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Effective Mitigation Strategies for Bio Medical Waste Management in Hospitals of Alwar City

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Abstract

With the advancement of medical facilities waste generation has also increased leaps and bounds. 2.4 billion tons of BMW is produced annually worldwide; which needs to be sustainably managed as it poses a dual crisis on public health and environment. The worst way to deal with any kind of waste is its disposal. No doubt BMW generation cannot be stopped but HCF's should frame their strategies scientifically and opt for greener alternatives wherever possible. Effective BMW M involves a hierarchy which includes pollution prevention (P_2) strategies,waste minimization, reuse, recycle, recovery, treatment and disposal with P_2 being the most desirable preference and disposal the least. Waste management is a technical practice which focuses on processing of waste after it is created therefore it is mandatory to have a critical knowledge of the production of waste at the source and then it requires concentrating on reuse, recycling and waste to energy conversion for which a detailed insight into the composition of waste generated is required. Thus scientific and significant amount of aptitude, time and resources are required for BMW M.

This article deals with the sustainable management of BMW based on the principles of waste reduction, waste segregation and waste recycle

Key words : BMW, Sustainable BMW M, Waste reduction, Waste segregation and waste recycling.

Abbreviations - BMW - Bio Medical Waste, BMW M- Bio Medical Waste Management, CBWTF's - Common Bio Medical Waste Treatment Facilities, CPCB - Central Pollution Control Board , HCF's - Health Care Facilities, MoEFCC -Ministry of environment forest and climate change.

The waste that is produced by HCF is called BMW. 85% of this waste is non-hazardous and 15% is hazardous (WHO). For the safe handling of BMW, BMW rules 2016

have been legalised in our country under which at the health care institute itself segregation of BMW in colour coded bins, followed by its temporary storage and then transportation in a closed vehicle for final disposal at the CBWTF have been adopted where incineration is the usual method for final disposal of BMW and the ash generated from BMW is land filled. COVID-19 pandemic era saw a huge rise in the amount of BMW generation. The safe handling and management of BMW during COVID pandemic was a major concern[5,14,18,22,25]. The generation of BMW is inevitable but its effective management will be a boon for human health and environment. For sustainable BMW M available infrastructure, capacity utilisation, policy frame working, operational practices and waste handlers attitude are the key issues. In India CPCB is the apex body which monitors the BMW M across the nation under the MoEFCC. Each State has a state pollution control board which annually submits its report to CPCB. Despite all these legal frameworks there have been issues of HCF violating the BMWM rules.

The study is based on secondary data collection where a systematic literature review of the various articles, reports and research papers over a time span of 10 years were studied. Maximum literature on BMW was found during the COVID-19 pandemic and was mostly concentrated on the segregation, storage, transportation and disposal of BMW; only a few research papers had discussions based on sustainable management of BMW based on 3 R's principle. Different terminologies were used to collect the data such as BMW, clinical waste, health care waste, hospital waste, hazardous and infectious medical waste, medical waste *etc*. It is due to the use of a wide variety of prevalent terminologies for BMW across different regions of the world that the study of severity of BMW and its sustainable management remains poorly defined. Furthermore the problem was addressed maximally through descriptive studies as most of the research papers were based on this methodology wherein the current situation of BMW was assessed based on the BMWM rules operating in that region. The second most frequently found research papers had adopted case analysis methodology where the validity of theoretical perspectives were examined through real life examples. operational, casual (cause and effect relationships) and empirical (evidence or experimental based research) were very few to be found. Also sustainable practices for BMW M have been theoretically mentioned but their actual performances and their positive impacts were least mentioned in the encountered research papers.

Table-1 shows the data pertaining to medical facilities of the hospitals selected for pilot study named as A & B

Hospitals	A	B
Type	Government	Private
No. of beds	368	100
Speciality	Multi	Multi

Table-2 Permitted Agencies and type of wastes they handle in the selected hospitals

Permitted Agency	Type of waste
Hoswin Incinerator	Hazardous wastes (Non sharp and sharp)
Municipality Contractor	Non-hazardous waste (*i.e.* Wet and dry)

After a formal permission was taken from the CMHO of the government hospital and management of the private hospital, data of BMW for 6 months was collected. Also during this data collection questions (based on pre-prepared questionnaires) were put up and discussed related to BMW M by the concerned hospital personnel to assess their knowledge and aptitude towards BMW generation and minimization.

Table-3 depicts the amount in kg of different categories of BMW generated in 6 months (July 2022-dec2022) in a government and private hospital.

