



## Bio-medical Waste – Review

Its real scenario, its Management, treatment and proper disposal

Binay Kumar Gupta  
Environmentalist & GM, Environment, Bihar Foundry & Castings Ltd.  
NABET Assessor, under NABET QCI-EIA Scheme, Ex -ASO cum Board  
Analyst, JSPCB, Ex-Nominated Member (from JSPCB), SEIAA, Jharkhand

**Many wastes are produced as a result of human activities. It includes House hold waste, Industrial waste, Biomedical waste or hospital waste. Biomedical/ Hospital waste is considered as hazardous because they contain toxic substances.**

---

**Abstract:** -This review study aims at biomedical waste management. Biomedical waste management is significant to **defend the environment and health of the population**. Necessity of Biomedical Waste Management has attracted attention because of Inadequate management of these wastes produced in health care facilities is causing a direct health hazards on the general public, the health care workers and on the environment.

Measures to ensure the safe and environmentally sound management of health care wastes can prevent adverse health and environmental impacts from such waste including the unintended release of chemical or biological hazards, including drug-resistant microorganisms, into the environment thus protecting the health of population.

Biomedical waste (BMW) is any waste produced during the diagnosis, treatment, or immunization of human or animal research activities pertaining thereto or in the production or testing of biological or in health camps.

It is observed from the analysis that there is significant association between type of hospital and waste handling safety measures.

Waste management is needed to prevent pollution. Waste management is important as **it saves the environment from the toxic effects of inorganic and biodegradable element present in waste**. Mismanagement of waste can cause great harm to society, water, soil and air contamination. Waste can be reduced, recycled if collected and managed efficiently.

Segregation refers to the basic separation of different categories of waste generated at source and thereby reducing the risks as well as cost of handling and disposal. Segregation is the most crucial step in bio-medical waste management.

The main objective of Waste management is **to reduce the environmental and health hazards that arise from indiscriminate dumping of waste and pollution of natural resources like the land, sea, and air.**

One of the essential aspects of waste management is **recycling**, and when you do it, you're helping in the conservation of natural resources by reusing materials such as glass, plastic, oil, and paper. But Biomedical wastes are such wastes where recycling does not work.

These wastes are of general category and are mostly Municipal wastes which can be managed by segregation, recycling and reduction.

But here In am dealing with Biomedical Wastes and as per the Rules these Biomedical wastes come under **ten categories** and need to be placed in four different coloured containers/ bags. The wastes have to be treated using techniques such as deep burial, incineration, autoclaving, micro waving, mutilation, shredding and chemical disinfection.

The general 4 different kinds of medical waste are of **infectious, hazardous, radioactive, and general type.**

Biomedical Wastes are studied utilizing biotechnology techniques, biomedical researchers study biological processes and diseases types with the ultimate goal of **developing effective treatments and cures.** Biomedical research is an evolutionary process requiring careful experimentation by many scientists, including biologists and chemists.

In general the most preferred method of waste management is source reduction, also known as waste prevention, means reducing waste at the source, and is the most environmentally preferred strategy. It can take many different forms, including reusing or donating items, buying in bulk, reducing packaging, redesigning products, and reducing toxicity. But here in case of Biomedical wastes the most preferable method of healthcare waste management is incineration. Our findings indicate that **incineration** is the best waste disposal technique among the available alternatives.

Therefore, **Incineration** is the technique that is most suitable for the disposal of biomedical waste. Sanitary landfills were adopted as the substitute for open-burning dumps.

The present COVID-19 pandemic has changed the scenario because of massive death and its fastest-spreading nature. The problem became more severe because not handling medical waste properly. It was a systemic review study regarding the relationship between COVID-19 and biomedical waste management. So far information gathered it has been observed that if the unmanaged medical wastages are not managed, treated and disposed properly and as per guidelines guide lines, chances are that major community can be infected by different trains of COVID-19 which can lead to major deaths in the upcoming days. Here, we will try to find out in simple term the potentials of Bio medical wastes generated in Jharkhand and gaps between treatment facility and Biomedical wastes generated and the management of these wastes are proper and sufficient or not.

