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## BIOMEDICAL WASTE MANAGEMENT AND THEIR POSSIBLE HEALTH RISKS WITH CONTROLLING MEASURES IN BAREILLY CITY, UP, INDIA

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**Abstract:** Biomedical waste has become a serious health hazard in many countries including India. The purpose of the study is to get background information about the disposal of hospital wastes and their health risks on our society. The MoEF notified Bio-medical waste and handling rules 1998 in July 1998. According to it every hospital generating Bio-medical waste needs to set a proper treatment facility nearby to ensure degradation of Bio-medical waste as the untreated Bio-medical waste should not be kept beyond 48 hours. In this research we try to elaborate the effects of Bio-medical waste and will also discuss its treatment techniques in Bareilly city. The studies were carried out for a three month *i.e.* from January 2012 to March 2012. The objective of this study was to critically evaluate the existing management practices of biomedical waste and its possible health risks on our environment. A detailed study of major hospitals (Government and Private) of Bareilly city was carried out to assess the current situation of Bio-medical waste generation and management. The results of the study demonstrate that there is a need of strict enforcement of legal provisions and a better environmental management system for the disposal of biomedical waste.

**Keywords:** Biomedical waste, Disposal, Hospital, Treatment

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### INTRODUCTION

Medical waste is broadly defined as any solid or liquid waste that is generated in the diagnosis, treatment or immunization of human beings or animals in research pertaining thereto, or in the production or testing of biological material (Tudor *et al.* 2005, Srivastav 2000). According to World Health Organization (WHO) estimates 85% of hospital 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 (Singh and Sharma 1996). Here the main concern of infectious hospital waste is the transmission of HIV and Hepatitis B or C viruses. In this context, syringes and needles have the highest disease transmission potential. Hospital waste,

till recently was not being managed but it was simply 'disposed off' (Singh *et al.* 2013; Silva *et al.* 2005). The disposal of hospital 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 (Acharya and Meeta 2000; Neema and Gareshprasad, 2002).

In the total amount of municipal waste a city generates, only 1 to 1.5% is hospital waste of which 10-15% is considered infectious (Almuneef and Memish, 2003). It is estimated, a city like New Delhi with about 40,000 beds generates about 60 metric tons of hospital

waste per day (Ministry of Health and Family Welfare, Government of India, 1998). But whatever the amount of hospital waste there be, it proves to be harmful to the community (Patil and Shekhar 200, Machala 2007). This needs immediate treatment and effective disposal. Discarded blood and blood products serve as significant foci of hazardous diseases. The waste stream from X-ray units has chemical contamination of silver bromide (Fixon), glutaraldehyde, hydroquinone and potassium hydroxide (Patil and Pokharel 2004). The waste stream from the sterilization of syringes usually has infectious materials and methanol. The usual infective waste consists of bandages, gauzes, cotton waste, amputated human parts, placenta and used dialysis kits containing plastic and aluminum (Rao, 1995; Shah and Mukharjee 2001). The sterilization of dialysis units, operation theatres and private wards contributes formaldehyde. The waste from laboratory contains infectious materials as well as reagents and solvents used for analytical purposes.

## EXPERIMENTAL

For the study of biomedical waste generation and disposal at Bareilly city data was collected from the Government and private hospital. A questionnaire was developed all the data of waste generation was collected with the help of personal observations and questionnaires. A total 10 major hospitals both

government and private was selected for the study purpose. For the collection of data we divided the biomedical waste in two categories hazardous and non hazardous.

## RESULTS AND DISCUSSION

Amount of Bio-Medical Waste generated in Bareilly city was calculated with the help of personal observation and questionnaire and was tabulated in table no 1. From the observation it was showed that the average hazardous waste generation was 60 kg/day from Rammurti while non-hazardous waste was 45 kg/day and the average hazardous waste generation was 30 kg/day 36 kg/day 32 kg/day 75 kg/day 85 kg/day 65 kg/day 38 kg/day 25 kg/day 20 kg/day from Ganga Charan Hospital, Sidhi Vinayak, Dhanvantari Tomar, Rohilkhand Medical College, Maharana Pratap District Govt. Hospital, Aurvedic College, Sheel Nursing home, Mahajan Nursing home, Kopal hospital repectively. Mean while non-hazardous waste was 25 kg/day 20 kg/day 25 kg/day 55 kg/day 59 kg/day 32 kg/day 30 kg/day 20 kg/day 20 kg/day from Ganga Charan Hospital, Sidhi Vinayak, Dhanvantari Tomar, Rohilkhand Medical College, Maharana Pratap District Govt. Hospital, Aurvedic College, Sheel Nursing home, Mahajan Nursing home, Kopal hospital respectively.

