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MANAGEMENT of BIO-MEDICAL WASTE DISPOSAL

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Abstract: Bio-medical waste is highly hazardous which can cause serious diseases. So bio-medical waste management is required to reduce the serious health implications. This paper deals with the basic issues of bio-medical waste disposal and management of biomedical waste. Its purpose is to spread knowledge among the personnel involved in health care facilities, research and development laboratories and manufacturing units to prevent transmission of the diseases in the society and to protect public health and environment. The Bio-Medical Waste Management Rules, 2016 have to be followed for the safe disposal of bio-medical wastes.

Keywords: Bio-medical waste, Health care facility, Segregation, Incineration

I. INTRODUCTION

Bio-medical waste' means any waste, which is generated during diagnosis, treatment or immunization of human beings or animals or research activities pertaining there to or in the production or testing of biological or in health camps. Bio-medical waste, also called Biohazardous waste or infectious waste. Management of bio-medical waste is an integral part of infection control and hygiene programs in healthcare settings. All bio-medical wastes generated from the health care facilities can adversely affect the health of a person or harm the environment, if not disposed properly. Bio-medical waste consists of human tissues, contaminated blood, body fluids, discarded medicines, contaminated cotton, dressings, and sharps such as needles, glass, blades, scalpels, lancets. The biomedical wastes need to be properly segregated at source of its generation and colour coded for transportation, storage, appropriate treatment and disposal. The treatment technologies identified for the biomedical wastes include chemical treatment, autoclaving, microwaving and the incineration. Shredding, deep burial and mutilation are also related methods for the waste disposal. On March 28, 2016, the Government of India published the Bio- medical Waste Management Rules, 2016 (Gazette of India, 2016). In the new Biomedical Waste Management Rules, 2016, several changes and additions have been made to further improve the collection, segregation, processing, treatment and disposal of the biomedical wastes in an environmentally sound manner. The existing waste treatment and disposal facilities are required to meet the new standards and stipulations of the Bio- medical Waste Management Rules, 2016 for the proper management and disposal of bio-medical hazardous waste.[1,2,3,4]

II. PROCEDURE for AUTHORISATION

Every occupier or operator handling bio-medical waste, irrespective of the quantity shall make an application in Form II to the prescribed authority i.e. State Pollution Control Board and Pollution Control Committee, as the case may be, for grant of authorisation and the prescribed authority shall grant the provisional authorisation in Form III and the validity of such authorisation for bedded health care facility and operator of a common facility shall be synchronised with the validity of the consents [1]

(a) The authorisation shall be one time for non-bedded occupiers and the authorisation in such cases shall be deemed to have been granted, if not objected by the prescribed authority within a period of ninety days from the date of receipt of duly completed application along with such necessary documents

(b) In case of refusal of renewal, cancellation or suspension of the authorisation by the prescribed authority, the reasons shall be recorded in writing: Provided that the prescribed authority shall give an opportunity of being heard to the applicant before such refusal of the authorisation.

(c) Every application for authorisation shall be disposed of by the prescribed authority within a period of ninety days from the date of receipt of duly completed application along with such necessary documents, failing which it shall be deemed that the authorisation is granted under these rules

(d) In case of any change in the bio-medical waste generation, handling, treatment and disposal for which authorisation was earlier granted, the occupier or operator shall intimate to the prescribed authority about the change or variation in the activity and shall submit a fresh application in Form II for modification of the conditions of authorisation [1].

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III. DUTIES of the OCCUPIER

Duties of the every Occupier is as follows.

(a) To take all necessary steps to ensure that bio-medical waste is handled without any adverse effect to human health and the environment and in accordance with these rules;

(b) To make a provision within the premises for a safe, ventilated and secured location for storage of segregated biomedical waste in colored bags or containers in the manner as specified in Schedule I. [1]

(c) To pre-treat the laboratory waste, microbiological waste, blood samples and blood bags through disinfection or sterilisation on-site in the manner as prescribed by the World Health Organisation (WHO) guidelines on safe management of wastes from health care activities and WHO Blue book, 2014 and then sent to the common bio-medical waste treatment facility for final disposal. [5]

(d) To phase out use of chlorinated plastic bags (excluding blood bags) and gloves. Explanation For removal of doubts, it is here by clarified that the expression chlorinated plastic bags shall not include urine bags, effluent bags, abdominal bags and chest drainage bags.[5,6]

(e) To provide training to all its health care workers and others, involved in handling of bio medical waste at the time of induction and thereafter at least once every year;

(f) To immunise all its health care workers and others, involved in handling of bio-medical waste for protection against diseases

(g) To establish a Bar- Code System for bags or containers containing bio-medical waste to be sent out of the premises or for the further treatment and disposal in accordance with the guidelines issued by the Central Pollution Control Board.[5]

(h) To ensure segregation of liquid chemical waste at source and ensure pre-treatment or neutralisation prior to mixing with other effluent generated from health care facilities.