*Keywords-Bio-medical waste management, pandamic covid 19, Incineration.*

## 1. INTRODUCTION

Biomedical waste (BMW) is generated in hospitals, research institutions, health care teaching institutes, clinics, laboratories, blood banks, animal houses and veterinary institutes during the diagnosis, testing, treatment, research or production of biological products for humans or animals. Biomedical waste includes syringes, live vaccines, laboratory samples, body parts, bodily fluids and waste, sharp needles, cultures and lancets.

Hospital waste is considered as hazardous because they contain toxic substances. Liquid waste can be divided into two components (a) Liquid reagents/ chemicals discarded and (b) the cleaning and washing water channel leading to the drain. Hospital waste generation is a prime concern due to its effect on the health of patients, hospital staff and then to the general population. Hospital waste refers to all waste, biologic or non-biologic that is discarded and not intended for further use. Medical waste is a subset of hospital waste.

For proper management of Bio medical wastes the first rule came in 1998 known as Biomedical wastes (M & H) Rules, 1998 which put emphasis on properly collection, transportation, and disposal of in order to safeguard the environment, and to streamline activities associated with these wastes.

Later in 2008 another rules came known as Medical Waste (Management and Processing) Rules 2008. This rule gave emphasis on "medical wastes could not be mixed with other wastes at any stage while producing inside hospitals, while collecting from hospitals, while transporting, and would be processed separately based on classification". These rules are continuously monitored, altered, and updated from time to time as effective management is necessary for a cleaner and greener environment. In 2016, the Government of India decided to publish a new set of rules, Biomedical Waste Management Rules, 2016, supervening the old one with various changes and additions in order to improve the collection, segregation, treatment, and disposal facilities of these biomedical waste produced by the hospitals and laboratories to mitigate the environmental pollution. The treatment technologies identified include incineration, microwaving, autoclaving, and chemical treatment.

The amended rules stipulate that **generators of bio-medical waste** such as **hospitals, nursing homes, clinics, and dispensaries etc will not use chlorinated plastic bags and gloves beyond March 27, 2019** in medical applications to save the environment.

Now we will discuss on 4 categories of biomedical waste produced in India. These are

1. Pathological Waste – Body parts of humans or animals, including tissues, fluids, or blood.
2. Pharmaceutical Waste – Unused drugs, medicine, or creams that are expiring.
3. Genotoxic Waste – Toxic drugs and hazardous toxic waste.
4. Radioactive Waste – Any waste containing potentially radioactive materials.

All these types of wastes are infectious, hazardous and carcinogenic.

## 2. OBJECTIVES

1. To analyze the potential production of bio medical waste in Jharkhand

2. To find out whether technique used for the bio medical waste management is sufficient in Jharkhand or not .

### 3. Findings

#### Jharkhand scenario of Biomedical wastes

Government Hospital: Jharkhand: Number of Hospitals: <b>Rural (Unit)</b>	4,371.000 - in 2020
Government Hospital: Jharkhand: Number of Hospitals: Urban (Unit)	92.000 – in 2020
Private Hospitals(Unit)	1037.000 - in 2020

The state has around 5,500 hospitals, nursing homes and clinics but only two common bio-medical waste incineration facilities are functioning, officials at the Jharkhand state pollution control board (JSPCB) officials claimed.

There are half a dozen incinerators in quite a few government and private hospitals but they use the facility for their individual purposes.

A recent survey claimed to have found that these hospitals produce around 4,700 tons of bio-medical waste annually but 59%, around 2,700 tons, are left untreated. The survey was conducted by Delhi-based environmental group Toxics Link and Ranchi-based NGO Lok Swar in 31 government and private hospitals of Ranchi, Jamshedpur, Dhanbad, Bokaro and Deoghar.

