

Biomedical Waste Management Practices in India-A Review

Anurag V. Tiwari^{A*} and Prashant A. Kadu^B

^ADepartment of Civil Engineering, G H Raisoni Polytechnic, Amravati, India

^BDepartment of Civil Engineering, PRMITR, Badnera, India

Accepted 20 December 2013, Available online 25 December 2013, **Vol.3, No.5 (December 2013)**

Abstract

Economic development of India in last two decades has resulted in environmental pollution and waste generation in huge quantity in India. Today biomedical waste management has become one of major issue of concern in India taking into account the rate of growth of population. In this paper an attempt is made to study the classification, legislation and management practices in relation with biomedical waste in India. The paper includes various management practices adopted for biomedical waste management by various countries. In all around 60 manuscripts were collected which may be classified such as general literature, legislative aspect, hospital experience, city experience, country experience for the review. In the country like India only 1 to 1.5% is Bio medical waste of the total amount of solid waste generated in a city, of which 10-15% is considered infectious. The paper aims to create awareness amongst the souls. The key step in reducing the hazards from Bio medical waste is to segregate the waste at source.

Keyword: Biomedical waste, health care waste India

Introduction

Due to economic development in industrial, infrastructure, medical, information technology and agriculture sector of India in last two decades life of human being has become more content, lavish and comfortable. On the other hand due to this economic development the environment is badly affected. Now a days, due to rapid urbanization and alarming growth in population bio medical waste management has become one of the major issue of concern. Waste product which is infectious, hazardous, and sometimes radioactive and is generated during the various medical related activities such as diagnosis, treatment and immunization is known as Bio medical waste.

Biomedical waste

Hospitals, clinics, research centers and health care centers use wide variety of drugs including antibiotics, radioactive substances, corrosive chemicals, which ultimately contribute in Bio medical waste. In the country like India the total amount of municipal waste a city generates, only 1 to 1.5% is Bio medical waste, of which 10-15% is considered infectious. Whereas, In developed countries due to increased use of disposables the waste produced has been up to 5.24 Kgs per bed per day. In hospitals of United Kingdom's, France, Norway, Spain, Netherlands,

USA and Latin America, waste produce is 3.3 Kgs, 2.5 Kgs, 3.9 Kgs, 4.4 Kgs, 4.2 Kgs, 4.5 Kgs and 3.8 Kgs per bed per day respectively which is on very higher side as compare to developing country like India. Most hospitals in India generate 1-2 Kgs per bed per day, except the tertiary care hospital (e.g. AIIMS and SKIMS) which produce waste on higher side. According to World Health Organization (WHO) estimates 85% of Bio medical waste is actually non-hazardous and around 10% is infectious while the remaining 5% is non-infectious but consists of hazardous chemicals like methyl chloride and formaldehyde (Glenn and Garwal, 1999). It is estimated, a city like New Delhi with about 40,000 beds generates about 60 metric tons of Bio medical waste per day. Bio medical waste, till recently was not being managed but it was simply 'disposed off'. The disposal of Bio medical waste can be very hazardous particularly when it gets mixed with municipal solid waste and is dumped in uncontrolled or illegal landfills such as vacant lots in neighboring residential areas and slums. This can lead to a higher degree of environmental pollution, apart from posing serious public health risks such as AIDS, Hepatitis, plague, cholera, etc.

Johannessen et al (2000) opine that proper management of medical waste can minimize the risk both within and outside healthcare facilities. The first priority is to segregate wastes, preferable at the point of generation into reusable and non-reusable, hazardous and non-hazardous components. There are generally four key steps to medical waste management: (1) segregation into various components, including reusable and safe storage in

*Corresponding author **Anurag V. Tiwari** is working as Lecturer and **Prashant A. Kadu** is working as Associate Professor

