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A Study of Impact of Integrated Biomedical Waste in Patna

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Abstract – Our modern medical science has discovered many advanced treatment methods to save our lives. The indiscriminate disposal of untreated biomedical wastes is the cause of spread of infectious diseases. Apart from these, a good amount of biomedical wastes including disposable syringes, saline bottles, IV fluid bottles, etc. are picked up by the rag pickers, and are recycled back to the market without disinfection.

Within the domain of municipal solid wastes, bio-medical wastes acquire a special dimension, since it is infected and hazardous. Wastes generated at hospitals and health care facilities are different from general municipal wastes. The municipal wastes by and large may need only one of these systems for collection, transportation and final disposal.

Against this the bio-medical wastes may need more systems, since it includes body parts, human and animal tissues, radioactive waste, gauze, cotton, plastics, infected liquid waste, blood and laboratory wastes. This paper provides comprehensive discussion on bio-medical wastes and makes some recommendations for their effective management besides discusses the key strategic actions required for an effective bio-medical waste management plan preparation.

The present review article deals with the basic issues as definition, categories, problems relating to biomedical waste and procedure of handling and disposal method of Biomedical Waste Management. It also intends to create awareness amongst the personnel involved in health care unit.

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INTRODUCTION

Biomedical waste management has recently emerged as an issue of major concern not only to hospitals, nursing home authorities but also to the environment. the bio-medical wastes generated from health care units depend upon a number of factors such as waste management methods, type of health care units, occupancy of healthcare units, specialization of healthcare units, ratio of reusable items in use, availability of infrastructure and resources etc.

The proper management of biomedical waste has become a worldwide humanitarian topic today. Although hazards of poor management of biomedical waste have aroused the concern world over, especially in the light of its far-reaching effects on human, health and the environment.

Now it is a well-established fact that there are many adverse and harmful effects to the environment including human beings which are caused by the “Hospital waste” generated during the patient care. Hospital waste is a potential health hazard to the health care workers, public and flora and fauna of the area. The problems of the waste disposal in the hospitals and other health-care institutions have become issues of increasing concern.

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

The Government of India (notification, 1998) specifies that Hospital Waste Management is a part of hospital hygiene and maintenance activities. This involves management of range of activities, which are mainly engineering functions, such as collection, transportation, operation or treatment of processing systems, and disposal of wastes.

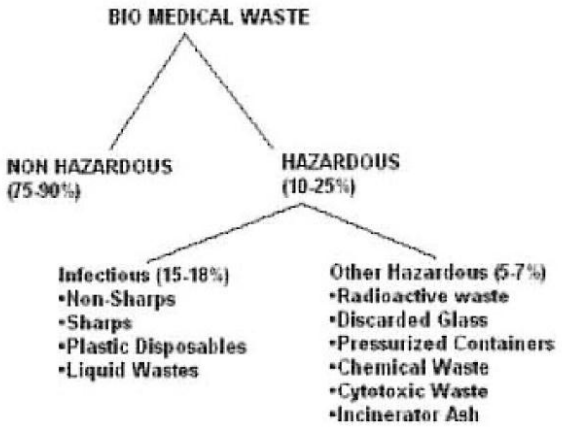
One of India's major achievements has been to change the attitudes of the operators of health care facilities to incorporate good HCW management practices in their daily operations and to purchase on-site waste management services from the private sector. World Health Organization states that 85% of hospital wastes are actually non-hazardous, whereas 10% are infectious and 5% are noninfectious but they are included in hazardous wastes. About 15% to 35% of Hospital waste is regulated as infectious waste. This range is dependent on the total amount of waste generated.

A major issue related to current Bio-Medical waste management in many hospitals is that the implementation of Bio-Waste regulation is unsatisfactory as some hospitals are disposing of waste in a haphazard, improper and indiscriminate manner. Lack of segregation practices, results in mixing of hospital wastes with general waste making the whole waste stream hazardous. Inappropriate segregation ultimately results in an incorrect method of waste disposal.

Inadequate Bio-Medical waste management thus will cause environmental pollution, unpleasant smell, growth and multiplication of vectors like insects, rodents and worms and may lead to the transmission of diseases like typhoid, cholera, hepatitis and AIDS through injuries from syringes and needles contaminated with human.