(i) To ensure treatment and disposal of liquid waste in accordance with the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974).

(j) To ensure occupational safety of all its health care workers and others involved in handling of biomedical waste by providing appropriate and adequate personal protective equipments.

(k) To conduct health check up at the time of induction and at least once in a year for all its health care workers and others involved in handling of bio- medical waste and maintain the records for the same;

(l) In case of all bedded health care units maintain and update on day to day basis the bio-medical waste management register and display the monthly record on its website according to the bio-medical waste generated in terms of category and colour coding as specified in Schedule I. [7]

(m) To report major accidents in Form I to the prescribed authority and also along with the annual report.

(n) In case of all bedded health care facilities (any number of beds), make available the annual report on its web-site as per the Bio-Medical waste Management (Amendment) Rules 2018. [7]

(o) To inform the prescribed authority immediately in case the operator of a facility does not collect the bio-medical waste within the intended time or as per the agreed time.

(p)To establish a system to review and monitor the activities related to bio-medical waste management.

(q) To maintain all record for operation of incineration, hydro or autoclaving etc., for a period of five years.

IV. BIO-MEDICAL WASTE CATEGORIES and THEIR SEGREGATION and COLLECTION

Different type of bio-medical wastes are generated from hospitals, nursing homes, Medical laboratories, blood banks, Mortuaries. Medical research and training centers, bio technology institution, production units and animal houses etc. Segregation of the different type of bio-medical waste is done as per new colour coding structure of the Bio Medical Waste Management Rules,2016. Bio-medical waste categories and their segregation options are as follows.[1, 8]

A. YELLOW CATEGORY TYPE of WASTE

1.HUMAN ANATOMICAL WASTE:

Human tissues, organs, body parts and fetus below the viability period (as per the Medical Termination of Pregnancy Act 1971, amended from time to time).It is collected in Yellow coloured non-chlorinated plastic bags

2.ANIMAL ANATOMICAL WASTE:

Experimental animal carcasses, body parts, organs, tissues, including the waste generated from animals used in experiments or testing in veterinary hospitals or colleges or animal houses. It is collected in Yellow coloured non-chlorinated plastic bags.

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3.SOILED WASTE:

Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components. It is collected in Yellow coloured non-chlorinated plastic bags.

4. EXPIRED or DISCARDED MEDICINES:

Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc. it is collected in Yellow coloured non-chlorinated plastic bags or containers.

5. CHEMICAL WASTE:

Chemicals used in production of biological and used or discarded disinfectants. it is collected in Yellow coloured containers or non-chlorinated plastic bags

6.CHEMICAL LIQUID WASTE :

Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X-ray film developing liquid, discarded Formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, house-keeping and disinfecting activities etc. it is collected in Separate collection system leading to effluent treatment system

7.DISCARDED LINEN,MATTRESSES, BEDDINGS, CONTAMINATED with BLOOD or BODY FLUID, ROUTINE MASK and GOWN:

it is collected in Non-chlorinated yellow plastic bags or suitable packing material.[5]

8. MICROBIOLOGY, BIOTECHNOLOGY and OTHER CLINICAL LABORATORY WASTE:

Blood bags, Laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines, human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures. it is collected in Autoclave or Microwave or Hydroclave safe plastic bags or containers. [5]

B. RED CATEGORY TYPE of WASTE

1.CONTAMINATED WASTE (RECYCABLE) :

Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and fixed needle syringes) and vaccutainers with their needles cut and gloves. it is collected in Red coloured non-chlorinated plastic bags or containers

C.WHITE (TRANSLUCENT) CATEGORY TYPE of WASTE

1.WASTE SHARPS INCLUDING METALS:

Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps. it is collected in Puncture proof, Leak proof, tamper proof containers.

D. BLUE CATEGORY TYPE of WASTE

1.GLASSWARE:

Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes. it is collected in puncture proof and leak proof boxes or containers with blue colored marking [5]

2.METALLIC BODY IMPLANT:

it is collected in puncture proof and leak proof boxes or containers with blue colored marking [5]

V. PACKAGING of BIO-MEDICAL WASTE

(a) Bio-medical waste bags and sharp containers should be filled no more than three quarter full. once this level is reached, .they should be sealed ready for collection

(b) Colour coded waste bags and containers should be printed with bio-hazardous waste symbol labeled with details such as date, type of waste, waste quantity, sender name and receivers details as well as bar coded label to allow them to tracked till final disposal.