Bags	Yellow		Red		Blue		Black		White	
	Govt.	Private	Govt.	Private	Govt.	Private	Govt.	Private	Govt.	Private
July	1557.6	616	665.6	446	271.9	141.3	1806	673.88	22.5	8.39
Aug	1362.2	490.3	571	393.6	235	170.6	1785	666	33	12.31
Sept	1520.2	318	603.7	487	267.7	155.6	1686	629	16.5	6.15
Oct	1216.9	599	480·7	455.6	247.6	112.6	1695	632.4	38.5	14.36
Nov	1025.1	410.4	333.4	486.3	223.45	62.6	2103	650	11	4.10
Dec	1321.4	592	456.1	260.3	312.6	140.3	1974	737	17.4	6.49

Table-4 and 5 show the amount and percentage of hazardous and non hazardous waste out of the total waste generated in kg in the selected hospitals A and B.

Table-4. Hospital A

S.no	Hazardous waste (in kg)	Non hazardous waste (in kg)	Total waste (in kg)	Hazardous waste %	Non hazardous waste %
I	2245.7	2077.9	4323.6	51.94	48.06
II	1964.2	2020	3986.2	49.27	50.67
III	2140.4	1953.7	4094.1	52.28	47.72
IV	1736.1	1942.6	3678.7	47.19	52.81
V	1369.5	2326.45	3695.95	37.05	62.95
VI	1794.9	2286.6	4081.5	43.98	56.02
			mean %	46.95	53.04

Table-5. Hospital B

	Hazardous waste (in kg)	Non hazardous waste (in kg)	Total waste (in kg)	Hazardous waste %	Non hazardous waste %
I	1070.39	815.18	1885.57	56.77	43.23
II	896.21	836.6	1732.81	51.72	48.28
III	811.15	784.6	1595.75	50.83	49.17
IV	1068.96	745	1813.96	58.93	41.07
V	900.8	712.6	1613.4	55.83	44.17
VI	858.79	877.3	1736.09	49.47	50.53
			mean %	53.92	46.08

As seen from the tables 4 and 5 it is apparent that in a government hospital percentage of hazardous BMW is 46.95% and non hazardous is 53.04% and in a private hospital %age of hazardous BMW is 53.92% and non-hazardous is 46.08% BMW as opposed to the WHO recommended %age which states 85% of BMW is non hazardous and only 15% is hazardous. This shows that segregation procedures are not being strictly followed by the hospital staff. This is because a misconception prevails among the personnel involved in the management of BMW *i.e.* if hazardous waste is mixed with non hazardous waste and disposed as a routine solid waste then it is an offence as per the BMWM rules 2016; but if non hazardous and hazardous BMW are mixed and disposed by regulated methods then it is not an offence. This is an utterly wrong concept that we came across during the study. Handling of BMW has been given least importance in HCF'S, As the amount of hazardous waste percent is increasing meaning that HCF have to spend a considerable amount from their finances for BMW management. Not only this but the load for fuel and land resources increases on CBWTF. So sustainable management of BMW is the need of the hour and the 1st step of any sustainable waste management is planning.

1. Planning in BMWM involves creating a separate committee and designating a team, allocating a budget for waste management; the responsible team members should be educated and well trained in the above work.
2. 2nd step involves minimization *i.e.* EPP environmentally preferred purchasing should be done. It should be remembered that every purchase that we do has a hidden environmental and social impact throughout its longevity as well as it imposes financial constraints too. So overstocking of drugs and pharmaceuticals to be avoided, *i.e.* more efficiently ordering protocols to be followed by HCFs. Redesigning in the packaging of products should be done to minimise waste generation. There should be a transition from disposables to reusables.
3) Those polluting the environment should repay back that is pharma industries or those that manufacture single use plastic products must take the responsibility and costs for the collection, reuse, recycling, safe treatment and disposal of products manufactured by them. The polluter should take responsibility of managing the pollutants generated by them; though production and use of single use plastics in medical sector cannot be banned but if at generation source used plastics can be segregated by using modern techno-machines then by recycling of these plastics amount of hazardous waste in the above hospitals can be reduced. The major problem in safe management of BMWs in developing nations is a crunch of resources because the majority of the budget is allocated for health facilities and little concern is shown for the waste that is generated. This attitude should be changed.

To conclude BMW generation cannot be stopped in fact as health infrastructure is developing amount of BMW is increasing so by appointing a trained team for its management and allocating a budget for its pretreatment and disposal; so that HCF's can opt for new technologies of segregation and recycling

BMW M can be given a sustainable approach or we can move one step towards sustainable management of BMW.

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