Various communicable diseases, which spread through water, sweat, blood, body fluids and contaminated organs, are important to be prevented. The Bio Medical Waste scattered in and around the hospitals invites flies, insects, rodents, cats and dogs that are responsible for the spread of communication disease like plague and rabies. Rag pickers in the hospital, sorting out the garbage are at a risk of getting tetanus and HIV infections. The recycling of disposable syringes, needles, IV sets and other article like glass bottles without proper sterilization are responsible for Hepatitis, HIV, and other viral diseases. It becomes primary responsibility of Health administrators to manage hospital waste in most safe and eco-friendly manner.

The problem of bio-medical waste disposal in the hospitals and other healthcare establishments has become an issue of increasing concern, prompting hospital administration to seek new ways of scientific, safe and cost effective management of the waste, and keeping their personnel informed about the advances in this area. The need of proper hospital waste management system is of prime importance and is an essential component of quality assurance in hospitals.



Biomedical waste management has recently emerged as an issue of major concern not only to hospitals, nursing home authorities but also to the environmental and law enforcement agencies, media and the general public. Biomedical waste is forming approximately 1 to 2 percent of the total municipal solid waste stream. Some of these wastes are potential threat to the human health and environment. Composition and quantity of biomedical wastes generated differ not only from country to country but also within the country.

Health care facilities viz. laboratories, clinics, nursing homes, medical, dental, and veterinary hospitals, generate a waste stream varied in its composition. Among these facilities the hospitals contribute maximum wastes.

Hospital waste is a potential health hazard to the health care workers, public and flora and fauna of the area. The problems of the waste disposal in the hospitals and other health-care institutions have become issues of increasing concern. Most countries of the world, especially the developing nations, are facing the grim situation arising out of environmental pollution due to pathological waste arising from increasing populations and the consequent rapid growth in the number of health care centres. India is no exception to this and it is estimated that there are more than 15,000 small and private hospitals and nursing homes in the country. This is apart from clinics and pathological labs, which also generate sizeable amounts of medical waste.

India generates around three million tonnes of medical wastes every year and the amount is expected to grow at eight per cent annually. Creating large dumping grounds and incinerators is the first step and some progressive states such as Maharashtra, Karnataka and Tamil Nadu are making efforts despite opposition. Barring a few large private hospitals in metros, none of the other smaller hospitals and nursing homes have any effective system to safely dispose of their wastes. With no care or caution, these health establishments have been dumping waste in local municipal bins or even worse, out in the open. Such irresponsible dumping has been promoting unauthorized reuse of medical waste by

the rag pickers for some years now. If we want to protect our environment and health of community we must sensitize ourselves to this important issue not only in the interest of health managers but also in the interest of community. Surveys carried out by various agencies show that the health care establishments in India are not giving due attention to their waste management.

HEALTH IMPACTS OF BIOMEDICAL WASTES

Only recently, this issue has captured worldwide attention. Unfortunately, quite some time medical community remained silent. Nevertheless, this issue becomes a major concern to most non-medical professionals and general community, and forced the health care personnel to adopt the safety rules and guidelines. Many of the dangers or hazards associated with biomedical wastes are hidden. Injuries may not occur right away but might build up or lie dormant in the body's system for years like hepatitis B and C and cancers. Hence all suspect and unknown substances should be considered hazardous. Potential health hazards of the various wastes are given in Table 1.

Potential Hazards	Waste Materials
Psychological Stress	Human Anatomical waste,
Infections and Diseases: HIV/AIDS, Hepatitis B &C, Hemorrhagic fever, Herpes, Measles, Shigellosis, Salmonellosis, Pneumonia, Septicemia, Bateraemia, Cholera, Tuberculosis, Anthrax, Helminthicinfections, Candidiasis and others	Human Anatomical waste, Soiled Waste, Microbial/ Biotech waste, Sharps,
Infections: Rabies, Anthrax, and other	Animal waste
Injuries	Sharps, cytotoxic & Radioactive dmgs, Incinerator waste;
Dermatitis, Conjunctivitis, Bronchitis,	Chemical, Cytotoxic, Radioactive, Incinerator wastes,
Cancer, Genetic mutation	Cytotoxic, Radioactive drugs and materials, Chemical wastes
Poisonings	Cytotoxic & other drugs, liquid & Chemical wastes,

Table 1 Health hazards of the waste.