Table 1: Typical Composition and Characteristics of Infectious Waste

Particulars	Percent
Composition:	
Celluloid Material (paper & Cloth)	50-70%
Plastics	20-60%
Glassware	10-20%
Fluids	1-10%
Typical Characteristics:	
Moisture	8.5-17% by weight
Incombustibles	8% by weight
Heating Value	7,500 BTU/lb

Table 2: General methods employed for disposal of biomedical waste in the various countries

S.No	Name of Country	General Methods employed for disposal of Biomedical waste	References
1	Mongolia	Open dumping or open burning, Incineration, Autoclaving	Shinee et al. (2008)
2	Iran	Landfill, Incineration, Sewers	M. H. Dehghani et al. (2008)
3	India	Landfill, Incineration, Autoclaving, Recycling – reuse	Yashasvi et al. (2012)
4	Bangladesh	Dumping	Hassan et al. (2008)
5	Malaysia	Landfill, Incineration, Recycling	Hossain et al. (2011)
6	Libya	Dumping, Incineration	Sawalem et al. (2009)
7	Greece	Recycling- Reuse, Pyrolytic combustion, Landfill	Tsakona et al. (2007)

Table 3: Category and components of Biomedical waste

Category	Waste Content	Components	Method of treatment and disposal
Category No. 1	Human Anatomical Waste	Human tissues, organs, body parts	Incineration /deep burial
Category No. 2	Animal Waste	Animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal, Houses	Incineration /deep burial
Category No. 3	Microbiology & Biotechnology Waste	Wastes from laboratory cultures, stocks or specimens of micro-organisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents and industrial laboratories, wastes from production of biologicals, from research toxins, dishes and devices used for transfer of cultures	Local autoclaving/ micro waving/ incineration
Category No. 4	Waste sharps	Needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps	Disinfections chemical treatment /autoclaving/micro waving and mutilation shredding
Category No. 5	Discarded Medicines and Cytotoxic drugs	Wastes comprising of outdated, contaminated and discarded medicines	Incineration / destruction & drugs disposal in secured landfills
Category No. 6	Solid Waste	Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, lines, beddings, other material contaminated with blood	Incineration , autoclaving/ micro waving
Category No. 7	Solid Waste	Wastes generated from disposable items other than the waste sharps such as tubing's, catheters, intravenous sets etc	Disinfections chemical treatment /autoclaving/micro waving and mutilation shredding
Category No. 8	Liquid Waste	Waste generated from laboratory and washing, cleaning, house-keeping and disinfecting activities	Disinfections by chemical treatment and discharge into drains
Category No. 9	Incineration Ash	Ash from incineration of any bio-medical waste	Disposal in municipal landfill
Category No. 10	Chemical Waste	Chemicals used in production of biologicals, chemicals used in disinfection, as insecticides, etc	Chemical treatment and discharges into drains

(Source- The Bio Medical Waste (Management and Handling) Rules, 1998)

appropriate containers; (2) transportation to waste treatment and disposal sites, (3) treatment and (4) final disposal.

Acharya and Singh (2000) also identified the medical waste management process to include, handling, segregation, mutilation, disinfection, storage, transportation and final disposal. According to Rao, Ranyal and Sharm (2004), the key to minimization and effective management of medical waste is segregation (separation) and identification of the waste. They recommend that the most appropriate way of identifying the categories of medical waste is by sorting the waste into colour coded plastic bags or containers. Medical waste should be segregated into containers/ bags at the point of generation. It should provide an easy access to waste collection vehicle (Srivastava, 2000). All disposable plastic should be subjected to shredding before disposing off to vendor. Final treatment of medical waste can be done by technologies like incineration, autoclave, hydroclave or microwave (Rao et al, 2004).

Classification and components of biomedical waste

The World Health Organization (WHO) has classified medical waste into eight categories such as General Waste, Pathological, Radioactive, Chemical, Infectious to potentially infectious waste, Sharps, Pharmaceuticals, Pressurized containers.

