

Study of Hospital Waste Generated Kg/Bed/Day in SIRSA City

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ABSTRACT: The overall objective of this analysis was to determine the hospital waste generated Kg/Bed/Day in Sirsa city. A huge amount of hospital waste is generated every day and their proper disposal is a very big problem as well as environmental issue. Biomedical wastes comprises of organic, inorganic, pathological and clinical infectious/hazardous waste. I sampled 15 medical establishments including multispecialty hospitals, indoor, outdoor, skincare, dental and civil hospital Sirsa. The overall mean general waste production rate was 0.758 Kg/Bed/Day in the Sirsa city. The study shows that disposal techniques are required to be improved in a more proper manner.

KEYWORDS: Hospital waste generation Kg/Bed/Day, Disposal techniques of hospital waste

I. INTRODUCTION

Hospitals are the region where patient's complications, problems are analyzed, diagnosed & treated. During these actions unavoidable waste is generated. This waste is generated from different sources such as dispensaries, small-clinics, and hospitals. These wastes are biological or non-biological discarded waste that will never be used again. Bio-medical waste generated from these diagnosis activities can be broadly categorized as general waste and hazardous waste. Further these can be more significantly divided into three types of waste:

1. Domestic waste
2. Infectious waste
3. Medical waste

¹**Domestic waste** is the waste consisting of combustible materials, such as paper, cardboard, yard clippings, wood, or similar materials, generated as a result of the ordinary day-to-day use.¹

²**Medical waste** refers to matter generated as a result of patient treatment, diagnosis & immunization of human beings.²

³**Infectious waste** refers to the part of medical waste that is in contact with a patient who has infectious disease and is capable of producing an infectious disease.³

These above types however, remain true only when proper segregation and separation of waste is adopted. Generally, hospital waste is considered to be infectious waste, when medical waste and other domestic or traditional waste are not collected separately. Unfortunately, some hospital' wastes have been disposed of with the municipal wastes in landfills. However, due to the spreading trend of hepatitis B virus, immunodeficiency virus (HIV), and other agents related with blood bone diseases has raised public awareness.

Due to this hospital waste is required to be deal in a special manner and not to be mixed with municipal waste. Medical waste is disposed of by incineration of hazardous waste or landfill facilities. The study shows that the best available technology for disposing of hospital waste is incineration. The proper segregation and collection of hospital waste will reduce the quantity of infectious wastes and consequently the funds for the treatment.

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II. DATA SAMPLING

The Sirsa city occupies an area of 19.73 sq. km within the municipal limit and is situated on the National Highway Number 10. Sirsa is located in north western part of Haryana. The study comprises of 15 hospitals that are outdoor hospitals, indoor hospitals, private hospital, multispecialty hospital, civil hospital to examine the hospital waste generation & management. The study was carried out from April-2015 to October-2015.

For proper data collection and their analysis I have given coding to different hospitals which are as follows:-

Table A.1

Hospital Code	Hospital Name	Location
A.1	Sanjivani Hospital	Hisar Road below overbridge, Sirsa
B.2	JCD Super Specialty Hospital & Trauma Centre	Barnala Road opposite "One life Fitness Club", Sirsa
C.3	Shah Satnam Ji Specialty Hospital	Begu Road, Dera Sacha Sauda-2, Sirsa.
D.4	Shree Hospital	Dabawali Road, Sirsa
E.5	Astha Hospital	Dabawali Road, Sirsa
F.6	Civil Hospital	F-Block, Sirsa
G.7	Dr. Mohr Singh Surgical & Maternity Hospital	Hisar Road, Sirsa
H.8	Dr. Pankaj Dental Hospital	Mal Godown Road, Near Sangwan chowk, Sirsa
I.9	Neeraj Choudhary Hospital	Near Shiv Chowk, Sirsa
J.10	Dr. Shoyran skin care Hospital	Dabwali Road Near, Red light Chowk, Sirsa
K.11	Patiala Nursing Home	Mal Godown Road, Near Sangwan chowk, Sirsa
L.12	Lalgarhia Hospital	Dabawali Road, Sirsa
M.13	Janta Hospital	Janta Bhawan Road, Automarket, Sirsa
N.14	Life Line Hospital	Near Sangwan chowk, Sirsa
O.15	Sihag Children Hospital	Near Sangwan chowk, Sirsa

The above Table A.1 shows the name of the hospitals under study and their locations with the codes provided A.1, B.2, C.3, D.4, E.5, F.6, G.7, H.8, I.9, J.10, K.11, L.12, M.13, N.14, and O.15 to fifteen hospitals respectively.