The study claimed that 90% of the surveyed hospitals are flouting the Bio-Medical Waste (Management and Handling) Rules, 2016. Roughly 60% Jharkhand's bio-medical wastes generated from hospitals, nursing homes and clinics across the state go untreated in absence of proper disposal facilities, according to pollution officials and environmentalists.

Project coordinator of Lok Swar, Prince Kunal, said the study conducted for the last six months also found large amounts of the infectious hospital wastes dumped along with municipal solid wastes in various parts of the city. "We found rag pickers rummaging through yellow and red colour coded bags containing body parts, used syringes and gloves in Jamshedpur and Deoghar municipal dumping areas," he said. The study further says 42% of wards, 13% of nursing stations, 39% of laboratories and six percent of OPDs did not even have proper color coded waste bins.

According to physicians, infectious waste including blood or other body fluids, culture that contain bacteria, viruses, parasites or fungi could invite a plethora of diseases, which can even be life-threatening. Association of Physicians of India (API) Jharkhand chapter chairman Dr NK Singh said untreated and dumped bio-medical wastes not only impact human health, environment but also the stray animals. "It could cause severe illness even death," he said.

In Ranchi, there are more than 200 hospitals and clinics, but incinerator facilities are available only in two hospitals. Ranchi-based Rajendra Institute of Medical Sciences (RIMS) has an incinerator, but untreated bio-medical wastes could be found littered in the backyard of incinerator units. "The capacity of the incinerator is 100 kg per hour. But it is used only for hospital wastes. Other hospitals in

the city are not allowed here,” said one of the incinerator operator at RIMS. In Dhanbad, despite High Court’s directive, no arrangement for scientific treatment of bio- medical waste was made till date. On February 17, 2016, the HC bench of the then chief justice Virendra Singh and justice S Chandrashekhar had expressed concern over dumping biomedical wastes in public places. Even after four years, bio-medical waste such as mound of plaster, blood-stained band-aid, cotton, gauze, bandage, syringe, saline bottles, medicines bottles, globs, saline bottles are found dumped both sides of Hirak Road bypass in Dhanbad. JPCB he has already set up team to probe who is dumping bio-medical waste there. “After getting reports action would be initiated as per the Act”, said by JSPCB Officer.

There are 294 big and small private nursing homes and clinics in Dhanbad and Bokaro, which fall under jurisdiction of Dhanbad regional pollution board area. The private hospitals claim to get their bio-medical waste treated at 120 kms away Bio-Genetic Laboratory, Ramgarh through private agency daily. However, neither pollution board nor officials at Dhanbad and Bokaro civic bodies have any idea whether private hospitals dispose of bio-medical waste there.

The incinerator at Patliputra Medical College Hospital (PMCH), Dhanbad, which also used to treat bio-medical waste of private hospitals, is lying defunct since 2006.

District health department has eight community health centre (CHC), 28 primary health centres (PHC) and 128 sub health centers. They claim to dispose of bio-medical wastes in deep burial.

Additional town commissioner at Dhanbad municipal corporation (DMC) Sandeep Kumar said a bio-medical waste treatment plant at the cost of ₹5 crore would be set up in Sindri area. (**Hindustan Times, Published on June 24,2019**). But it has not been established till date.

Now as survey conducted following are the details of Biomedical wastes generated in some of the major hospitals of Jharkhand which have captive incinerator:-

Table-1

S. No.	Name & Address of HGFs	Quantity of Bio-medical Waste generation (in kg/ day)					Total Biomedical wastes generated (Kg/day)	Total installed capacity				Total Biomedical wastes treated	
		Yellow	Red	Blue	White	Incinerator		Autoclave	Deep Burial	Any other	Incinerator		
1.	RIMS,	185	132	86	34.5	437.5	100 Kg/	60	-	-	Autoclave	Deep Burial	Any other