Whereas, In India, Ministry of Environment and Forest, Government of India (1998) has notified Bio-medical Waste (Management & Handling) Rules -1998, which describes ten categories as follows

Sources of generation of biomedical waste

Although the solid waste management has become one of the major topic of importance but still local bodies are unable to give the proper attention towards some special sources of wastes out of which biomedical waste is one. The sources of biomedical waste can be categorized as primary and secondary sources according to the quantities produced. While minor and scattered sources may produce some biomedical waste in categories similar to Bio medical waste, their composition will be different.

Table 4: primary and secondary sources of generation of biomedical waste

Primary sources		Secondary sources
Hospital	Medical College	Clinic
Nursing Home	Immunization centers	Ambulance Service
Dispensaries	Nursing Homes	Home treatment
Maternity home	Animal research centers	Slaughter houses
Dialysis center	Blood bank	Funeral Service
Research lab	Industries	Educational institutes

Hazards from biomedical waste

Implementation of rules and regulation of the biomedical waste management systems in India is major drawback of the whole system. The doctors, nurses, technicians, sweepers, hospital visitors, patients, rag pickers and their relatives are exposed routinely to Bio-Medical Waste and are at more risk from the many fatal infections due to indiscriminate management. Due to improper management of the biomedical waste this infectious waste gets mixed with solid waste. During the rainy season infectious substance may get added to the ground water and spreads hazardous diseases.

Legislative aspect in relation to biomedical waste

Various central legislation related to biomedical waste management in India are as follows

- The water (prevention and control of pollution) Act, 1974
- The Air (prevention and control of pollution) Act, 1981
- The Environment(Protection) Act,1986
- The hazardous waste(management and handling) rules,1998
- The Biomedical waste(management and handling) rules,1998
- Municipal Solid waste (management and handling) rules, 2000
- The Biomedical waste(management and handling) rules Amendment ,2000 and 2003
- The Bio-medical Waste (Management and Handling) Rules, 2011 [Draft].

It may be kept in mind that any person can report any alleged negligence in Management and Handling of Bio-Medical Waste to the appropriate authority.

Biomedical waste handling, treatment and disposal methods

In India huge amount of medical facility are available which are producing the Biomedical waste such as body parts, organs, tissues, blood and body fluids along with soiled linen, cotton, bandage and plaster. This waste is very infected and contaminated. It is very essential to properly collect, segregate, store, transport, treat and dispose this waste in safe manner. Incineration of biomedical waste is one of the most commonly adopted methods of treatment in India because of its low cost but Incineration causes bad environmental effects. Other than incineration the methods such as autoclave treatment, microwave treatment, dielectric heating, Depolymerization, Pyrolysis-Oxidation, etc are used in some places in India.

Conclusion

The present study concludes that Bio medical waste is one of the most hazardous waste generated by human beings.

Management of the bio medical waste is becoming a challenging issue in India. Governmental and non governmental agencies have recognized the biomedical waste management as matter of concern. More and more studies must be conducted in qualitative as well as quantitative access for bio medical waste so that the proper management of bio medical waste take place. Proper methods of treatment of bio medical waste needs to be developed for health and environmental safety.