III. OBSERVATIONS

TABLE A.2

Hospital category (Indoor or Outdoor) & waste generation Kg/Bed/Day

Hospital Code	Waste Generated Per day	Total No. of Bed Available	No. of Bed occupied by patient	Waste Generated Kg/Bed/ Day	Type of Hospital Indoor(I)/ Outdoor(O) Or Both(I-O)
A.1	59.2 kg	108	74	0.8Kg/Bed/Day	(I-O)
B.2	26.88 kg	110	42	0.64Kg/Bed/Day	(I-O)
C.3	167.2 kg	300+100	220	0.76Kg/Bed/Day	(I-O)
D.4	15.4 kg	30	22	0.7kg/Bed/Day	(I-O)
E.5	12.92 kg	30	19	0.68Kg/Bed/Day	(I-O)

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F.6	170 kg	300	230	0.73Kg/Bed/Day	(I-O)
G.7	55.04 kg	100	64	0.86Kg/Bed/Day	(I-O)
H.8	0.25 kg	1	1	0.25Kg/Bed/Day	(O)
I.9	8.8 kg	15	11	0.8Kg/Bed/Day	(I-O)
J.10	0.34 kg	1	1	0.34Kg/Bed/Day	(O)
K.11	3.5 kg	10	5	0.7Kg/Bed/Day	(I-O)
L.12	8.97 kg	20	13	0.69Kg/Bed/Day	(I-O)
M.13	51.48 kg	100	66	0.78Kg/Bed/Day	(I-O)
N.14	21.33 kg	45	27	0.79Kg/Bed/Day	(I-O)
O.15	10.27 kg	18	13	0.79Kg/Bed/Day	(I-O)
Total	611.58kg	1170 + 100	806	0.758/Kg/Bed/Day	611.58/806 =.758

From Table A.2 all the data i.e. waste generated from hospitals, their bed capacity and no. of beds on an average occupied by the patients, it was observed that the waste generated is **0.758/Kg/Bed/Day**.

IV. HOSPITAL WASTE DISPOSAL AND MANAGEMENT PROCESS

Health care waste is a heterogeneous mixture, which is very difficult to manage as such. But the problem can be simplified and its dimension reduced considerably if a proper management system is planned. The hospital waste can be properly managed by adopting the following steps:-

1. Waste collection
2. Segregation
3. Transportation and storage
4. Treatment & Disposal
5. Transport to final disposal site
6. Final disposal

The various methods used for waste disposal are as Follows:

1. Incineration Technology

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 thereof. 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.

2. Non-Incineration Technology

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 state criteria for disinfection.

3. 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:

1. Gravity type
2. Pre-vacuum type
3. Retort type.

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4. Microwave 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 and heat generated kills all pathogens.

5. Chemical Methods

1 % hypochlorite solution can be used for chemical production of biological chemicals, used in disinfection, as insecticides, etc

6. Landfills

Some hospital wastes may be disposed off in landfills same as done with the municipal wastes. Generally, this technique was used in previous years but now these days maximum hospital waste is disposed of by incineration technology due to the shortage of land availability.

TABLE B.1

The Below table B.1 shows the color coding and type of container which should be used for separation and segregation of different wastes:-

Waste Category No.	Color Coding	Type of Container
2,4,6	Red	Disinfected Container/Plastic Bag
1,2,3,6	Yellow	Plastic Bag
5,9,10	Black	Plastic Bag
4,7	Blue/White Translucent	Puncture proof container/ Plastic Bag

The above table B.1 shows that for waste category no. 2, 4 & 6 color coding should be red and type of container used is plastic bag. For category 1, 2, 3 and 6 the type of color code is yellow and container is plastic bag. Waste category no.5, 9, 10 requires black coding and plastic bag as a container and last category 4 & 7 should be in blue or white translucent coding with puncture proof bag.

