

HOSPITAL WASTE MANAGEMENT-A CASE STUDY

Shivani¹, Syed Khursheed Ahmad², Saurabh Kumar Garg³, Pintu Kumar³

¹M.Tech. Student

²Professor and HoD

³M.Tech. Student

^{1,2,3}Dept. of Civil Engineering, Al-Falah University, Dhauj, Faridabad

Abstract - The hospital wastes are the waste produced from hospitals, nursing homes, dental clinics, surgery centers, personal healthcare's etc. These type of waste is different from the other types of waste like household waste, industries waste and municipal wastes etc. and consists of the following types of waste like sharps waste, clinical laboratory, human anatomical waste, discarded and expired medicines etc. the hospital waste causes the direct as well as indirect impact on human being, animals and environment too. Due to this situation proper handling and disposal of waste is necessary. To overcome this situation the ministry of environment and forest published guidelines on the Biomedical Waste (Management and Handling) Rules, 1998 in India for the minimization of hospital waste quantity. The actual situation of hospital waste management in India is extricable because the hospital waste is dumped on the municipal landfill sites along with the other soiled waste. The main focus of this study is on the evolution of hospital waste generated quantity and the practices adopted for safe collection and disposal of waste in the environment. The overall waste is being segregated in different color coded containers/bags before the disposal according to the Biomedical Waste (Management and Handling) Rules, 1998. These wastes are to be treated and disposed off in the common treatment facilities. The incinerator ashes and other soiled waste generated in these treatment plants is disposed off in the municipal landfill sites.

Key Words: Hospital Waste, Immunization, Landfill, Disposal, Management, Incinerator, Treatment.

1. INTRODUCTION

Hospitals are the essential waste generation sites. Every department in the hospitals produces different kinds of waste like healthcare waste, household waste, industries waste and household wastes.

A Healthcare wastes consist of bacterial, toxic, cytotoxic waste, expired nuclear and pharmaceutical wastes and sharps waste etc. Other wastes products produced from healthcare are not dangerous and include prescription boxes, packaging of medicals and food items and offices wastes.

The hospital waste management is not only the responsibility of hospital administrations but also the

hospital employees too. The process of hospital waste management should began with the generation of wastes at sites followed by the process of segregation and handling of waste the waste is segregated in different color coded containers with the symbol of biohazard. The distribution and transportation of hospital waste should be done by the special vehicles which are covered fully. The transportation vehicles transported this hospital waste to the final disposal sites. For the proper handling and management of this waste the workers should be properly qualified.

According to the Biomedical Waste (Management and Handling) Rules, 1998 of India "Any waste which is generated during diagnosis, treatment or immunization of human beings, animals or in research activities pertaining there to or in the production and testing of biologicals.

The Government of India Notification, 1998 specify that Hospital Waste Management is the integral part of hospitals hygiene and maintenance activities. This involves the management of the limits of activities like collection, transportation, operation or treatment of processing systems, and disposal of wastes.

With the references to the literatures keeping in mind the objective of the present study is the quantitative analysis with respect to its physical characteristics of the waste generated in hospitals.

2. LITERATURE REVIEW

Many researchers have discussed the Indian scenario of how hospitals in India deal with the hospital waste and how they manage them, so many have given there point and ideas to execute hospital waste management and what are problem are faced during execution.

Harendersingh, Rahila Rehman, Swapnil S Bumb, says biomedical waste management required commitment at all the level from every health provider. So awareness at every level should be done. Significance of biomedical waste and its relationship with ecosystem.

Anurag v. Tiwari and Prashant A. Kadub (December 2013) in this paper he has described various method of Biomedical waste management is done in various countries and how in

India population is the main role in increase of biomedical waste, out of total waste 1-1.5% waste is biomedical waste and how this waste creates serious problem in society.

Praveen Mathur, Sangeeta Patan (2017) in this paper they discuss about mainly on handling and transportation and disposal of biomedical waste and role of hospital in managing to do in better way by just by separating things at initial level.