**Table 1. Average daily biomedical waste generated in Hospital of Bareilly City**

S. No.	Name of Hospital	Type	Number of beds	Hazardous waste/day(kg)	Non Hazardous waste per day(kg)
1	Shri Ram Murti Smarak Hospital and Research Centre	Private	300	60	45
2	Ganga Charan Hospital	Private	80	30	25
3	Sidhi Vinayak	Private	85	36	20
4	Dhanvantari Tomar	Private	75	32	25
5	Rohilkhand Medical College	Govt.	300	75	55
6	Maharana Pratap District Govt. Hospital	Govt.	300	85	59
7	Ayurvedic College	Govt.	300	65	32
8	Sheel Nurshing Home	Private	150	38	30
9	Mahajan Nurshing Home	Private	100	25	20
10	Kopal Hospital	Private	85	20	20

## Health Impacts of Bio-Medical Waste

**a. Persons at risk:** All individual exposed to Bio-medical waste are potentially at risk including those within the health care establishments that generate hazardous waste and those outside these sources who either handle such waste or are exposed to it as a consequence of careless management (Manohar 1998; Shah *et al.*, 2001, Saurabh and Ram 2006). The main groups at risk are the following

- i. Medical doctors, nurses, health-care auxiliaries and hospital maintenance personnel,
  - ii. Patients in health-care establishments or receiving home care,
  - iii. Visitors to health-care establishments.
  - iv. Workers in support services allied to health care establishments such as laundries, waste handling and transportation.
  - v. workers in waste disposal facilities (such as landfills or incinerators), including scavengers
- The hazards associated with scattered, small sources of health care waste should not be over looked; waste from these sources includes that generated by home-based health-care, such as dialysis and that generated by illicit drug use.

**b. Hazards from Infectious Waste and Sharps:** Infectious waste may contain any of a great variety of pathogen micro-organisms (Malviga 1999). Pathogens in infectious waste may enter the human body by a number of routes:

- i. Through a puncture, abrasion or in the skin,
- ii. Through the mucous membranes,
- iii. By inhalation,
- iv. By ingestion.

### c. Types of Hazards

i. **Health hazards:** According to the WHO. The global life expectancy is increasing year after year. However, deaths due to infectious disease are increasing (Ndiaye, 2003). A study conducted by the WHO in 1996. Reveals that more than 50.000 people die every day from infectious diseases. One of the causes for the increase in infectious diseases is improper waste management. Blood, body fluids and

body secretions which are constituents of bio-medical waste harbor most of the viruses, bacteria and parasites that cause infection (Gupta 1998; Sadhu and Singh 2003). This passes via a number of human contacts, all of whom are potential recipients of the infection. Human Immunodeficiency Virus (HIV) and hepatitis viruses spearhead an extensive list of infections and diseases documented to have spread through bio-medical waste (Singh *et al.* 2003). Tuberculosis, pneumonia, diarrhea diseases, tetanus, whooping cough etc., are other common diseases spread due to improper waste management (Singh *et al.* 2003).

ii. **Occupational health hazards:** The health hazards due to improper waste management can not only affect the occupants in institutions, but also spread in the vicinity of the institutions. Occupational health concerns exist for janitorial and laundry workers, nurses, emergency medical personnel, and refuse workers. Injuries from sharps and exposure to harmful chemical waste and radioactive waste also cause health hazards to employees in institutions generating bio-medical waste. The problem of occupational health hazards due to bio-medical waste is not publicized as there is lack of information. Hence, the Bio-Medical Waste (Management and Handling) Rules. 2000 prescribe a form under schedule VI to report such incidences in order to develop a database. There is plenty of scope for research in this field. Proper management of waste can solve the problem of occupational hazards to a large extent.