(c) Ensure that Bar coded stickers are pasted at each bag as per the guidelines issued by CPCB.

(d) Microbiology waste and all other clinical laboratory waste shall be pre-treated by sterilisation to Log 6 or disinfection to Log 4, as per the World Health Organisation guidelines before packing and sending to the common bio-medical waste treatment facility. [1]

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VI. LABELLING of BIO-MEDICAL WASTE

All the bags/containers/bins used for the collection and storage of bio-medical waste must be labelled with the warning symbol of Bio hazard or Cytotoxic hazard as the case may be as per the type of waste according to the Bio Medical Waste Management Rules,2016.

VII. STORAGE of BIO-MEDICAL WASTE

Healthcare facilities, Research centers and Manufacturing units must provide a storage area for medical waste until it is collected for treatment and disposal. Storage area should be selected carefully which is unapproachable to the general public and must exhibit warning symbols & signs. It should be stored in a dry and secured area before being transported. The area must be protected from water, wind, rodents, insects and animals. Untreated human anatomical waste, animal anatomical waste, soiled waste and, biotechnology waste shall not be stored beyond a period of forty eight hours. The planned space must be sufficient so as to store at least two days generation of waste The planned space must include space provision for storage of waste collection trolleys. There should be easy access between storage room and Common Bio-medical waste Treatment Facility. Provision of water supply for daily cleaning and maintenance of the room with disinfectants There should be provision of routing of waste water to Effluent Treatment Plant. [1,9]

VIII. TRANSPORTATION of BIO-MEDICA WASTE

(a) The operator of common bio-medical waste treatment facility shall transport the bio-medical waste from the premises of an occupier to any off-site bio-medical waste treatment facility only in the vehicles having label as provided in part 'A' of the Schedule IV along with necessary information as specified in part 'B' of the Schedule IV.[1]

(b) The vehicles used for transportation of bio-medical waste shall comply with the conditions if any stipulated by the State Pollution Control Board or Pollution Control Committee in addition to the requirement contained in the Motor Vehicles Act, 1988 (59 of 1988), if any or the rules made there under for transportation of such infectious waste.[1]

(c) Transportation vehicles should be fitted with GPS to track the movement of vehicle.

(d) Separate cabins shall be provided for driver/staff as well as for placing the designated colour coded bio- medical waste containers.

(e).The base of the waste cabin shall be leak proof to avoid pilferage of liquid during transportation.

IX. TECHNIQUES of BIO-MEDICAL WASTE DISPOSAL

A. INCINERATION

This is a high temperature thermal process employing combustion of the waste under controlled condition for converting them into inert material and gases. Incinerators can be oil fired or electrically powered or a combination there of. Broadly, three types of incinerators are used for hospital waste: multiple hearth type, rotary kiln and controlled air types. All the types can have primary and secondary combustion chambers to ensure optimal combustion. These are refractory lined.[10]

B. NON-INCINERATION

Non-incineration treatment includes four basic processes: thermal, chemical, irradiative, and biological. The majority of non-incineration technologies employ the thermal and chemical processes. The main purpose of the treatment technology is to decontaminate waste by destroying pathogens. Facilities should make certain that the technology could meet criteria for disinfection.[11]

C. AUTOCLAVING

The autoclave operates on the principle of the standard pressure cooker. ´ The process involves using steam at high temperatures. ´ The steam generated at high temperature penetrates waste material and kills all the micro organism ´ These are also of three types: Gravity type, Pre-vacuum type and Retort type. In the first type (Gravity type), air is evacuated with the help of gravity alone. The system operates with temperature of 121 deg. C. and steam pressure of15 psi. for 60-90 minutes. Vacuum pumps are used to evacuate air from the Pre vacuum autoclave system so that the time cycle is reduced to 30-60 minutes. It operates at about 132 deg. C. Retort type autoclaves are designed for much higher

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steam temperature and pressure. Autoclave treatment has been recommended for microbiology and biotechnology waste, waste sharps, soiled and solid wastes..[12]

D. HYDROCLAVING

This method is similar to that of autoclaving except that the waste is subjected to indirect heating by applying steam in the outer jacket. The waste is continuously tumbled in the chamber during the process.