Praveen Mathur, Sangeeta Patan and Anand S. Shobhawa have discussed in this paper about how biomedical waste cause serious health issue in the society and why should disposal of waste should be done in better way.

Ranju Rajan (2017) have discussed about biomedical waste management in ayurvedic hospital and current used practice with their merits and demerits, they have divided in biomedical waste into different types and discussed why hospital hygiene is important for all of us.

3. METHODOLOGY

The main focus of this study is the waste generated from different activities like diagnosis, treatment etc. of human being and animals in the hospital. The waste generated by the different departments of hospitals is collected and categorized. The waste is collected in the different color coded containers and bags. After the collection of the bags and containers of waste, weighed these bags and then record the data.

3.1 CHARACTERISTICS OF HOSPITAL WASTE

From the study, we found that the waste generated from the hospitals is mainly infectious such as bandages, dressings, disposable medical items masks, gloves etc. According to the Central Pollution Control Board (CPCB), the biomedical waste rules emphasize the segregation of waste in hospitals at the source of its generation. The segregation of waste at the source of generation helps in minimizing the mixing of different types of wastes and their toxic gases emissions.

3.2 COMPOSITION OF HOSPITAL WASTE

According to World Health Organization (WHO), approximately 80-85% of hospital waste is non-hazardous, 10% is infectious and 5% are the non-infectious one. The sharp waste represents about 1% of the total solid waste and are the major source of disease transmission if not managed properly. Out of the total healthcare activities, around 3% is considered genotoxic and radioactive matter and 1% is heavy metal.

3.3 HOSPITAL WASTE MANAGEMENT

i. WASTE GENERATION

The waste generated in hospitals depends upon the various factors like number of beds, types of healthcare facilities provided, economic, social and cultural status of patients, conditions of locality in which the hospital is located. Hospital waste should always be discarded at the point of generation. The generated waste in hospitals is categorized in the table 1 given below.

TABLE: 1 CATEGORIZATION OF SOLID HOSPITAL WASTE

CATEGORY	WASTE CATEGORY	TREATMENT AND DISPOSAL
Category No. 1	Human anatomical waste (human tissues, organs and body parts)	Incineration, deep burial
Category No. 2	Animal wastes considered the tissues of animals, organs, body parts carcasses, bleeding parts, fluids, blood and animals utilized in experimental researches, waste generated by institutions, discharges from hospitals, and animal houses)	Incineration, deep burial
Category No. 3	Microbiology and biotechnology waste (waste from laboratory cultures, stocks or vaccines, human cultures utilized in research related works and infectious agents from research and industrial laboratories waste from production of biological, toxins.)	Autoclaving/ microwaving/ incineration
Category No. 4	Waste sharps (needles, syringes, blade, glass that may cause puncture, cuts). These considered the both used and non-used sharps.	Disinfection(chemical treatment)/autoclaving/ microwaving/shredding
Category No. 5	Expired medicines and cytotoxic medicines (waste considered the outdated, contaminated and discarded medicines)	Incineration/destruction and drug disposal in secured landfill
Category	Soiled wastes (items which is contaminated with the blood, body	Incineration/ autoclaving/

No. 6	fluids considered as cotton, dressings, soiled plaster, lines, bedding, different materials that is being contaminated with blood)	microwaving
Category No. 7	Solid waste (waste generated from disposable items other than sharps such as tubings)	Disinfection by chemical treatment/ autoclaving/ microwaving/ shredding
Category No. 8	Liquid waste (waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Discharge into drains
Category No. 9	Incineration ash (ashes from incinerator of any biomedical waste)	Disposal in municipal landfill
Category No. 10	Chemical waste	Chemical treatment and discharge into drains for liquids and secured landfills for solids)

i. WASTE COLLECTION

Hospital waste need to be collected from the hospital by direct way the waste collected from the hospital in such a way that the interaction with the human beings, animals and the external environment is minimized. For an instance, hospital waste is collected in the containers or bags which are coded with the color with the label biohazard. Collect the waste daily and then transport it to the central storage sites. These containers or bags should be replaced when they are filled with the three quarter. The supply of new collection

containers or bags is provided at the point of waste generation sites.

ii. WASTE SEGREGATION

Waste segregation means the separation of different types of waste at the point of generation. It is an important step in the management of hospital waste. The waste is segregated in different color coded containers and bags according to the biomedical waste (management and handling) rules, 1998. The segregation of different category of waste is shown by the table 2 given below.

