

# Biomedical Waste Management System for Mandya City

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**Abstract:** *Biomedical waste management (BMWM) has become an important issue as it poses potential health risks and damage to the environment. Biomedical waste (BMW) if not handled in a proper way, is a potent source of diseases like HIV, Hepatitis B & C and other bacterial diseases causing serious threat to human health so prime attention needed for its safe and proper disposal. Bio-medical waste includes all the wastes generated from hospitals, medical centers, healthcare establishment and research facilities in diagnosis, treatment, immunization and associated research. This paper looks upon the aspects and step-by-step approach for establishing BMWM System for Mandya city. Mandya is the smallest district in Karnataka according to 2011 census the population of the Mandya district is 18, 05,769 and the population of Mandya city is 1, 37,368. The project Study includes probing the practices of managing Bio-medical Waste, to quantitatively and qualitatively assessing the rate of generation of biomedical waste, to determine the level of awareness on waste management, and to propose suitable suggestions for an effective management. The study will be carried out in hospitals, clinics and laboratories falling under the Mandya city limits. The study proposes a common biomedical waste management system for the city and estimates the cost for the same.*

**Keywords:** Biomedical waste, Waste management, Generation rate, Mandya biomedical waste

## 1. Introduction

Bio-medical waste (BMW) is, waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining there to or in the production or testing of biological including categories mentioned in Schedule I of Bio-medical Waste (Handling and Management) Rules, 1998. In India the waste generation rate ranges from 0.5 to 2.0 kg per bed per day. BMW mismanagement poses various environmental, biological and radiological hazards to the population. Biomedical waste is a special category of waste, which needs to be handled appropriately with precautions because it carries a higher potential for infection and injury than any other type of waste. With a rapid increase in the number of hospitals, clinics and laboratories in the country, the generation of biomedical waste has been increasing considerably. In western countries it is estimated that hospitals generates 1 t to 105 kg of waste per bed per day. And it is estimated that in clinics, total amount of waste generated is 200kg/year. Also It is estimated that in India Bio Medical waste (BMW) generate between 0.5 to 1 kg of waste/person/day. In Karnataka state the generation of biomedical waste has been estimated to be 1.0kg/bed/day in private and government health care establishments, 1.5kg/day in blood bank. 1.0kg/day in diagnostic laboratory, 0.2 kg/day in small clinics and 0.25 kg/day in veterinary clinics. Even the industry over the last decade has shifted from a mainly reusable product supply system (e.g.: disposable syringes, disposable hospital linen etc..) which leads to increase in the bio-medical waste generation and its management is difficult.

## 2. Study Area

Mandya city growth rate is increasing year by year rapidly. As the population increasing city expansion is also

increasing so that, new hospitals, clinics, and laboratories, educational institutions, blood banks, dispensaries, training centers are also increasing. Since in Mandya in any hospital there is no proper biomedical waste disposal units are not there and also there is common biomedical waste disposal units are not there. Till today all Mandya district biomedical waste which is accountable is being taken by the MARIDI which is situated about approximately 70kms far from the Mandya city. But there is no accountability of waste generate from the rural side of the Mandya district as well as the clinics, dispensaries of city limits. Hence to minimize the improper waste disposing practices, in order to control the risks associated with this hazardous biomedical waste on environment and also on health and to streaming the accountability of waste generation the project study has been carried out in Mandya city. The study covers all hospitals (government and private), clinics, laboratories, blood banks, dispensaries. Study encloses collecting the waste generation data, observation on waste handling procedure, waste storage, waste transportation, and maintenance of day to day accountability of waste generation, disposal techniques, health and safety of waste handlers, hygiene of the hospital. From various health care's has created tremendous environmental and public health problems. The all-cause mortality data from India and other developing countries shows that infectious disease is the most common cause of death. Improper Bio medical waste Management has the potential to spread infections, lead to development of resistant organisms and bringing these resistant hospital organisms to the doorstep of the community. Further, biomedical waste has the potential for polluting air, water and food and also it is foul smells.