E. MCROWAVE IRRADIATION

The microwave is based on the principle of generation of high frequency waves. ´ These waves cause the particles within the waste material to vibrate, generating heat. This heat generated from within kills all pathogens.

F. CHEMICAL METHODS

1 % hypochlorite solution can be used for chemical disinfection

G. PLASMA PYROLYSIS

Plasma pyrolysis is a technology for safe disposal of medical waste. It is an environment-friendly technology, which converts organic waste into commercially useful byproducts. The intense heat generated by the plasma enables it to dispose all types of waste including municipal solid waste, biomedical waste and hazardous waste in a safe and reliable manner. Medical waste is pyrolysed into CO, H_2 and hydrocarbons when it comes in contact with the plasma-arc. These gases are burned and produce a high temperature (around 1200^{o}C).[11]

H. DEEP BURIAL

Disposal by deep burial is permitted only in rural or remote areas where there is no access to common bio-medical waste treatment facility. This will be carried out with prior approval from the prescribed authority and as per the Standards specified in the rules. The deep burial facility shall be located as per the provisions and guidelines issued by Central Pollution Control Board from time to time.

X. TREATMENT AND DISPOSAL

(a) Occupier shall hand over segregated waste as per the Schedule-I to common bio-medical waste treatment facility for treatment, processing and final disposal: Provided that the lab and highly infectious bio-medical waste generated shall be pre-treated by equipment like autoclave or microwave.[1]

(b) No occupier shall establish on-site treatment and disposal facility, if a service of `common biomedical waste treatment facility is available at a distance of seventy-five kilometer.

(c) Bio-medical waste shall be treated and disposed of in accordance with Schedule I, and in compliance with the standards provided in Schedule-II by the health care facilities and common bio-medical waste treatment facility. Treatment and disposal options for the four categories of Bio-medical wastes are as follows.[1]

A. YELLOW CATEGORY TYPE of WASTE

1. HUMAN ANATOMICAL WASTE

Its treatment and disposal options are Incineration or Plasma Pyrolysis or deep burial

2. ANIMAL ANATOMICAL WASTE:

:Its treatment and disposal options are Incineration or Plasma Pyrolysis or deep burial

3. SOILED WASTE:

Its treatment and disposal options are Incineration or Plasma Pyrolysis or deep burial. In absence of above facilities, autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery.

4. EXPIRED or DISCARDED MEDICINES:

Its treatment and disposal options are as follows. Expired cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature >1200^{0}C or to common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >1200^{0}C Or Encapsulation or Plasma Pyrolysis at >1200^{0}C. All other discarded medicines shall be either sent back to manufacturer or disposed by incineration.[1]

5. CHEMICAL WASTE:

It is disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility.

6. CHEMICAL LIQUID WASTE :

Its treatment and disposal options are as follows, after resource recovery, the chemical liquid waste shall be pre-treated before mixing with other wastewater. The combined discharge shall conform to the discharge norms given in Schedule III.

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7. DISCARDED LINEN,MATTRESSES, BEDDINGS, CONTAMINATED with BLOOD or BODY FLUID, ROUTINE MASK and GOWN:

Its treatment and disposal options are as follows, non- chlorinated chemical disinfection followed by incineration or Plasma Pyrolysis or for energy recovery. In absence of above facilities, shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery or incineration or Plasma Pyrolysis [1,5]

8. MICROBIOLOGY, BIOTECHNOLOGY and OTHER CLINICAL LABORATORY WASTE:

Its treatment and disposal options are as follows, Pre-treat to sterilize with nonchlorinated chemicals on-site as per World Health Organisation guidelines on safe management of wastes from health care activities and WHO Blue book , 2014 and thereafter sent for incineration.[5]

B. RED CATEGORY TYPE of WASTE

1. CONTAMINATED WASTE (RECYCABLE) :

Treatment and Disposal options Autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to registered or authorized recyclers or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible. Plastic waste should not be sent to landfill sites.[1]

C. WHITE (TRANSLUCENT) CATEGORY TYPE of WASTE

1. WASTE SHARPS INCLUDING METALS:

Its treatment and disposal options are as follows. Autoclaving or Dry Heat Sterilization followed by shredding or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Boards or Pollution Control Committees) or sanitary landfill or designated concrete waste sharp pit.[1]

D. BLUE CATEGORY TYPE of WASTE

1. GLASSWARE:

Its treatment and disposal options are as follows. Disinfection (by soaking the washed glass waste after cleaning with detergent and Sodium Hypochlorite treatment or through autoclaving or microwaving or hydroclaving and then sent for recycling.

