used in identification and drug sensitivity test an stock cultures have perhaps the highest infectious potential. However, autoclaving has been a time-tested method of disinfection of microbiology waste. Among waste sharps **category 4** the quantity of glass in pathology is more than needle sharps and **category 6** (soiled waste) is a small quantity in form of cotton balls used while blood collection or used as absorbent material for accidental blood and body fluid spillage. **Category 7** is the solid waste mainly from disposal items other then sharps for example tubings, tubes and containers used for blood and other pathological samples blood collection sets in blood bank and blood bags. **Category 8** includes liquid waste generated while washing of laboratory waste and processing of sample on the analyzers **category 9** (incineration ash) are not generated in pathology laboratory **Category10** is the chemical waste generated while testing and analysis.

CLASSIFICATION OF THE HAZARDOUS HELTH CARE

1. INFECTIOS WASTE

Infectious waste suspected to contain pathogen (bacteria, viruses, parasites or fungi) in sufficient concentration or quality to cause disease in susceptible hoots.

The category includes:

- * Culture and stocks of infection agent from lab works
- * Waste form surgery autopsies of patient with infectious disease
- * Waste from infected patient in isolation ward (eg. Excreta dressing from infected or surgical wounds clot heavily soiled with human blood or other body fluids.
- * Waste that has been in contact with infected patient undergoing haemodialysis.

- * Any other instrument or material that have been in contact with infected person or animals.

2. PATHOLOGICAL WASTE

Pathological waste consists of tissue. Organ, body parts, human, and animal carcasses, blood and body fluids.

3. SHARPS.

Sharps are items that could cause cuts or punctures wounds including needles, hypodermic needles. Scalpel and other blades, knives, infusion sets, saws broken glass and nails whether or not they are infected. Such items are usually considered as highly hazardous health care waste.

4. PHARMACEUTICAL WASTE

Include expired, unused, spill and contaminated pharmaceutical product drugs, vaccines and sera that no longer required and need to be disposed off appropriately. The category also includes discarded items used in handling of pharmaceutical; such as bottles with residue gloves masks, and connecting tubes and drug vials.

5. CHEMICAL WASTE

Chemical waste consists of discarded solid. liquid and disinfecting gaseous chemicals eg. From diagnostic and experimental work and from cleaning, housekeeping procedures, chemical waste from health care may be hazardous or non-hazardous, if it has at least one of the following properties. Toxic corrosive (e.g. Acid of pH2 and base of pH12).

Flamable reactive genotoxic. Non-hazardous chemical waste consists of chemicals with none of above properties such as sugars. AA and certain organic and inorganic salt.

6. GENOTOXIC WASTE

Highly hazardous and may be mutagenic or carcinogenic properties. It raises serious problem both inside hospital and after disposal and should be given special attention include certain drugs vomits, urine or faeces from patient treated with cytostatic drugs, chemical and radioactive material. Waste with high content of heavy metals –represent subcategories of hazardous chemical waste and usually highly toxic mercury waste etc.

WASTE WITH HIGH CONTENT OF HEAVEY METALS.

Represents subcategories of hazardous chemical and are usally highly toxic like mercury waste.

Pressurized Containers:

Many types of gases are used in health care and are often stored in pressurized cylinders, catridages and aerosols cans, many of these once empty ore of no further use are reusable but certain types not to ally disposed off.

Radioactive Waste

This include solid, liquid and gaseous materials contaminated with radio nuclides, it is produced as a result of procedure such as inventor analysis of body tissue and fluid in vivo organ imagine and tam our localization and various investigative and therapeutic practices. Radio nuclides used in health care are usually conditional in unsealed or sealed sources.

BIOMEDICAL WASTE MANAGEMENT SYSTEM

DEEFINION

It stands for bio-medical waste: term broadly used for waste generated in any hospital, clinical environment. It encompasses the waste generated in diagnosis, treatment immunization of humans as well as animals in hospitals /clinics &at home. The waste generated during research of biological products is also included.

Bio-medical waste (Handling and Management) Rules have

been enacted to regulate disposal of bio-medical waste including human anatomical waste, blood and body fluid, medicines and glassware's, solid liquid and biotechnology waste from occupiers of clinics, dispensaries, pathology laboratory blood banks, providing treatment/ service.