## Health Impacts of BMW on Community of Bareilly City

Exposure to hazardous health-care waste can result in disease or injury. The hazardous nature of health-care waste may be due to one or more of the following characteristics:

- It contains infectious agents,
- It is genotoxic,
- It contains toxic and hazardous chemicals and pharmaceuticals,
- It contain sharps.

In spite of high sickness rate among the sanitation staff dealing with health care waste,

the awareness regarding the protection of their bodies and manual handling was found to be missing (Das 2004). The common perception is that "everybody else is doing the same so there lays danger in doing it myself. No body was found wearing an protective gears, spectacles, shoes and hand gloves even. These items are considered to be a luxury and were thought to hinder the work. Besides they complained that the same are not provided by their employers like hospitals and municipalities. The sanitation staff do understand the relation of waste and diseases but they replied that they have been doing the same for a very long time (ranging from 8-20 years) so they have become immune to many health problems The sanitation staffs working in hospital and health care facilities get free medication from their place of work or from municipal clinics. They are not provided with gloves while the treatment takes place, which might be infectious to them. They are open to the diseases of the patients, as the public hospitals do not provide them with proper equipment and facility. The nurses, sweepers and cleaners are not aware of taking any precautionary measures while disposing the hazardous hospital/clinical waste. The scavengers outside the hospitals are exposed to the hospital/clinical waste, as the waste is disposed into the UMC dustbin. Studies have not been carried out on the health effects of the community those who are exposed to the hospital/clinical waste in Bareilly. But, short information is given some evidence that exposure to hospital/clinical waste there might be some possibility of health effects in future. Mainly people at risk to hospital/clinical waste in Bareilly City are:

- Cleaners,
- Sweepers,
- Nurses.

### Good Biomedical waste management practices

Bio-medical Waste Management means the management of waste produced by hospitals using such techniques that will help to check the spread of diseases through it (Kelkar 1998; Askarian, 2004). Handling, segregation, mutilation, disinfection, storage, transportation and final disposal are vital steps for safe and

scientific management of biomedical waste in any establishment (Kelkar 1998; Pruthvish *et al.* 1998; 2002). The key to minimization and effective management of biomedical waste is segregation (separation) and identification of the waste (Baccini 1991; Burd 2005). The most appropriate way of identifying the categories of biomedical waste is by sorting the waste into color coded plastic bags or containers (Gayathri and Kamala, 2005; Da Silva *et al.* 2005; Chitnis *et al.* 2005). Biomedical waste should be segregated into containers/ bags at the point of generation in accordance with Schedule II of Biomedical Waste (management and handling) Rules 1998 (Jaswal and Jaswal 2000; Kela *et al.* 2000; Glenn and Garwal 1999; Rao *et al.* 1994) for the management of biomedical waste following methods should be employed (Singh *et al.* 2003):

- a) Segregation,
- b) Storage,
- c) Pre-treatment,
- d) Recycling,
- e) Internal Transportation,
- f) Post-treatment,
- g) External transportation,
- h) Final Disposal.

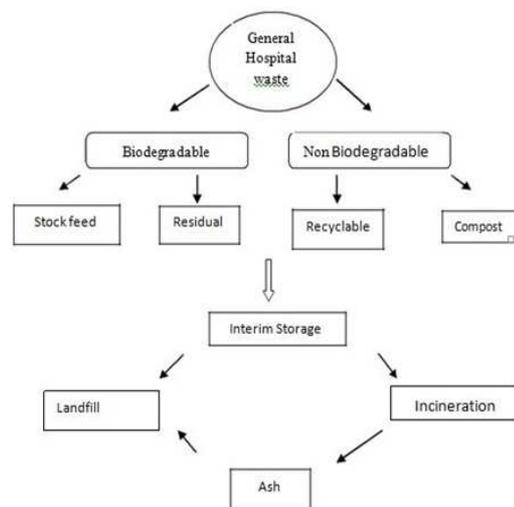


Figure 1. Hospital Waste management Flow Chart

### Classification of Bio-Medical Waste

The World Health Organization (WHO) has classified medical waste into eight categories (Pruss *et al.* 1998; Rasheed *et al.*, 2005):

- i. General Waste,
- ii. Pathological,

- iii. Radioactive,
- iv. Chemical,
- v. Infectious to potentially infectious waste
- vi. Sharps,
- vii. Pharmaceuticals,
- viii. Pressurized containers.