BIOMEDICAL WASTE MANAGEMENT IN PATNA

The main land of Patna extends between latitude 25 degree 37 min North, longitude 85 degree 10 min East and elevation 173 ft above sea level. The urban area is about 110 sq km. Patna is situated on the southern bank of river Ganges. The southern side of the city, Punpun river flows which meets the river Ganga near Fatuha, which is situated at 8 km from Patna in the downstream of Ganga in the east and Sone river flowing west of Patna meets the river Ganga near Koilwar and Gandak River meets in Ganga from the northern side just in front of the central zone of Patna.

Thus, the city of Patna is surrounded on all sides by rivers. The ground level of Patna's slopes away from Ganga River and the topography of the town are like a saucer. Patna is a linear city which has grown on either sides of the main road (Ashok Raj Path) running east to west on a ridge, almost parallel to the bank of the river Ganga. The length of the city is nearly 24 kilometers. Before the new Bypass road was built, the city was about two and a half kilometers (maximum) in breadth and at certain places even less than 0.8 kilometer. The city has now 57 councilors elected at the rate of one member per ward. The elected body is responsible for governing the affairs of the municipal corporation. The city corporation is chaired by a mayor.

The study of the existing land use pattern on the basis of the survey conducted for the master plan reveals that in Patna there is no exception in regards to mixed land use pattern as in the case of most of the Indian cities. The city has grown under very stringent physical limitations, the river Ganga formed natural barrier to any expansion towards the north. In spite of that the riverfront has not been utilized properly.

The areas in the south are generally low lying and subject to flood from river Punpun. Fig. 1 and Fig. 2 gives the Landuse Map and Landuse distribution of PMC and Fig. 3 has a ward map of Patna.

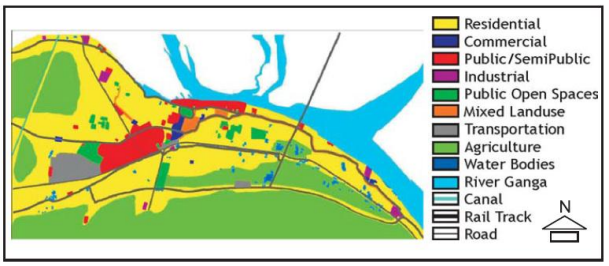


Fig 1 Land-Use Map of Patna.

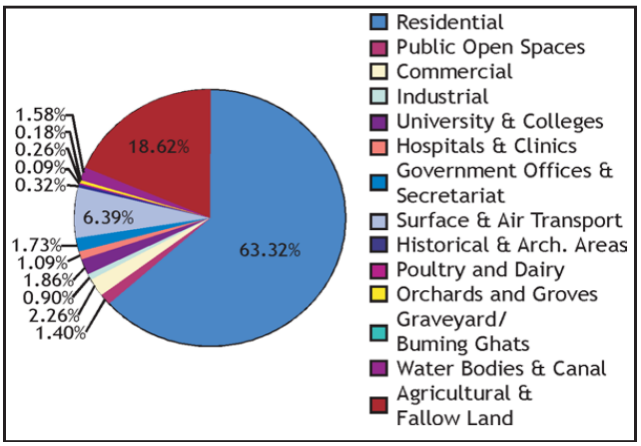


Fig 2 Landuse Distribution of PMC.

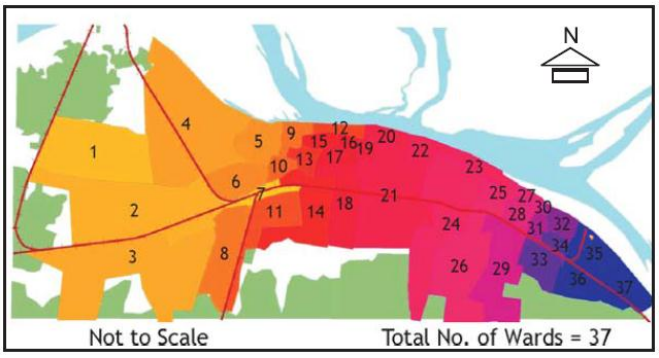


Fig 3 Ward Map of Patna.