Reference

- A Report by Dr. Saurabh Sikka on Biomedical Waste in Indian Context.
- Acharya, D. B. and Singh, M. (2000), *The Book of Hospital Waste Management*, *Minerva Press*, New Delhi, 2000, 15, 47
- Ahmed, R. (1997), *Hospital Waste Management in Pakistan: Case Study Report Special Waste Fractions: Hospital Waste*, Waste, August 1997.
- Akter Nasima (1998), *Medical waste management, Environmental Engineering program school of Environment, Resources and Development, Asian Institute of Technology.*
- Askarian M, Vakili M, Kabir G, (2004) Hospital waste management status in university hospitals of the Fars province, Iran. *Int. J. Environ. Health Res.* 14, 295–305.
- Glenn, Mc.R & Garwal, R. (1999), *Clinical waste in Developing Countries. An analysis with a Case Study of India, and a Critique of the BasleTWG Guidelines*
- Hassan M.M., Ahmed S.A., Rahman K.A., Biswas T.K., (2008), *Pattern of medical waste management: existing scenario in Dhaka City, Bangladesh.* *BMC Public Health.* www.biomedcentral.com/1471-2458/8/36 Accessed 09/05/2013.
- HCWH (2001), *Non-Incineration Medical Waste Treatment Technologies, Health Care without Harm, Washington, DC 20009*, pp.01-90.
- Hem Chandra (1999), *Hospital Waste an Environmental Hazard and Its Management.*
- Hossain M.S., Santhanam A., Narulaini N.A.N., Omar A.K.M. (2011), *Clinical solid waste management practices and its impact on human health and environment – A review.* *Waste Management*, 31, 754-766
- <http://health.delhigovt.nic.in/Health/files/bio.htm>
- <http://isebindia.com/95-99/99-07-2.htm>
- <http://kspcb.kar.nic.in/BMW>
- <http://mpcb.mah.nic.in>
- <http://www.cpcb.nic.in>
- <http://www.ipaiindia.org/files/2007.pdf>
- Johannessen, I. M., Dijkman, M., Bartone, C., Hanraban, D., Boyer, G. and Chandra, C. (2000), *Healthcare Waste Management Guidance Note, Health Nutrition and Population discussion Paper*
- Mandal S. K. and Dutta J. (2009), *Integrated Bio- Medical Waste Management Plan for Patna City, Institute of Town Planners, India Journal* 6-2: 01-25.
- MoEF, GoI, (1998), *The Gazette of India: Extraordinary, Notification on the Bio-medical Waste (Management and Handling) Rules, [Part II – Sec.39 (ii)]*
- MoEF, GoI, (2011), *The Gazette of India: Extraordinary, Notification on the Bio-medical Waste (Management and Handling) Rules [Draft]*
- Patil GV, Pokhrel K, (2004) *Biomedical solid waste management in an Indian hospital: a case study Waste Management*, 25, 592–599
- Praveen Mathur, Sangeeta Patan and Anand S. Shobhawati (2012), *Need of Biomedical Waste Management System in Hospitals - An Emerging issue - A Review, Current World Environment* Vol. 7(1), 117-124
- Rao, Ranyal. R. K. and Sharm. V. R. (2004), *Biomedical Waste Management: An Infrastructural Survey of Hospitals, MJAFI*, 60, 379-382
- Rasheed, S., Iqbal, S., and Baig, L.A. (2005) *Hospital waste management in the teaching hospitals of Karachi. J. Pak. Med. Assoc.* 55 (5), pp.192–195
- Saurabh Sikka (1999). *Mercury Recovery from Biomedical Waste, Congress Proceedings, Vol. IV, 356-361, Geneva, Switzerland*
- Sawalem M., Selic E., Herbell J-D., (2009), *Bio medical waste management in Libya: a case study. Waste Management*, 29, 1370-1375
- Shinee E., Gomobojav E., Nishimura A., Hamajima N., Ito K., (2008), *Healthcare waste management in the capital city of Mongolia. Waste Management*, 28, 435-441.
- Srivastava, J. N. (May 2000), *Hospital Waste Management Project at Command Hospital, Air Force, Bangalore. National Seminar on Hospital Waste Management: A Report* 27.
- Tiwari T N and Nanda S N (2002), *Generation rates of biomedical waste in different wards of a large hospital in Burla, Orissa, In Indian J.Environmental Protection.* 22(3) , 351-355
- Tsakona, M., Anagnostopoulou, E., Gidarakos, E., (2007), *Bio medical waste management and toxicity evaluation: a case study. Waste Management* 27, 912-920
- Waste Characterization and Quantification "Parvesh" Newsletter on Hospital Waste. CPCB, Ministry of Environment and Forests, Govt. of India, NewDelhi 1998; 4(IV): 3-4*
- WHO (1999), *Safe Management of Wastes from Healthcare Activities, World Health Organization.*