	Ranchi	Kg	Kg	Kg	Kg	Kg	Hr.	Kg/d ay				
2.	Apollo Hosp., Ranchi	25.6 Kg	5.2 Kg	18.2 Kg	2.46 Kg	51.46 Kg	40 Kg/Hr.	25 Kg/d ay	-	-		
3.	TMH,J SR	125.2 Kg	104.2 Kg	52.7 Kg	22.41 Kg	304.53 Kg	50 Kg/Hr.	50 Kg/d ay	-	-		
4.	Mercy Hosp.,J SR	10.35 Kg	0.8 Kg	0.9 Kg	1.16 Kg	13.21 Kg	20 Kg/Hr.	200 Kg/d ay	-	-		
5.	Telco,J SR	117.3 Kg	35.2 Kg	22 Kg	1.25 Kg	175.77 Kg	50 Kg/Hr.	10 Kg/d ay	-	-		
6.	TCIL,	1.70 Kg	1.36 Kg	0.25 Kg	0.85 Kg	4.16 Kg	50Kg/Hr	50 Kg/d ay	-	-		
7.	UCIL,G HATSH ILA	1.875 Kg	0.45 Kg	0.87 Kg	0.28 Kg	3.475 Kg	5.5 Kg/Hr.		-	-		
Total Wastes generated		467.0 Kg	279.2 Kg	180.92 Kg	62.91 Kg	990.095 Kg	315.5 Kg/Hr	395 Kg/d ay				

Total Biomedical Wastes generated in these hospitals = 999.095 Kg/day

Total Biomedical Wastes treatment capacity through Incinerator = 315.5 Kg/Hr

Total Biomedical Wastes treatment capacity through Autoclave = 395 Kg/day

Incinerator generally operates 4 hours a day then total 1262 Kg Biomedical wastes can be treated.

Similarly Autoclave can treat 395 Kg Biomedical wastes in one day i.e., 1262 Kg Biomedical wastes in incinerator and 395 Kg in Autoclave can be treated in these hospitals i.e., 1657 Kg can be treated in these hospitals. Total generation of Biomedical wastes in these hospital are 999.095 Kg so rest 657.905 Kg can be treated in these treatment equipments. But all these can happen if hospitals run these equipments regularly with honesty.

If Government can insist on these hospitals then Biomedical wastes of surrounding hospital in the tune of 657.905 can be treated in these hospitals in turn hospitals can charge the treatment charge At the rate of per Kg of wastes treated.

Now in Jharkhand there are 03 functional Common Biomedical Wastes treatment facilities (CBWTF). Details are as under:-

Bio-medical waste treatment & disposal ~ CBWTFs

Table-2

Sr. No.	Name of CBWTF	Total installed treatment capacity (Kg/day)	Operative/ Non-operative	Total bio-medical waste treated in kg/ day
1.	M/s Bio Genetic Laboratory, Hesla, Ramgarh	750 Kg/day	Operative	750
2.	M/s Medicare Environmental Pvt.,Lohardaga	200 Kg/day	Operative	200
3.	Adityapur Waste Management	200 Kg/day	Operative	200

	Pvt.ltd, plot no.- 43,Khata no.- 529,Dungi Saraikela khersawan			
4.	Biogenetic laboratory pvt.ltd.,Chhota picjri,Dhanbad.	Non-operative	Non-operative	Nil
Total		1150 Kg/day		

Table-3

Other means of treatment Equipment in CBWTFs

Sr. No.	Type of treatment Equipment	No.	Total Capacity (Kg/day)	Total Biomedical Wastes Treated (Kg/Day)
1.	Plasma Pyrolysis	Nil	Nil	Nil
2.	Autoclave	04	400	480
3.	Hydroclave			
4.	Shredder	04	100	224
5.	Sharps encapsulation or concrete pit	Nil	Nil	Nil
6.	Deep burial pits	Nil	Nil	Nil
7.	Any other Equipment	Nil	Nil	Nil
8.	ETP	04	6000	1500
Total		12 No.	6500 Kg/day	2204 Kg/day

