

Biomedical Waste Management for Environmental Sustainability in Mumbai

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Abstract

Biomedical waste is a specific category of waste produced from hospitals and laboratories, clinics, research laboratories, nursing home etc. The waste which produces during the time of health care activities, are highly infectious. It can be a beginning of many diseases like AIDS, hepatitis, TB and other communicable diseases. Currently handling of biomedical waste is become a prime concern. Waste management is the collection, transport, processing, recycling and monitoring of waste disposal. In 1950 Mumbai ranked 17th, where as currently Mumbai is the 7th most populous mega city in the world. With the increasing population number of hospitals, clinics and nursing home has also increased in the city. Mumbai is having superior health infrastructure in comparison to other cities in India. Therefore an efficient use of resources and effective management of waste are essential features of an environmentally sustainable economy. However Biomedical Waste (Management and Handling) Rules, 1998 and 2011 makes it mandatory for the healthcare establishment to ensure that such waste should handled without impacting environment and human health. This paper highlights brief about Biomedical Waste (Management and Handling) Rules and how the different health care provider managing Biomedical Waste in Mumbai for the sustainability of the city. The paper is based on primary sources as well as secondary sources.

KEYWORDS: Biomedical Waste, Management, Environment, Sustainability.

Introduction:

Biomedical waste (BMW) is broadly defined as any solid or liquid waste that is generated during the time of diagnosis, treatment of human beings, animals or in the production or testing of biological materials. Biomedical waste carries a high potential infection than any other categories of waste. In this context, syringes and needles have the highest disease transmission potential. BMW is the potential sources of diseases like AIDS, hepatitis, T.B., and other communicable diseases. With the increasing population numbers of HCEs (Health Care Establishments) as well as medical care facilities are increasing throughout the country. Medical care is vital for our life and health, but the waste generated from the medical activities becoming concern for the human being as well as environment. According to the Ministry of Environment and Forests the total generation of BMW in India is 4, 05,702 kg/day out of that only 2,91,983 kg/day of BMW is disposed, that means 28% of the waste is left untreated. This untreated waste can create severe health problem for human being as well as for environment. Therefore for the sustainability of any region the treatment of biomedical waste is an urgent need.

Objectives:

The main objectives of the study are

- i) To find out the awareness of BMW rules among the health care provider.
- ii) How different hospitals, Nursing homes are managing BMW for the sustainability of the city?

Methodology:

The study is based on the secondary as well as the primary sources. Secondary information has been collected from Govt. reports and references. Primary information has been collected through survey with pre structured questionnaire. Primary survey conducted with randomly chosen HCEs in Western-Suburb of Mumbai. Questions mainly asked regarding the awareness about BMW, total no beds, no of staffs, their training, segregation, transportation and management process of BMW etc. Medical staffs including doctor, nurses, ward boy were interviewed for collection of data.

Biomedical Waste Management Issues:

Population in Mumbai is increasing in faster rate and at the same time number of health care providers in the city is also increasing. In Maharashtra the total number of health care providers are approx. 14,438 (with beds) out of that Mumbai is having approximately 1417 (with beds) health care providers. But when it comes to total numbers of beds then Mumbai is having highest no of beds i.e. 41,488 out of 1,94,623 in Maharashtra.(MPCB Report,2011) followed by Pune, Aurangabad, and Kolhapur. The following Tables I and II shows the total no beds in different region of Maharashtra and details of beds in Mumbai.

Table-I, Total Number of Health Care Establishments (With Beds) in Maharashtra

Sr. No	Regional Office	No of Health Care Establishment	Total No of Beds
1	Amaravati	913	12015
2	Aurangabad	2678	24646
3	Kalyan	558	7645
4	Kolhapur	1543	20350
5	Mumbai	1417	22182
6	Nagpur	1166	41488
7	Nasik	2569	19010
8	Navi Mumbai	191	4298
9	Pune	2764	33258
10	Raigad	404	5707
11	Thane	235	4024
12	Maharashtra	14438	194623

Source: MPCB, CME Report (2011)

Table- II, Different Category of Hospital Beds in Mumbai

Sr. No	Category	Number of Beds
1	≥ 500	10704
2	200-499	9057
3	50-199	6561
4	≤ 50	15166
5	Total	41,488

Source: MPCB, CME Report (2011)

In Mumbai waste from the hospitals and other health care center is disposed of in a haphazard and improper manner. Moreover many health care centers there are no mechanism to ensure that all waste collected and segregated and finally reaches its ultimate destination for the further process of waste management. In some of the hospitals no person is there as an in-charge for handling waste. This indicates lack of awareness among the hospital employees regarding the safe disposal of BMW.