**Table 2. Classification of Biomedical waste**

Colour	Waste Category	Wastes	Treatment
Yellow	Plastic bag Cat.1, Cat.2 and Cat. 3, Cat. 6.	Anatomical waste	Incineration /deep burial
Red	Disinfected container/plastic bag Cat.3,Cat.6, Cat.7	Infectious wastes	Autoclaving/ Microwaving/ Chemical Treatment
Blue/ White Plastic	Bag/puncture proof Translucent Cat.4, Cat.7 Plastic bag Cat.5 and Cat. 9 and Cat. 20 (Soild)	Sharp wastes For normal MSW/ kitchen wastes	Autoclaving/ Microwaving/ container Chemical Treatment and Destruction/S hredding
Black			Disposal in secured landfill

## CONCLUSION

The management of biomedical wastes poses a great challenge to the policy planners, city administrators, medical personnel and workers in the recycling industry. There is a need for adopting a cost-effective system for providing better medical waste treatment facilities and reduce the amount of waste generation by awareness and education of all concerned. Biomedical waste management requires intensive efforts to make environmentally sound. There is a need of segregation of the hospital wastes according to the available disposal technology, employment of cost-effective and available relevant technology, possibilities of recycling to be explored in a scientific and hygienic manner for permissible items, setting up of common medical waste treatment facilities for/by different hospitals such as transportation of the hazardous waste to the common disposal system to reduce expenditure, safety of medical staff/rag-pickers, by the use of gloves and masks and housekeeping aspects (drinking water,

sewage system of the hospitals), implementation of recycling etiquette by medical and paramedical personnel, training of Municipality workers by medical personnel in handling of medical waste to avoid risks and health hazards and implementations of legislations pertaining to hygiene of freelance workers such as rag pickers in the recycling industry.

## REFERENCES

- Acharya, D.B.and Meeta, S. (2000). Hospital Waste Management. Minerva Press, New Delhi 2000,pp 15,47.
- Almuneef, M. and Memish, Z. (2003). Effective medical waste management: it can be done. American Journal of Infection Control, 31, 188–192.
- 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.
- Baccini P, Brunner P, (1991). The Metabolism of the Anthroposphere, Springer Verlag, Berlin, 1991
- Baveja, G., Muralidhar, S. & Aggarwal, P.(2000). Hospital waste management– an overview. Hospital Today, 5, 9 485–486.
- Burd M, (2005). Reducing the risks related to the handling and disposal of healthcare waste. Prof. Nurses 20, 40–42.
- Chitnis V, Vaidya K, Chitnis DS, (2005) Biomedical waste in laboratory medicine: Audit and management, Indian Journal of Medical Microbiology, 23 (1):6-13 J. Int. Environmental Application & Science, Vol. 4 (1): 65-78 (2009)
- Da Silva, CE, Hoppe AE, Ravello MM, Mello N, (2005). Medical wastes management in the south of Brazil. Waste Manage. 25, 600-605.
- Das NK, Sushant P, Jayaram K, (2001). A TQM Approach to Implementation of Handling and Management of Hospital Waste in Tata Main Hospitals. The official Journal of the Indian Society of Health Administrator, 11, 75-78.
- Gayathri VP, Kamala P, (2005). Biomedical solid waste management in an Indian hospital: a case study. Waste Management, 25, 6, pp.592-599.
- Glenn McR, Garwal R, (1999). Clinical waste in Developing Countries. An analysis with a