## 3. Steps Involved In Biomedical Waste Management System

Inspectors, Head of some clinical departments and member secretary. It was made mandatory for the WMC to have

quarterly meetings and discuss about the progress made so far and to formulate further action plans.

### 3.1 Formation of Waste Management Committee (WMC)

WMC consist of Head of the Institution, Chief Medical superintendent, Financial Officer (FO), Registrar, Matron, Civil Engineer, Sanitary

### 3.2 Member secretary

Member secretary of Waste Management Committee is the key person responsible for all the activities related to BMW as Formulation of the policies, procure infrastructure and made it available at each and every work station in the hospital, formulating training and monitoring module and work in coordination with the higher authorities.

## 4. Problems Associated With Biomedical Waste

Biomedical waste management has become an important issue as it poses potential health risks and damage to the environment. Biomedical waste if not handled in a proper way, is a potent source of diseases like HIV, Hepatitis B & C and other bacterial diseases causing serious threat to human health. So, prime attention needed for its safe and proper disposal.

Bio-medical waste includes all the wastes generated from hospitals, medical centers, healthcare establishment and research facilities in diagnosis, treatment, immunization and associated research. This Biomedical waste which is generated

### 4.1 Nodal officer (NO)

A faculty member from every department was appointed as Nodal officer for BMW. The NO is made responsible for each and every activity related to BMW in their department. The NO has to implement the BMW practices as per the norms and hospital policy in the department.

NO can also formulate a sub committee consisting of the staff nurses, ward boys, resident doctors etc who are directly related to the day to day activities in generation of BMW. The members of the sub committee were supposed to report to the Nodal officer in case of any requirement, complaints, non-compliance, solutions regarding disposal of any specific category of waste generated in the department. NO are instructed to co-ordinate with the member secretary and also to participate in various Monitoring and Training activities being conducted in the hospital.

### 4.2 Baseline assessment of waste produced in the HealthCare Facility

This assessment was done for determining the percentage of different category of waste produced in the HCF. Baseline assessment gives strength to BMW System. During baseline assessment waste was not segregated properly. All the hospital waste was collected at the temporary area.

### 4.3 Importance of performing baseline assessment

This assessment provided the exact quantity of various categories of waste generated in the hospital and thereby giving us data for procuring various equipments for terminal disposal and for the Common Treatment Facility (CTF). It helps in assessing the current situation & provides systemic approach & methodology to improve the BMW System.

### 4.4 Planning and Implementation

The Bio medical waste management cell furnished with all required necessary facilities. And also manages the records pertaining to the various waste management procedures and policies adopted in the hospital. Specialized infrastructure has also been developed under the project.

### 4.5 Allocation of Funds

- Consumables: Hub cutters, bins, poly bags of different colors, personnel protective equipments (gown, mask, protective boots, eye protector, gloves etc)
- Equipment: Autoclave, Microwave, Shredder and incinerator
- Collection and Transportation trolleys: Work station trolley, Injection trolley, Rickshaw trolley Wheel trolley
- For loading and de loading of waste at site Man power required for following activities:
- Collection of waste from various work stations
- Operating machines
- Data entry/record keeping
- Organizing regular training sessions and monitoring rounds
- Infrastructure Site development and its maintenance
- Incineration cost To have contract with an authorized CTF

### 4.6 Preparation of Central Collection and Treatment Site (CCTS)

A site situated in a comparatively secluded area in the hospital surrounded by greenery was selected. Site is designed in the manner so that different category of collected waste can be stored and finally treated and disposed off as per the norms. The facility is large enough to house the machines used for storage and disposal of recyclable waste. The size and number of the machines are decided according to the requirement and size of the facility.

## 5. Sustainability of BMW System

A smooth running BMW System require a lot of efforts. Development of BMW System is the biggest deal but its proper maintenance with time to time is also another significant task. Regular training program and monitoring is very much essential to maintain the BMW System.