2. METALLIC BODY IMPLANT:

Its treatment and disposal options are as follows. Disinfection (by soaking the washed metallic body implants waste after cleaning with detergent and Sodium Hypochlorite treatment) or through autoclaving or microwaving or hydroclaving and then sent for recycling.[1]

XI. ANNUAL REPORT

(a) Every occupier or operator of common bio-medical waste treatment facility shall submit an annual report to the prescribed authority in Form-IV, on or before the 30th June of every year.

(b) The Annual Reports shall also be available online on the websites of Occupiers, State Pollution Control Boards and Central Pollution Control Board.

XII. MAINTENANCE OF RECORDS

Every authorised person shall maintain records related to the generation, collection, reception, storage, transportation, treatment, disposal or any other form of handling of bio-medical waste, for a period of five years, in accordance with these rules and guidelines issued by the Central Government or the Central Pollution Control Board or the prescribed authority as the case may be.

XIII. ACCIDENT REPORTING

(a).In case of any major accident at any institution or facility or any other site while handling bio-medical waste, the authorised person shall intimate immediately to the prescribed authority about such accident and forward a report within twenty-four hours in writing regarding the remedial steps taken in Form I [1]

(b) Information regarding all other accidents and remedial steps taken shall be provided in the annual report in accordance with rule 13 by the occupier.

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XIV. CONCLUSION

In this study, the focus was on the management of bio-medical waste disposal. We have discussed the functional elements involved in bio-medical waste management (i.e. .procedure of authorization, Duties of the occupier, Bio-medical waste categories, segregation. packaging, labeling. storage, transportation, techniques, Treatment and disposal). Subsequently we explained the techniques of bio-medical wastes disposal through incineration, Non incineration, Auto claving, Hydroclaving, Microwave irradiation, chemical methods, Plasma Pyrolysis and deep burial methods to reduce their impact on public health and the environment. The result of the study demonstrate the need for strict enforcement of legal provisions and a better environment system for the disposal of bio-medical waste. Provision of a bio-medical waste management planning and monitoring system is a prerequisite issue for effective reduction of bio-medical waste associated risks**.**

REFERENES

[1]. Gazette of India. GSR. 343(E) dated 28 March 2016, Bio-medical Waste Management Rules, 2016, Ministry of Environment and Forests, Government of India, New Delhi, India. 2016, 1-37.

[2]. UNEP. Compendium of Technologies for Treatment/Destruction of Healthcare Waste, United Nations Environment Programme Division of Technology, Industry and Economics International Environmental Technology Centre, Osaka, Japan. 2012, 106-201

[3]. CPCB. Biomedical waste management - An overview, News Letter, Central Pollution Control Board, Delhi, India. 2014, 16-18

[4]. Divya Rao, M.R. Dhakshaini, Ameet Kurthukoti and Vidya G. Doddawad, Biomedical Waste Management: A Study on Assessment of Knowledge, Attitude and Practices among Health Care Professionals in a Tertiary care Teaching Hospital. Biomed. & Pharmacol. J; Vol. 11(3), 1737- 1743 (2018).

[5]. Bio-medical Waste Management (Amendment) Rules,2018.G.S.R. 234(E). , Ministry of Environment, Forests and climate change. Government of India,

[6]. Bio-medical Waste Management (Second Amendment) Rules,2019.G.S.R.360(E). , Ministry of Environment, Forests and climate change. Government of India,

[7]. Bio-medical Waste Management (Amendment) Rules,2019.G.S.R. 129 (E). , Ministry of Environment, Forests and climate change. Government of India,

[8]. Kumar SR, Abinaya NV, Venkatesan A, Natrajan M. Bio-medical waste disposal in India : From paper to practice, what has been effected. Indian J Health Sci Biomed Res 2019; 12 : 202-10

[9]. Sarsour A, Ayoub A, Lubbad I, Omran A, Shahrour I (2014) Assessment of medical waste management within selected hospitals in Gaza strip Palestine: A pilot study. Int J Sci Res Environ Sci 2(5): 164-173

[10]. Gravers PD. Management of Hospital Wastes-An overview. Proceedings of National workshop on Management of Hospital Waste, (1998)

[11]. Surjit S. Katoch Biomedical Waste Classification and Prevailing Management Strategies, Proceedings of the International Conference on Sustainable Solid Waste Management, p.p 169-175(2007)

[12]. Thornton J., Tally MC, Orris P., WentregJ. Hospitals and plastics, Dioxin Prevention and Medical Waste Incineration; Public Health Reports, 1996; 1: 299-313