TABLE B.2

The below Table B.2 represents various categories of waste and their disposal technique

Sr. No.	Type of Disposal Technique	Type of Waste Generated
1	Deep burial/ Incineration	Animal tissues, wastes, organs, ,bleeding parts, Body parts carcasses, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals / discharge from hospitals, medical colleges, animal houses)
2	Local autoclaving/ micro waving/ incineration	Biotechnology & Microbiology waste (wastes from laboratory cultures, human and animal cell culture used in research and infectious agents from research and industrial laboratories, stocks or specimens of micro-organisms live or attenuated vaccines, wastes from production of biological, toxins, dishes and devices used for transfer of cultures)
3	Deep burial /Incineration	Human Anatomical Waste (organs, body parts, human tissues etc.)
4	Disinfections by chemical treatment autoclaving/ micro waving & mutilation shredding.	Solid Waste (items contaminated with blood and body fluids including cotton, dressings, soiled plaster casts ,linens, bedding, waste generated from disposable items other than the waste sharps such as catheters, tubing, intravenous sets etc.)

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5	Incineration / destruction & drugs disposal in secured landfills	Cytotoxic drugs and Discarded Medicines (wastes comprising of outdated, discarded and contaminated medicines)
6	Incineration , autoclaving/ micro waving.	Solid Waste (Items contaminated with blood and body fluids including cotton, dressings, soiled plaster casts, line beddings, other material contaminated with blood)
7	Disinfections (autoclaving/ chemical treatment micro waving and mutilation shredding	Waste Sharps (scalpels blades needles, glass, syringes etc. that may cause puncture and cuts. This includes both used & unused sharps)
8	Disinfections by chemical treatment and discharge into drains	Liquid Waste (waste generated from laboratory & washing, cleaning , house-keeping and disinfecting activities)
9	Disposal in municipal landfill	Incineration Ash (ash from incineration of any bio-medical waste)
10	Chemical treatment & discharge into drain for liquid & secured landfill for solids	Chemical Waste (chemicals used in production of biological, chemicals, used in disinfect ion, as insecticides, etc)

The Table B.2 i.e. provided above gives the disposal methods for the different types of hospital waste generated this disposal technique which includes the incineration method, landfills, autoclaving, shredding, chemical treatment etc.

IV. RESULTS & DISCUSSION

The rate of generation of hospital waste is the basic and fundamental information for analyzing, evaluating and designing the disposal system. Therefore, the waste generation rate of each unit of hospitals has been determined and results are given in Table A.2. “On an average daily hospitals waste generation rate was found to be 0.758 kg/bed/day”. “This can be seen in Table A.2, the waste generation rate of each unit of hospital is different due to their bed capacity, type of treatment & characteristics”. Each unit requires a different type of diagnosis and treatment. Some diagnosis and treatment methods produce more waste than others. The following aspects were needed to be discussed:-

The separate collection of hospital waste (medical, kitchen, etc.) will decrease investment and operation cost of the incineration plant.

#There was a Lack of waste disposal plans for the disposal and technical aspects of hazardous wastes.

The proper disposal method is incineration. However, individual incineration for each hospital does not seem to be economic. Therefore, one common incinerator should be designed for the hospitals in Sirsa.

#The results revealed that one of the reasons for incomplete waste separation in the hospitals was the lack of initial training of nurses and new personnel, while service sectors personnel were constantly trained changed or replaced.

V. RECOMMENDATIONS

1. The staff dealing with the disposal of infectious health-care waste i.e. segregation, separation, collection, transportation, treatment and must be well trained and have a proper knowledge.
2. To store waste at site, including the specification of the containers their color, size, type etc. should be as per “The Biomedical Waste Management and Handling Rules 1998/2000”.
3. A proper time table should be develop for proper waste collection and transportation at dumping site.
4. Regulation of labeling of biomedical waste containers should be implemented.
5. Safety measures and protective clothes should be practiced by waste handling staff members.

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VI. CONCLUSION

The waste disposal by the hospitals, medical cares, dispensaries require an urgent and powerful controlling management system with a proper eye on starting of generation of waste to finally their disposal activities, by the concerned govt. bodies. Related law & orders must be followed by medical-cares eminently and strict actions are required to be taken in the case of violation of rules and regulations.

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