Biomedical Waste Rules-1998 and 2011:

Keeping in view inappropriate Bio-medical Waste Management, the Ministry of Environment and Forests notified the Biomedical Waste (Management and Handling) Rules, in 1998. The rule says that it is a duty of every occupier who has the control over institution or the health care premises to take all the steps to ensure that waste generated is handled without any adverse effect to human health and environment. Schedule –II (Table-III) contains the colour coding and the type of container. Schedule-I (Table-IV) of Biomedical Waste Rules- 1998, contains the categories of Biomedical Waste and

Table-III, Schedule- II Colour Coding And Type Of Container For Disposal Of Bio-Medical Waste (1998)

Colour Coding	Type of Container -I	Waste Category	Treatment options as per Schedule I
Yellow	Plastic bag	Cat. 1, Cat. 2, and Cat. 3, Cat. 6.	Incineration/deep burial
Red	Disinfected container/plastic bag	Cat. 3, Cat. 6, Cat.7.	Autoclaving/Microwaving/ Chemical Treatment
Blue/White translucent	Plastic bag/puncture proof Container	Cat. 4, Cat. 7.	Autoclaving/Microwaving/ Chemical Treatment and destruction/shredding
Black	Plastic bag	Cat. 5 and Cat. 9 and Cat. 10. (solid)	Disposal in secured landfill

Source: Chakrabarti A, Waste Management, An Overview, 2007

Table: IV, Schedule: I, Categories of Bio-Medical Waste.(1998)

Option	Waste Category	Treatment & 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)	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 from research and industrial laboratories, wastes from production of biologicals, 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)	disinfection (chemical treatment /auto claving / micro- waving and mutilation/ shredding"
Category No 5	Discarded Medicines and Cytotoxic drugs (wastes comprising of outdated, contaminated and discarded medicines)	Incineration /destruction and drugs disposal in secured landfills drugs disposal in secured
Category No 6	Solid Waste (Items contaminated with blood, and body fluids including cotton dressings, soiled plaster casts, lines, beddings, other material	Incineration/ autoclaving / micro-waving

	contaminated with blood)	
Category No. 7	Solid Waste (wastes generated from disposable items other than the waste sharps such as tubings, catheters, intravenous sets etc).	Disinfection by chemical treatment autoclaving/micro-waving and mutilation/
Category No. 8	Liquid Waste (waste generated from laboratory and washing, cleaning, house-keeping and disinfecting activities)	Disinfection by chemical treatment and discharge into drains.
Category No. 9	Incineration Ash (ash from incineration of any bio-medical waste)	Disposal in municipal landfill
No. 10	Chemical Waste (chemicals used in production of biological, chemicals used in disinfection, as insecticides, etc.)	Chemical treatment and discharge into drains for liquids and secured landfill for solids

Source: Source: Chakrabarti A, Waste Management, An Overview, 2007

Ministry of Environment and Forests has revised the Bio Medical Waste (Management and Handling) Rules under the Environment Protection Act of 1986. The new Bio Medical Waste Rules-2011, are elaborate, stringent and several new provisions have been added in it. Currently the rules are not applicable for the radioactive waste, hazardous waste, municipal solid waste and battery waste which would be dealt under the respective rules. The following table (Table-V) shows the major difference between the Bio Medical Waste Rules 2001 and 1998.

Table: V, Difference Between BMW Rules Between 2011 and 1998

Sr. No.	2011	1998
1	Every occupier generating BMW, irrespective of the quantum of wastes comes under the BMW rules and requires obtaining authorization.	Occupies with more than 1000 beds required to obtain authorization.
2	Duties of the operator listed	Operator duties absent
3	Categories of BMW reduced to 8	There were ten categories
4	Treatment and disposal of BMW made mandatory for all the Health Care Establishments.	Rules restricted to Health Care Establishments more than 1000 beds.
5	Form VI, i.e. the report of the operator on Health Care Establishments not handing over the BMW added to the rules.	Form VI absent.
6	A format for annual report appended with rules.	No format for Annual report.

Source: <http://blog.acrosspg.com/2013/06/latest-bio-medical-waste-management.html>

The current rules of BMW has discarded the category eight which contains liquid wastes generated from laboratory, cleaning, washing and disinfection activities and category nine containing incineration ash. Moreover the new rules cleared the confusion about the colour coding of the container used for disposal of BMW. According to 1998 rules category three and category six could either be disposed of red or yellow colour bags. Similarly category seven could be disposed of red or blue bags. Bio Medical Waste Rule 2011 clarified the vagueness and allotted one colour code for each category of waste. The following table (Table VI) shows the colour coding and type of container for disposal of BMW.

Table-VI, Colour Coding and Type of Container for Disposal of BMW. (Rule-2011)

Sr. No	Colour Coding	Type of Container	Waste Category No
1	Yellow	Non chlorinated plastic bags	Category-1,2,5,6
2	Red	Non chlorinated plastic bags/Puncture proof container for sharps	Category-3,4,7
3	Blue	Non chlorinated plastic bags container	Category-8
4	Black	Non chlorinated plastic bags	Municipal Waste

Source: <http://blog.acrosspg.com/2013/06/latest-bio-medical-waste-management.html>

Primary Survey- Findings and Discussion:

Survey is mainly conducted in Western-Suburb of Mumbai. Fourteen hospitals and nursing homes are randomly chosen and surveyed. All types of Health Care Establishments like large, small considered which varies from less than 10 beds to above 60 beds. The pre structured questionnaire asked to the doctors, nursing staffs, word boy whoever was available during the time of interview. During the interview emphasis mainly laid on the awareness of biomedical waste and how they manage wastes for the betterment of environment. In general it is understood that health care providers are somehow aware about rules regulation about BMW but when it comes to the total management of BMW then lots of improvement in the system is required.