Incinerable Biomedical Wastes treatment capacity =	1150 Kg/day
Biomedical Wastes treatment capacity using Autoclave=	400 Kg/day
Biomedical Wastes treatment capacity using shredder =	100 Kg/day
Biomedical Wastes treatment capacity through ETP =	6500 Kg/day

We can say in Jharkhand the capacity of Biomedical Wastes treatment using Incinerator is  $1262 \text{ Kg} + 1150 \text{ Kg} = 2,412 \text{ Kg/day}$ .  
Using Autoclave is  $400 + 395 = 795 \text{ Kg / day}$ .  
Using Shredder is  $100 \text{ Kg/day}$   
Using ETP is  $6500 \text{ Kg/day}$

Total 880.38 tons per annum Biomedical Wastes can be treated using incinerator and as per survey conducted in Jharkhand total 4,700 tons per annum Biomedical wastes are generated .So 3,819.62 tons per annum of Biomedical wastes are still untreated in Jharkhand.

This means 81.2 % Biomedical Wastes are remaining untreated and are thrown either through municipal wastes or are thrown here and there causing lots of diseases which are carcinogenic as well as non carcinogenic. This is the alarming picture of Jharkhand. The State Government and Jharkhand State Pollution Control Board should take action and do actual survey and also should install more CBWTF with proper capacity.

Biomedical wastes are hazardous and have potential virus particles that can be hidden beneath human tissues, items contaminated with blood bags, needles, syringes or any other sharp object, body fluids-remaining like dressings, plaster casts, cotton swabs, beddings contaminated with blood or body fluid etc. Experts say medical wastages are not like other wastes such as the household or industrial wastages. It can infect one directly through the skin or by ingestion and inhalation with objects like inhalers or ventilating pipes. Many contagious viruses including HIV and Hepatitis (B and C) can easily be generated from such wastes and can harm the ones who do not have the diseases. Germs and

viruses, which are antibiotic-resistant (such as the COVID-19 at this point) can easily spread from medical waste.

## CONCLUSION

The ongoing COVID-19 pandemic has already turned the Biomedical Wastes into fastest-spreading disease carrier and continuously. The unmanaged Biomedical Wastes can create major havoc in this already devastating and contagious atmosphere especially in densely populated city if Biomedical Wastes are not handled properly.

If the massive amount of medical wastes cannot be managed through maintaining proper and adequate guidelines, chances of community-based spreading of COVID-19 can be avoided. In simple term the preferable technique for the bio medical waste management is incineration but it has to be managed properly and proper capacity has to be installed. Incinerator is Adequate for all infectious waste, most chemical waste, and pharmaceutical waste and also has very high disinfection efficiency.

### Biomedical Wastes Relevance To Treatment

Bio medical waste in itself is a huge problem. As developing countries are making transition into developed countries, need for healthcare is increasing and due to such economic advancements, BMW waste generation is also increasing at rapid pace.

In India BMW is a huge problem. There is lack of awareness. We have stringent rules and regulations but its implementation is very poor, it is sometimes found that hospitals are dumping waste into ground or river which is very dangerous because it contains hazardous and infected substance like blood, skin, imputed organs, syringe, needles, etc.

## REFERENCES

1. Hindustan Times, Jharkhand
2. Jharkhand state pollution control board, Regional Offices.
3. Kerkar, S. S., and S. S. Salvi. "Application of eco-enzyme for domestic waste water treatment." International Journal for Research in Engineering Application and Management.



4. Rutala WA, Weber DJ. Disinfection, sterilization and control of hospital waste. In: Mandell, Douglas and Bennett's Principles and practice of infectious diseases 2005; (6th Ed.). Elsevier Churchill Livingstone Publication. Pg: 3331-47.
5. Lee B K, Ellenbecker M J and Moure- Ersaso R 2004 Alternatives for treatment and disposal cost reduction of regulated medical wastes, Waste management.