TABLE: 2 SEGREGATION OF BIOMEDICAL WASTE

COLOR	TYPES OF BAGS/CONTAINERS	WASTE CATEGORY
Yellow	Plastic Bags	Category1,2,3,6
Red	Plastic Bags	Category3,6,7
Blue/White Translucent	Plastic Bags	Category4,7
Black	Plastic Bags	Category5,9,10

ii. WASTE TRANSPORTATION

The transportation of waste is the movement of waste from hospital to the selected point by trucks, tankers, or different vehicles. The waste is transported to the municipal disposal site for the treatment and final disposal.

iv. WASTE TREATMENT

I. INCINERATION

Incineration is the high temperature dry oxidation method that reduces the organic and combustible waste into inorganic and incombustible matter which results in the reduction of weight and volume of waste. This process is used to treat wastes which are not recycled and reused.

iii. WASTE DISPOSAL

Waste disposal is the most important step in the hospital waste management. Disposal helps in the minimization of waste. Municipal landfill sites are mostly used for the disposal of waste like solid waste, incinerator ashes etc.

II. ROTARY KILN

A rotary kiln is operates continuously and used to treat chemical waste as well as toxic waste.

III. AUTOCLAVING

Autoclaves are used to sterilize mechanical equipment's like surgical knives, clamps for reuse. It can be used as a heat treatment process for destroying microorganisms and large quantity of infectious waste before disposal on landfill sites or treatment.

IV. MECHANICAL PROCESSING

Mechanical processing is used to reduce the volume of waste by 60% or more in preparation of further treatment and disposal.

V. CHEMICAL TREATMENT

Chlorine disinfection is used to kill microorganisms and E.Coli.

VI. MICROWAVE RADIATION

Microwave radiations used to treat waste sludge. This process reduces 99% microorganisms and reduces the volume of waste for the disposal.

VII. PLASMA PYROLYSIS

Plasma pyrolysis is the method for safe disposal of medical waste. This method converts organic waste into useful

byproducts. Medical waste is pyrolysed into carbon monoxide, hydrogen and hydrocarbons to contact with the plasma arc. This method is very costly.

VIII. SECURED LANDFILL

A secure landfill is a carefully designed depression in the ground (or built on top of the ground) in which wastes are put. The aim is to avoid any hydraulic (water-related) connection between the wastes and the surroundings environment.

4. RESULTS

The result is based on the data provided from the hospital according to the biomedical waste (management and handling) rule, 1998. In the hospital we found that the waste is collected and segregated in different color coded containers. With reference to the biomedical waste (management and handling) rule, 1998, the hospital associations made their own waste segregation chart which describes the waste segregation in different color coded containers/bags which uses for the collection and segregation of waste in the study area. For example: red bags consists PPE's, nitrile gloves etc, yellow bags consists shoe cover, linen clothes, body tissues, cotton etc.

After the collection and segregation, the waste is packed and labeled with the symbol biohazard. These bags are then transported with the special transportation vehicles like covered tractors, trucks and trolleys etc. to the disposal sites. The quantity of waste generated in the hospital is shown in figures given below. These graphs show the average waste generated per month in the hospital. Figure 1 shows the generation of general waste while figure 2 shows the generation of biomedical waste. These wastes are generated by the different activities performed in the hospital.