The prevalent solid waste management practices in the city are highly deficient. Storage of wastes at source is generally not attended to. Households, commercial establishments, industries, hospitals, and nursing homes, etc. keep on throwing the waste on the streets, footpaths, drains, etc. The biomedical waste has been grossly neglected in Patna. Large number of hospitals, nursing homes, health care centres has been identified by the State Pollution Control Board in Patna but do not take any measure for the safe disposal of the biomedical wastes. The biomedical wastes get mixed up with the municipal solid waste and deposited at the common disposal site. Only few incinerators have been installed in Patna. These institutions are Patna Medical College and Hospital, Kurji Family Hospital, Mahavir Cancer Sansthan Hospital, and recently at IGIMS. But often these plants remain out of order as they are not managed and maintained properly and none of them is having the speci-fications according the Biomedical Waste Management Rules, 1998.

There are 31 public and private hospitals and more than 100 nursing homes in the city, accordingly to Patna Municipal Corporation's Executive Engineer. At present the handling of wastes in health care institutions in Patna are not satisfactory. All types of wastes are mixed together and disposed. Most of the hospitals in the city are not having adequate facilities for the safe disposal of the biomedical waste. Wastes are either dumped in open space behind the hospital and occasionally burnt causing severe air pollution and land pollution. In certain hospitals, incinerators are provided, but the same is not meeting the statutory requirements of operation and emission standards and are a source of pollution. The contaminated syringes and needles are dumped along with other wastes, which are being collected by scavengers and illegally returned to the hospitals. The body parts often dumped along with the wastes are seen carried by birds and animals. The hospital authorities and staff are not fully aware of the seriousness of the problem created by the unscientific way of disposal of these wastes and hence give only very little attention to the disposal of these wastes.

Problems Faced by the Health Care Institutions: The problems faced by health care institutions in the management of biomedical wastes are many. Even though the problems faced by health care institutions in the public and private institutions are almost the same, there is lot of differences as well. The problems faced by health care institutions are:

- The health care institutions are constructed and operated from places where there is no scope for any future expansion. In many cases during the establishment of institutions there was no consideration on the waste management. So now the health care institutions are finding it very difficult to search for suitable and adequate space in their hospitals to accommodate the waste treatment and disposal facilities.

- In general it is felt that there is no scarcity of funds in the private health care institutions. However, adequate priority is not given for the biomedical waste management. All are having a notion to install some type of incinerator and incinerate all waste irrespective of its category or type. There is a notion that incineration of waste is the one and only option of waste management. However, in the case of government hospitals, finance is the vital problem. At present there is no budgeted allocation of funds. Hence these health care institutions are facing lot of problems for purchasing biomedical waste containers and bags, making facilities for storage of waste, establishing treatment facilities, disposal of treated waste, etc.

- The waste management techniques suggested in the Rules are quite new to all and different from which was followed by the institutions till 1998. Health care institutions as per the information available were doing the waste management by dumping in the backyard and in most cases adequate attention was not given to waste management. All institutions try to avoid the waste management.

- At present the waste management system is undeveloped in most health care institutions particularly so in most of the public health care institutions. The lowest level of staff is supposed to manage the waste as per their will and pleasure. This has to be changed and altered drastically. Modern techniques like formation of committees comprising of members representing all category of staff can improve the situation.

- At present there is no monitoring system to assess the waste management facilities available are carried out effectively as expected. Periodical meetings of waste

management committees can improve the system.

- Responsibilities of waste management and connected matters are not made mandatory to any officer of health care institutions. It is true that the head of institutions is responsible. However, the head of institutions has to find out suitable officer under him and give responsibility on these matters along with powers for carrying out the works.

- There is a problem regarding the non-availability of required instruments, waste containers, bag, etc; of required specifications.

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.

METHODOLOGY

The purpose of the data collection was to know the actual condition of the biomedical waste management in Patna. To have an understanding of the existing condition of the biomedical waste management in Patna, it was essential to have data regarding demography, infrastructural facilities in the Patna Municipal Corporation (PMC). To collect primary and secondary data, various sources and departments were contacted. The collected data was analyzed to reach important inferences and conclusions.