Table VII Findings of Survey of Health Care Establishment in Mumbai.

Sr. No	Name of the Hospital	Location	No of Beds	No of Employee	Proper Training About BMW	In-Charge Person For BMW Management	Awareness	BMW Management Level
1	Siddharth Hospital	Goregaon(W)	Above 60	50-60	Trained but not for All Employee	Yes	High	Good

2	Jain Hospital	Goregaon(W)	10-20	10-20	Trained	Yes	Medium	poor
3	Leela Maternity Nurshing home & Durga Eye Clinic	Malad (W)	Upto 10	10	Trained	Yes	medium	Poor
4	Noor Nurshing Home	Jogeshwari	10-20	20-30	Trained (5 People)	Yes	High	Good
5	Vrindavan Care	Kandivali (W)	10-20	20-30	Trained (All Employee)	Yes	High	Bad
6	Pooja Hospital	Goregaon(W)	20-30	50-60	Trained	Yes	Low	poor
7	Craz Ball Hospital	Malad (W)	Above 60	50-60	Only Orientation	Yes	Low	Very Poor
8	Life Line Medicare	Goregaon (East)	40-50	50-60	Regular Training	Yes	High	Bad
9	Sai Sprash Hospital	Goregaon (East)	Upto 10	10-20	Trained	No	Medium	Bad
10	Shah's Nurshing Home	Kandivali (W)	Upto 10	10-20	Trained	Yes	Very High	Very Good
11	Mangal Murti Nurshing Home	Malad (W)	20-30	10-20	Trained	Yes	Low	Poor
12	Baliga Nurshing Home	Goregaon(W)	20-30	20-30	No formal training	Yes	Medium	Bad
13	Holy Spirit Hospital	Andheri (West)	Above 60	50-60	Trained, All New Employee Get training	Yes	Very High	Very Good
14	Kapadia Hospital	Goregaon (West)	30-40	30	Trained	Yes	Medium	Poor

Source: Primary Survey

Table VII shows findings of survey of Health Care Establishment in Mumbai. For their awareness of BMW during interview it is marked very high, high, medium and low. If staffs, doctors, ward boys clearly explain about rules, categories and colour container and environmental impact then given very high awareness if not accordingly marked high to low. To know the management level of BMW for different HCEs it is marked for the range of very good to poor. If a health care provider's collection, segregation transportation and finally disposed of waste according to the schedule then it is marked management level is very high or else lower range. In some cases hospitals awareness about BMW is very high but the management level is not good so marked bad or poor.

Only 14% HCE's awareness is very high where as 29% sample is having low awareness about BMW. While formally talking to the staffs of the hospitals and nursing home it is noticed that some of the HCE's are properly aware but they don't properly segregate the medical waste. 36% samples are very poor about the managing of the wastes. 29% samples are bad where as 7% samples are very poor about the collection, segregation, and transportation and disposing of the bio medical waste. It is noticed some of the hospital don't segregate the waste moreover from these hospitals collection of biomedical waste happens twice in a week. Since without treatment of wastes can't keep the hospital premises more than 48 hrs. Therefore the situation can create severe problem for the human health as well as environment. While surveying it is found that few hospital staffs are not having the formal training about handling the BMW and some hospitals only few staffs are trained for handling the wastes. Just 14% of the sample's handling and managing of bio-medical waste is very good. These hospitals employees are all trained, they do collection, segregation, properly labeled the bag then they send it through BMC van to dispose site. Approximately fifteen percent of the sample use different disposal methods like incineration, autoclaving, shredding, chemical methods, thermal methods, deep burial etc. Maximum number of the sample doesn't follow these methods of disposal.

The above study clearly demonstrates that there is an urgent need to increase awareness about new, rules, regulations and process about the safe management of BMW. The BMW management program can't be successfully implemented without the self motivation, co-operation and willingness of healthcare employees, patients and hospital management authorities.

Conclusion:

The improper management of bio-medical waste causes serious environmental problems in terms of air, water and land pollution. Inefficient and inadequate segregation and transportation system may cause severe problem to the environment. Safe and effective management of waste is not only a legal necessity at the same time it is a social responsibility also. With the collection and segregation, the amount of waste is generating that is also important. Lesser amount of bio-medical waste means lesser burden on environment. City like Mumbai population will be there at the same time number of HCE's (with and without bed) will increase. Therefore all health care providers, with proper planning should try to reduce the amount of waste generate in every day. An efficient use of recourses and effective management of waste are indispensable for the sustainability of the city.

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