- Training and awareness raising programs: Regular and updated training program helps to aware the healthcare personnel. Training programs are conducted in every department as per requirement.
- Certificate Course in HealthCare Waste Management (CHCWM): A 6month certificate course in Health Care

Waste Management through IGNOU for Nodal officers/staff.

- **Monitoring rounds:** Regular monitoring by the NO and the members of BMWM Committee helps to improve BMWM System.

## 6. Objective of the Study

The main objective of the project study is, to carry out the qualitative and quantitative analysis of biomedical waste in Mandya city and to devise the effective framework for bio medical waste management.

## 7. Materials and Methodology

The project started with the literature review on “biomedical waste management system”. After the deep understanding on biomedical waste management system and recent improved technologies for disposing of BMW, as well as the rules and regulations of biomedical waste management made by the CPCB and MOEF and also KSPCB, and also the operation, maintenance and cost of the equipments used. Four months has been spent for the collection of waste generation data in all the hospitals, clinics, and laboratories, educational institutions, blood banks, dispensaries, training centers. At the same time observation of waste handling procedure like placing of waste bins, maintenance of color coded bags, frequency of removal of waste from the bins, waste lifting practices, identification and labeling for the waste bins, segregation of waste, transportation method, disposing method, of all the observations has been noted and documented.

## 8. Audit Checklist

1. Name of health centers and units/institution:
2. Address:
3. Telephone:
4. Name of the respondent with designation:
5. Average out-patients/day :
6. Total number of beds:
7. Authorization obtained from State pollution control board: Yes/No
8. How is the waste collected: Together/Segregated
9. Is container has identification :
10. Who collects the solid waste at source?
11. At the time of collection of the waste, is ppe's were wear?
 

Apron	Yes/No
Gloves	Yes/No
Boots	Yes/No
Mask	Yes/No
Goggles	Yes/No
12. Method of transportation of waste from hospital to site of final disposal
 

Manually
Container
Open Vehicle
Closed Vehicle
13. Does the institution have bio-medical waste disposal facility

**Table 1:** Checklist for Waste Generation Data

Hospital Name	Type Of Hospital	Waste Generated / Day In Kg			
		Infectious waste	Non infectious Waste	Sharps	Plastic waste

After the collection of waste generation data population forecasting of mandya city is carried out by collecting the previous census year 1991, 2001, 2011 population data from nagarsabha office of the Mandya city. Population forecasting for the year 2021 has been done by using incremental increase method. The formula for calculating the population increased by incremental increase method is as follows,

$$P_n = P + n \cdot X + \{n(n+1)/2\} \cdot Y$$

$P_n$  = Population after  $n^{\text{th}}$  decade

$X$  = Average increase

$Y$  = Incremental increase

So the population of the Mandya city in 2021 is approximately 1, 50,640, and the amount of waste generated for the year 2021 is approximately 1054.5 metric tons.

## 9. Results

After collecting the waste generation data it has been found that, Due to the rapid urbanization and increase in human migration to the city the number of medical entities also increased and the rate of waste generation gradually increasing. And While observation some of the environment, health and safety issues are also noted and tabulated below,

- In some hospitals there is lack of availability of color coded waste bins so that proper segregation is not happening
- There is no closed type of waste bins available In most of the hospitals
- There is no permanent identified place for placing the waste bins
- In some hospitals waste bins are not provided where the waste is generating frequently
- There is a lack of practicing the segregation at the place of generation due to lack of awareness
- There is no accountability of waste generation
- Cleanliness has not been maintained at the place where the waste bins are placed, there is splash of blood on the wall and also medicine spillages on the ground
- Waste handlers while handling the waste they use surgical gloves which doesn't protects the palm from sharps and syringes
- While handling the waste they are not provided with a goggle which protects the eyes from splashes of body fluids, medicines. And from viral and bacterial infections
- Handlers will not use filter respiratory mask which protects from microorganisms inhalation
- In any hospital body suit is not provided for the waste handlers which protects the body from all infections
- In some hospitals waste lifting trolleys are not provided hence the handlers lift the waste on their shoulders to the storage yard
- The waste generated from all the clinics is being dumping in to the municipal waste bins



