



**ORIGINAL RESEARCH PAPER**

**Economics**

**BIO-MEDICAL WASTE MANAGEMENT : A RISK ANALYSIS**

**KEY WORDS:**

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**INTRODUCTION**

Owing to concrete efforts taken by the state as well as private institutions in the field of health care, there is a perceptible improvement in the health status of Indian population. Better records are achieved in life expectancy, infant mortality rate and maternal mortality rate. At the same time, there is still a lot of demand for better health care due to continuous increase in population and environmental degradation, which cause many diseases. To meet such a demand the health care providers – both in public and private sectors - are increasingly opening up hospitals, dispensaries, clinics and diagnostic centers. Their growth has been tremendous in the cities and urban centers. In the process of their service they generate a large amount of wastes and in the absence of scientific disposal systems such wastes are turning up as health hazards. Hence there is a need for awareness, action and accomplishment of set standards in collection, transportation and disposal of such health care wastes.

**Meaning of Bio-medical Waste**

Health-care waste includes all the waste generated by the health-care establishments, research facilities, and laboratories. In addition, it includes the waste originating from “minor” or “scattered sources” - such as that produced in the course of health care undertaken in the home (dialysis, insulin injections, etc.). Between 75 per cent and 90 per cent of the waste produced by health – care providers is non-risk or “general” health-care waste, comparable to domestic waste. It comes mostly from the administrative and housekeeping functions of health-care establishments and may also include waste generated during maintenance of health – care premises. The remaining 10 – 25 per cent of health-care waste is regarded as hazardous and may create a variety of health risks.

The World Health Organization has classified hazardous health-care waste as

i. *Infectious Waste*

- ii. *Pathological Waste*
- iii. *Sharps*
- iv. *Pharmaceutical Waste*
- v. *Genotoxic Waste*
- vi. *Chemical Waste*
- vii. *Wastes with high context of chemicals*
- viii. *Pressurized Containers*
- ix. *Radioactive waste*

**Persons at Risk**

All individuals exposed to hazardous health – care waste are potentially at risk, like medical doctors, nurses, health – care auxiliaries, and hospital maintenance personnel, apart from the patients and visitors. The more prone to such hazards are workers in waste disposal facilities (such as landfills or incinerators), including scavengers.

**Methods for Proper Disposal Bio Medical Waste Management**

The management of bio-medical waste involve seven steps and they were listed below

- 1 Waste Segregation (at source generation)
- 2 Pre-treat Laboratory and Highly infectious waste
- 3 Collection and storage of segregated waste in colour coded bags / containers/bins
- 4 Intra-mural transportation from generation site to central storage area
- 5 Storage
- 6 Treatment (within 48 hours of generation)
- 7 Disposal

**Colour Coding for Bio-Medical Waste Disposal**

The first step in the treatment of health-care waste is segregation of such wastes at source. According to the Bio-Medical Waste (Management and Handling) Rules 2016, colour coding and type of container for disposal of bio-medical waste are prescribed as follows:

**Colour Coding for Biomedical Wastes , Categories and their Segregation, Collection, Treatment, Processing and Disposal Options**

Category	Type of Waste	Type of bag or Container to be used	Treatment and Disposal options
Yellow	a. Human Anatomical Waste	Yellow coloured non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial
	b. Animal Anatomical Waste		
	c. Soiled Waste		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.
	d. Expired or Discarded Medicines	Yellow coloured non-chlorinated plastic bags or containers	Expired cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature >1200 0C or to common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >12000C Or Encapsulation or Plasma Pyrolysis at >12000C. All other discarded medicines shall be either sent back to manufacturer or disposed by incineration
	e. Chemical Solid Waste	Yellow coloured containers or non-chlorinated plastic bags	Disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility.

f. Chemical Liquid Waste in KLD	Separate collection system leading to effluent treatment system	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.
g. Discarded linen, mattresses, beddings contaminated with blood or body fluid routine mask and gown	Non-chlorinated yellow plastic bags or suitable packing material	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.
h. Microbiology, Biotechnology and other clinical laboratory waste	Autoclave safe plastic bags or containers	Pre-treat to sterilize with nonchlorinated chemicals on-site as per National AIDS Control Organisation or World Health Organisation guidelines thereafter for Incineration.