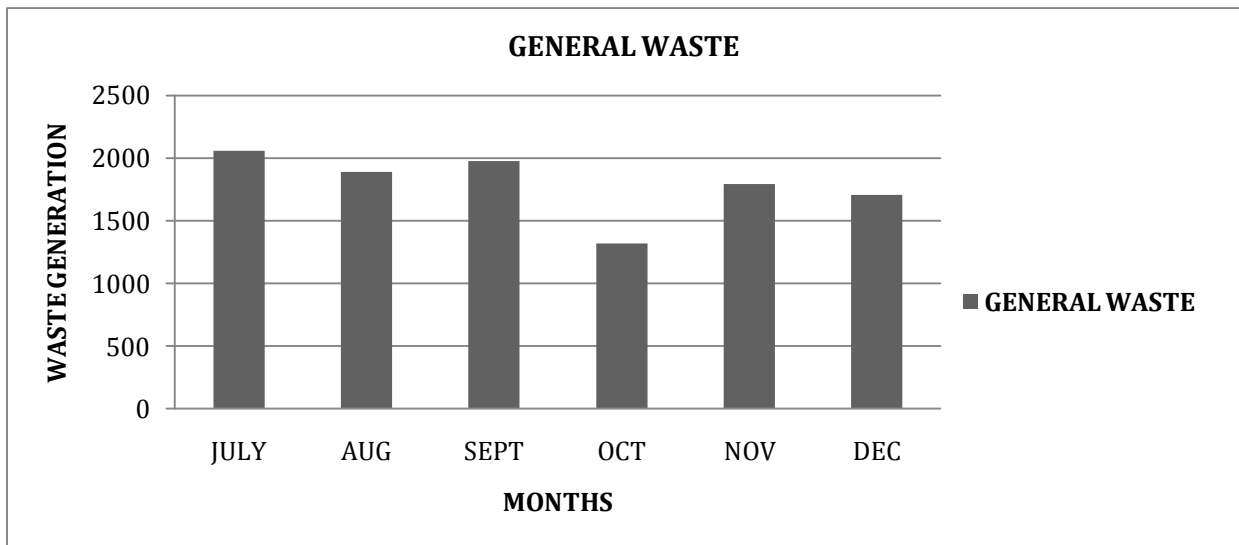


Fig.1 Generation of General Waste

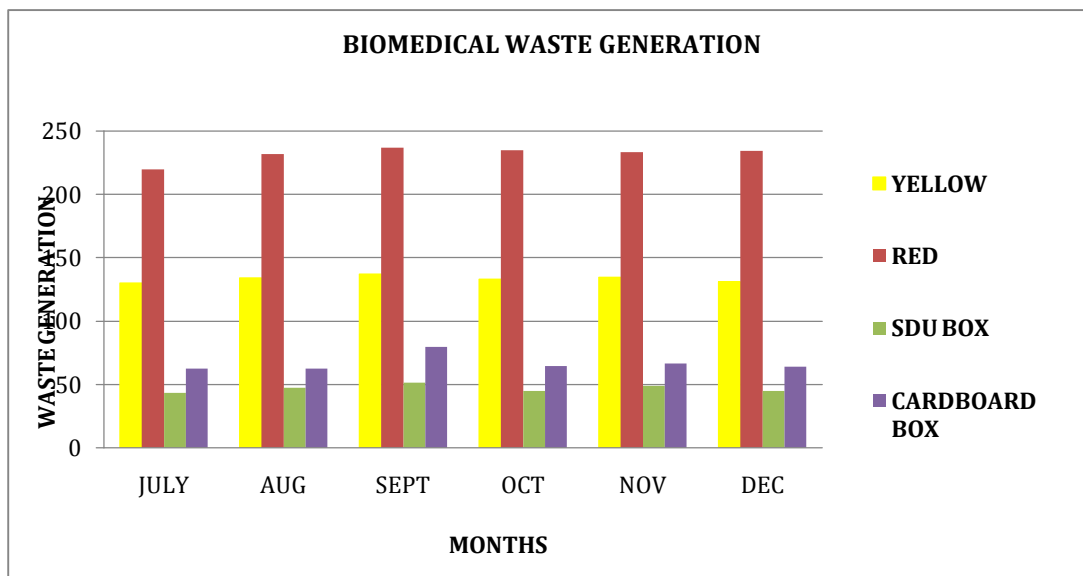


Fig.2 Generation of Biomedical Waste

As we discussed from the data given above we found that the general waste and red waste is generated in more quantity as compared to the above waste generated in the hospital.