- Case Study of India, and a Critique of the Basle- TWG Guidelines.
- Gupta SP, (1998). Statistical Methods, Revised & Enlarged, S. Chand & Sons, New Delhi, India.
- Jaswal PS, Jaswal N, (2000.) Environment Law, Allahabad Law Agency, Hararyana, India.
- Kela M, Nazareth S, Goel A, Agarwal R, (2000). Managing Hospital Waste: A Guide for Health-Care Facilities, New Delhi.
- Kelkar R, (1998). A practical approach to hospital waste management in India. Industrial Safety Chronicle, Oct–Dec, pp. 67–70.
- Machala Z, Janda M, Hensel KI, Jedlovsky, Lestinska L, Foltin, V, Martisovits, V, Morvova M. (2007). Emission spectroscopy of atmospheric pressure plasmas for bio-medical and environmental applications. J. of Molecular Spectroscopy, 243, 194-201
- Malviga K, (1999). Existing Solid Waste Management from Hospitals. MSc Dissertation. Devi Alivya University, Indore, India. Management and Handling Rules (1998) Notification: Bio-medical Waste Ministry of Environment and Forests, GOI (E), part 3(ii), New Delhi.
- Manohar D, Reddy PR, Kotaih B, (1998). Characterization of solid waste of a super speciality hospital – a case study. Ind. J. Environ. Health, 40, 319-326.
- Ministry of Health and Family Welfare, Government of India (1998). Health Information of India (1995 & 1996) 131–136. New Delhi: Central Bureau of Health Intelligence Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India.
- Ndiaye P, Fall, C, Diedhiou A, Tal-Dial A, Diedhiou O, (2003). Biomedical waste management in the Regional Hospital Center of Ziguinchor. Sante. 13, 171–176.
- Neema SK, Gareshprasad KS, (2002). Plasma pyrolysis of medical waste. Current Science, 83, 3. NEERI, (1995) National Environmental Engineering Research Institute in Nagpur Comprehensive Characterization of Municipal Solid Waste at Calcutta.
- Patil AD, Shekdar AV, (2001). Health-care waste management in India. National Environmental Engineering Research Institute Nehru Marg, Nagpur, India
- Patil GV, Pokhrel K, (2004). Biomedical solid waste management in an Indian hospital: a case study. Waste Management, 25, 592–599.
- Pruss A, Giroult E, Rushbrook P, (1999). Safe Management of Wastes from Health-care Activities. Geneva,WHO J. Int. Environmental Application & Science, Vol. 4 (1): 65-78 (2009)
- Pruthvish S, Gopinath D, Jayachandra Rao M, Girish N, Bineesha P, Shivaram C, (1998). Health-Care Waste Management Cell, Department of Community Medicine, M.S. Ramaiah Medical College. Bangalore, India. Information Learning Units for Health-Care Waste.
- Rao, H. V. N. (1995). Disposal of hospital wastes in Bangalore and their impact on environment. In The Third International Conference on Appropriate Waste Management Technologies for Developing Countries. Nagpur, February 25–26, pp. 839–842.
- Rao,S.K.M., and Garg, R.K.(1994) A study of Hospital Waste Disposal System in Service Hospital.. Journal of Academy of Hospital Administration, July ,6(2) pp.27-31.
- 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.
- Ravikant, C.V., Jaiswal, S.P., Vaidya K., Chitnis, D.S. (2002). Effluent Treatment Plant: Why and How?. Journal of Academy of Hospital Administration, 14(1) pp. 33-37.
- Sadhu, T.S., and Singh, N. (2003). A Hazard Going Unnoticed – Biological Waste is a Threat to the Community at Large. The Tribune.
- Saurabh, G., and Ram, B. (2006). Report: Biomedical waste management practices at Balrampur Hospital, Lucknow. India Waste Management & Research, 24, pp.584-591.
- Shah, S., Mehta, M., Mukherjee, M.D. (2001). Occupational Health Hazards Encountered at Health Care Facility and Medical College in India. American Industrial Hygiene Association.
- Silva CE, Hoppe AE, Ravanello MM, Mello N, (2005). Medical waste management in the south of Brazil. Waste Management, 25, 600–605.
- Singh A., Bhadouria, R. and Singh, A.P., (2013). Biomedical Waste Management Practices in Bareilly, India. ISBN. 978-3659381782,

- LAP Lambert Academic Publishing, Germany.
- Singh, I.B., and Sarma, R.K. (1996). Hospital Waste Disposal System and Technology. *Journal of Academy of Hospital Administration*, July, 8(2), pp. 44-48.
- Srivasta, J.N. (2000). Hospital Waste Management project at Command Hospital, Air Force. National Seminar on Hospital waste Management, a report 27 May, Bangalore
- Tudor TL, Noonan CL, Jenkin LET, (2005). Healthcare waste management: a case

study from the National Health Service in Cornwall United Kingdom. *Waste Management*, 25, 606–615.

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