There are two principal reasons because of which bio-medical poses hazard-the first is infectivity and other toxicity. Health hazards & environment hazards involved in effects of hospital waste It has been observed that medical teaching in university Hospital with research facilities produces more clinical waste than general hospital. Similarly, hospital with greater number of beds produce more waste per bed then a smaller hospital. It has been derived from the study that the bio-medical waste contribution of major hospital (more then 100 bedded), is about 1.01% of total generated waste. But when viewed individually, they generate significant bio- medical waste generated in India is 1.0-2.0kg / bed/day.

The typical hospital solid waste composition is as follows (based on CPCB report):

26.60 % food material
10.24 % paper, hard board etc.
9.99 % Miscellaneous
9.85 % Plastic PVC etc.
1.09 % Disposable syringes
0.12 % Glasses & crockery
39.17 % Cloth, bandages etc.
2.94 % Disposable needles

Segregation, collection storage and transport of bio-medical waste.

Segregation:

The bio-medical waste management requires its segregation at source it self for proper management. The BMWs must be segregated in accordance with the guidelines laid down under schedule 1 of BMW Rules, 1998. Segregation of waste allows special attention to be given to the relatively small quantities of waste and thereby reducing the risks as wall as cost of handling and disposal.

Collection:

The collection of bio-medical waste involves use of different types of contain from various sources of bio-medical waste like operation theater, laboratory, wards, kitchen, corridor etc. The containers/bins should be placed in such a way that 100% collection is achieved.

Storage:

once collection occurs then bio-medical waste is stored in proper place. Segregated wastes of different categories need to be collected in identifiable containers. The color-coding, and types of containers, shall be followed as per the schedules 11 of the BMW Rule. The duration of storage should not exceed for 8-10 hrs in big hospital (more then 250 bedded) and 24 hrs in nursing home. Each container may be clearly labeled to show the ward or room where it is kept. The reason for this labeling is that it may be necessary to trace the waste back to its source. Besides this, storage area should be marked with caution sign.

Transportation:

The waste should be transported for treatment either in trolleys or in covered wheelbarrow. Manual loading should be avoided as far as possible. The bag container containing BMWs should be tied /lidded before transporting and it should accompany with signed document by nurse/ doctor mentioning date destination. Special vehicles must be used so as to prevent access to, and direct contact with the waste by transportation operators, the scavengers and the public. The transport containers should be properly enclosed. The effects of traffic accident should be considered in the design, and the driver must be trained in the

procedures he must follow in case of an accidental spillage. It should also be possible to wash the interior of the containers thoroughly.

ELEMENTS AND CONSECUTIVE STEPS OF THE BIO-MEDICAL WASTE MANAGEMENT PLAN.

Bio-medical waste

Bio-medical waste minimization /separation

Bio-medical waste identification
(Category, use of color coding / labeling)

Bio-medical waste handling
(Schedule for collection within the health care premise) and
(Selection of storage area till on –site treatment or transport to
off –site treatment)

Bio-medical waste treatment
(On site / off –site)

Bio-medical waste disposal

Record /report

Treatment of bio- medical waste.

- Disfigurement
- De contamination
- Sterilization

Technologies for treatment of biomedical waste

- I Mechanical processes
- II Thermal processes - Autoclaving
 - Microwave treatment
 - Incineration
- III Chemical process
- IV Irradiation process
- V Biological process

I. Mechanical process:

Technical processes are used to change the physical 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 and shredding.

II. Thermal process:

Thermal processes used that to decontaminate or destroy medical there are two categories of thermal processes viz. low-heat system and high heat system. Low heat system use steam, hot water, or electromagnetic radiation to heat and decontaminate the waste. Autoclave & microwave are low heat system. High – heat system employ combustion, pyrolysis and high temperature plasma to decontaminate and destroy the waste. Incinerator& Plasma system are high heat system.

III. Chemical process:

Chemical treatment involves the use of chemical for disinfections. Disinfectants are mostly chlorine compounds, iodine alcohols, and hexachlorophene. Formaldehydes, Iodine-alcohol combination, formaldehyde-alcohol combination etc.

IV. Irradiation process:

Irradiation treatment involves the use of chemicals for radiation In an enclosed chamber. Processes utilizing Cobalt-60, and electron beam accelerator unit or electron beam gun, for irradiating and sterilizing the medical waste has been developed. These system require post-shredding to render the waste unrecognizable.

V. Biological process :

A system is being developed using biological enzymes for treating medical waste. It is claimed that biological reaction 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