Category	Type of Waste	Type of bag or Container to be used	Treatment and Disposal options
Red	Contaminated Waste (Recyclable)	Red coloured non-chlorinated plastic bags or containers	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.
White (Translucent)	Waste sharps including Metals	Puncture proof, Leak proof, tamper proof containers	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
Blue	Glassware	Cardboard boxes with blue colored marking	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.
	Glassware Metallic Body Implants	Cardboard boxes with blue colored marking	

Source : Bio-Medical Waste Management Rules ,2016

**Past Situation**

The data and information available for health – care waste management in India show that except some major hospitals in cities like Hyderabad and Bangalore the situation still remains worse. A study done at Coimbatore covering a Corporate hospital and a Government hospital revealed that a resemblance of scientific health-care waste management has been found in the corporate hospital and even this was not there in the Government hospital. The results of the study indicate that a lot needs to be done in the form of awareness, coordination (between the Coimbatore Municipal Corporation, hospitals and Tamil Nadu Pollution Control Board and concrete action taken by the Tamil Nadu Pollution Control Board avoided the health hazards arising out of improper treatment of bio-medical waste.

The Ministry of Forest and Environment (MoEF), and the Central Pollution Control Board passed the rule that all the hospitals should have their own incineration. Majority of hospitals were located in the centre of city, the own incineration resulted in air pollution and smoke surrounded the city. Due to this, the Bio-medical Waste (Management & Handling) Rules, 1998, instructed the hospitals to go for a Common Facilitator for the bio-medical waste treatment. Common Bio-medical Waste Treatment and Disposal Facility (CBWTF) is a set up where biomedical waste generated from health care establishment is imparted necessary treatment to reduce adverse effects that this waste may pose on human health and environment. In Coimbatore, Tekno Therm Industries (Common Facilitator), has been established. This firm is operating the facility since 2002 and it became fully functional in 2007.

**Present Situation**

The Bio-medical Waste Management Rules 2016, implies that

scientific disposal of Biomedical Waste through segregation, collection, treatment, transport and disposal in an environmentally sound manner minimizes the adverse impact on health workers and on the environment. The hospitals are required to put in place the mechanisms for effective disposal either directly or through common biomedical waste treatment and disposal facilities. The new bio-medical waste management rules will change the way country used to manage this waste earlier. Under the new regime, the coverage has increased and also provides for pre-treatment of lab waste, blood samples, etc. It mandates bar code system for proper control.

In Coimbatore District the private firm Tekno Therm authorized by the Tamil Nadu Pollution Control Board to operate the Common Facilitator, located at the outskirts of the Coimbatore City collects and disposes the bio-medical waste from 585 health care establishment, which includes private hospitals, government hospitals and 32 Urban Health Posts of the City Municipal Corporation. On an average the Tekno Therm Industries treats 3000 kgs/day of bio-medical waste per day. The charges varied from Rs 6.75 to Rs 53. Kovai Bio-waste Management Private Limited, the another common facilitator in Coimbatore district were disposing 487 kgs/day. Due to non-compliance registered by the Tamil Nadu Pollution Control Board, Coimbatore, Kovai Bio-waste Management Private Limited is not functioning.

**CONCLUSION**

By drawing on the positive experiences of Bio-medical Waste Management outside India, and from progressive initiatives of Bio-medical Waste Management across hospitals in India, it can be suitably surmised that this particular exercise in the city of Coimbatore has thrown ample light on the good practices followed in the hospitals. Undoubtedly, this study has also aided in bringing to the fore, issues in Bio-medical Waste Management that need to be sorted out, for a safe and

healthy hospital environment.

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