In compliance to Biomedical Waste (Management and Handling) Rules, 1998, Delhi Pollution Control Committee has established three centralized treatment facilities for disposal of infectious hospital waste. These are the public private partnership company in joint venture with Directorate of Health Services, Government of NCT, Delhi.

5. CONCLUSION

The focus on this study is on the practices related to the hospital waste collection, segregation, transfer and transportation, and final disposal of the waste as per the Biomedical Waste (Management and Handling) Rules, 1998 in our country especially for the metropolitan cities. Based on the results the wastes are collected in different bags which are color coded and these bags sent to the common treatment facilities for their treatment and disposal. The treatment facilities consists the equipments like autoclaves, shredders and incinerators etc. The air pollution control devices are also provided for the control and emission of the particulates matter, NO_x, SO_x, etc.

Based on the experience and the literature the following steps could be made for the management of the hospital waste.

- Detailed characterization of the hospital waste generated in the hospitals.
- Long term study for comprehensive assessment of hospital waste management status in Delhi for the development of the waste management system.
- More studies should be conducted for the qualitative and quantitative analysis on hospital waste.
- Proper method for the treatment of hospital waste need to be developed for the safety of health and the environment.

6. REFERENCES

- [1] Nema, S. K. and Ganeshprasad, K. S. (2002) Plasma pyrolysis of medical waste. *Current science*. Vol. 83, No. 3., pp. 271 – 278.
- [2] PavithraKumari, “Limitations of Legal Enforcement in Bio –Medical Waste Management in India”, *International Journal of Engineering Research and Modern Education*, Volume 2, Issue 1, Page Number 33-36, 2017.
- [3] Anurag V. Tiwari and Prashant A. KaduN Department of Civil Engineering, G H Raison Polytechnic, Amravati, India Department of Civil Engineering, PRMITR, Badnera, India, Vol.3, No.5 (December 2013).
- [4] Santosh Kumar Sharma, SparshGuptab Indian Institute of Management, Jammu 180006, India Department of Management & Humanities, NIT Hamirpur, Himachal Pradesh, India Healthcare waste management scenario: A case of Himachal Pradesh (India), *Clinical Epidemiology and Global Health* 5 (2017) 169–172.
- [5] Shweta Singh, Sahana S., Anuradha P., Manu Narayan and Sugandha Agarwal, *Decoding The Coded, an overview of biomedical waste management International Journal of Recent Scientific Research* Vol. 8, Issue, 7, pp. 18066-18073, July, 2017.
- [6] KR Mahalaxmi, Ramya Arumugam Department of Management Studies, Anna University (BIT Campus), Tiruchirappalli, Tamil Nadu, India, *Conceptual Overview of the Biomedical Waste Management System Volume 5 Issue 2 (2017) 283-285 International Journal of Advance Research and Innovation*.
- [7] Government of Tamil Nadu, (2005), “Department of Health and Family Welfare,” Tamil Nadu Health Systems Project, Health Care Waste Management Plan for Hospitals in Tamil Nadu, Chennai.
- [8] Ministry of Environment and Forests (1998) *Bio Medical Waste (Management & Handling) Rules, S.O.630 (E)*.
- [9] Ministry of Environment and Forests *Bio Medical Waste (Management & Handling) Rules, 1998*.
- [10] Gajanan C. Soyam, Prabhakar A. Hiwarkar¹, Umesh G. Kawalkar¹, Vishal C. Soyam, Vimal K. Gupta³, Department of Community Medicine, Yavatmal, Maharashtra, Maulana Azad Medical College, Delhi, India GDMO, MCD East Delhi, Padpadganj, Delhi, India , KAP study of bio-medical waste management among health care workers in Delhi (2017).