- There is no accountability of waste generating from clinics with Mandya pollution control board
- It has been noted that there is no accountability of biomedical waste generation from the clinics. Almost all the clinics are dumping their waste in to the municipal solid waste bins.
- In some hospitals and other medical entities proper segregation is not happening and there is no frequency setup for waste removal from the waste bins due to the long transportation route for disposal.
- In any hospital there is no availability of waste disposal unit

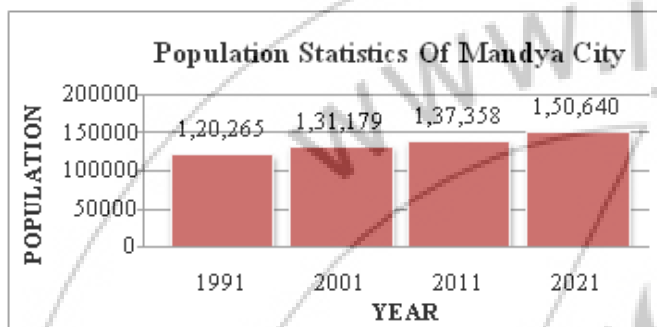


Figure1: population statistics of Mandya city

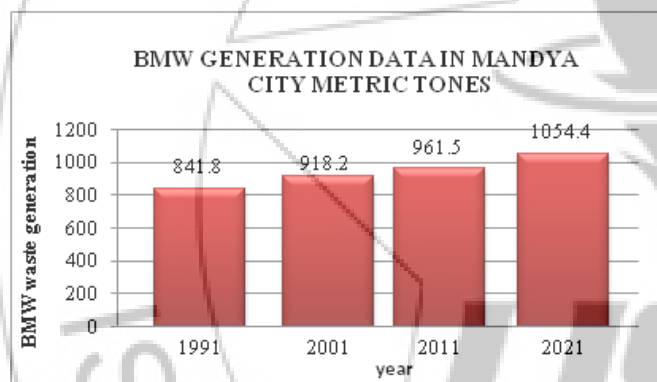


Figure 2: BMW generation data of Mandya city

## 10. Basic Requirements of a Common Biomedical Waste Disposal Unit

- Consumables
  - Hub cutters, bins, poly bags of different colours, protective
  - Gear (gown, mask, protective boots, eye protector, gloves etc)
  - IEC materials/training
- Equipments
  - Incinerator [double chambered]
  - Shredder
  - Autoclave
  - Microwave
  - Generator unit
  - Trolleys and other containers:
- Collection and transportation trolleys:
  - Work station trolley
  - Injection trolley
  - Rickshaw trolley
  - Wheel trolley

## D. Manpower

- Collection of waste from various work stations
- Operating machines
- Data entry/record keeping
- Distributing consumables, hub cutter repair, attending
- To the complaints from various equipments
- Organizing regular training sessions and monitoring

## E. Infrastructure Site development and its maintenance

## 11. Recommendations

- Accountability of clinical waste generation should be traced by the regional pollution control board, so that proper disposal of clinical waste can be achieved
- Proper segregation of waste and frequent waste removal should happen
- Planned training and education should be given to the waste handlers
- Required and recommended personal protective equipment should be given to the waste handlers
- There is a requirement of common biomedical waste disposal unit in Mandya city premises, which helps in proper disposal of waste, and also there is financial benefit or the medical entities.

## 12. Conclusion

Some of the hospitals, clinics, laboratories, blood banks, medicine dispensaries are not disposing their waste according to biomedical waste rules and regulations(2011).so the proper documentation of waste generation and disposal data should be done and maintained by all the medical entities and should be monitored by the regional pollution control board.

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