- Talks with the PMC staff, Bihar State Pollution Control Board, Healthcare Personnel and workers, NGOs and residents.

- Use of secondary sources like records of PMC, newspapers, books and internet.

- Field surveys and case studies' examination.

Study of the existing infrastructure with respect to the needs is not organized. One important thing, people use the maps and the database in a disorganized way. There is a feeling among the people that they need an organized system like GIS, since most of the data they use is spatially related, not only it helps in viewing and also analyzing, it will help in decision making. Following tasks were per performed:

- Study and analysis of the existing conditions through study of maps, attribute data, reports, the monitoring mechanism.

- Creation of the baseline data and the waste quantity details.

- Digitizing and demarcation of the existing health ward boundaries.

- Generation of health ward maps with all the existing details for 37 health wards.

A map of the municipal area of Patna (2001) was available with relevant data from the Patna Municipal Corporation (PMC) containing 37 wards. Ward-wise population of all the 37 wards was available.

The administrative set up of wards seems to have been modified subsequently, since different offices provided different ward divisions. Notably, the map from the Census Office Patna showed 42 wards, the map from the Bihar Remote Sensing Office showed 43 wards, and finally another rough sketch map showing 57 wards was also available. Due to the unavailability of the corresponding ward wise population statistics of these differing maps, the map showing 37 wards was used for this research. It was considered judicious and effective to use the population projections for Patna, made by the Patna Municipal Corporation (PMC).

Present (2001) : 13.7 lakhs

Projected (2011) : 17 lakhs

Projected (2021) : 21 lakhs

These population figures will be used for the present research. The projected population densities will be extrapolated from these figures, assuming uniform spatial decadal population growth rate i.e. each ward density increases at proportionate rates over 10 years.

According to the PMC Executive Engineers, the hospital waste generation per day in the city is 2 percent of the total solid waste generation. Thus, for 900 metric ton per day of total hospital waste generated, is 18 metric ton per day, the bio-medical waste generated is 20 percent of the hospital waste i.e. 3.6 metric ton per day.

The total BMW that will be generated in 2011 and 2021 are then projected to be about 4.46 metric ton per day and 5.51 metric ton per day respectively. Table 2 gives the present and projected generation of BMW in Patna. Institute of Town Planners, India Journal 6 - 2, 01-25, April - June 2009 Shailendra Kumar Mandal and Joydeep Dutta

Waste (Description)	Present Generation in Patna (Amount in MT)	Projected In 2011 (Amount in MT)	Projected in 2021 (Amount in MT)
Human Anatomical Waste	0.24	0.30	0.37
Animal Waste	0.10	0.12	0.15
Microbial and Biotechnology Waste	0.12	0.15	0.19
Waste Sharps	0.33	0.41	0.50
Discarded Medicines and Cytotoxic drugs	0.20	0.25	0.31
Soiled Waste	1.74	2.15	2.66
Solid Waste	0.61	0.76	0.94
Incineration Waste	0.06	0.07	0.09
Chemical Waste	0.20	0.24	0.30
Liquid Waste			
Total	3.60	4.46	5.51

Table 2 Present and projected generation of categories of BMW in Patna.

CONCLUSION

The problem of bio-medical waste disposal in the hospitals and other healthcare establishments has become an issue of increasing concern, prompting hospital administration to seek new ways of scientific, safe and cost effective management of the waste, and keeping their personnel informed about the advances in this area. The proper management of biomedical waste has become a worldwide humanitarian topic today. Although hazards of poor management of biomedical waste have aroused the concern world over, especially in the light of its far-reaching effects on human, health and the environment.

Through the primary and secondary studies, infrastructure deficiencies have been found in Patna city. On the basis of understanding the study seeks to improve the current scenario of Patna with respect to solid waste management in general and biomedical waste management in specific. The study has provided detailed policy guidelines for the efficient management of biomedical wastes on the basis of a review of the current trends and best practices in the field. This research model has been designed to act as a useful study for the municipal or state pollution control board's administration in assessing present situation of BMW within the city.

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