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A Brief Introduction about Biomedical Waste for its Sustainable Management

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ABSTRACT

Biomedical waste is a special category, complex waste, which is to be handled scientifically. As app. 67% of biomedical waste is general waste, so this waste needs to be segregated from the remaining hazardous waste so that the overall harmful impact of biomedical waste on environment and human health can be reduced. This concept of waste segregation and category wise waste treatment is called sustainable waste management. For this it is essential that the waste handlers should have an adequate knowledge about biomedical waste so that appropriate treatment options are adopted. The other aspect of sustainable waste management is that the waste should be handled in such a manner that it causes least risks, for this it is essential that waste handlers should be trained and protective measures should be followed. This article gives a brief insight of all these aspects of biomedical waste and also briefly highlights the biomedical waste scenario of India.

Key words: Biomedical waste, categories of biomedical waste, treatment options, sustainable waste management.

INTRODUCTION

Any type of waste that is generated during the diagnosis or medical treatment of patients in various kinds of healthcare facilities i.e. laboratories, diagnostic centers, nursing homes, hospitals etc is called Biomedical waste (BMW) (WHO, 2015). BMW can be infectious, pathogenic, hazardous or non hazardous. The non hazardous BMW is also known as general BMW which is similar to the ordinary municipal solid waste. [1,2]

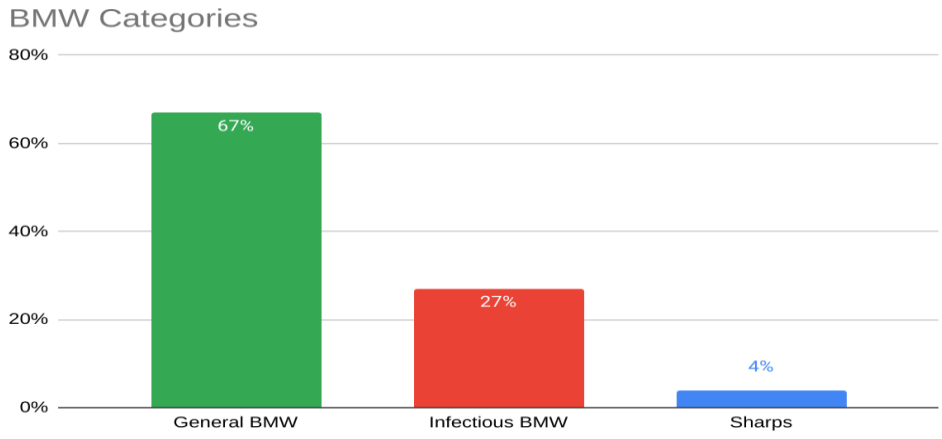

Fig. 1 Three main categories of BMW

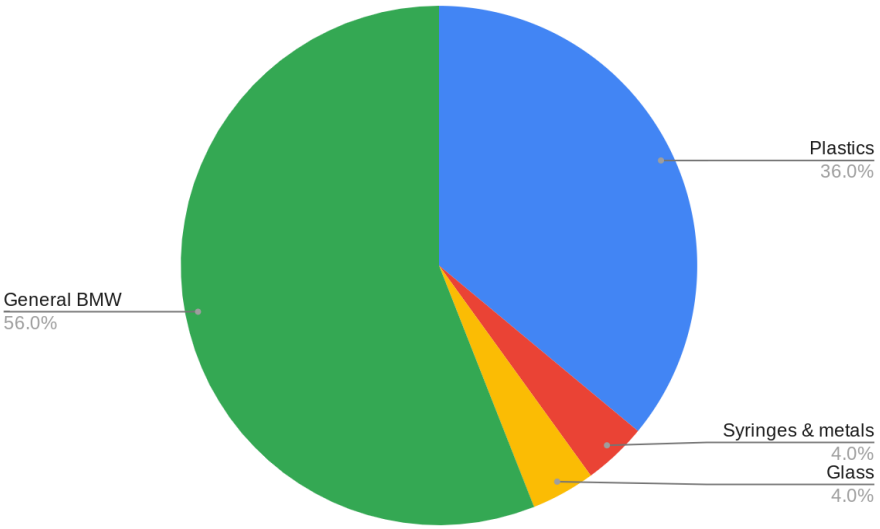

Fig. 2 Highlights the average percentage of different types of BMW and its composition.

Note: General waste refers to waste that does not pose any biological, chemical, radioactive or physical hazard, and contains organic waste such as food, clothing, paper, and wood.
Of the total generated medical waste approximately 67% is general waste, 27% is infectious or toxic waste, and approximately 4% is sharp waste [3]. The composition of the waste revealed that approximately half of the waste contained general waste such as food, liquids, and paper. The second major part was plastic waste with about 36% of the total generated medical waste. Glass waste and syringes each represent 4% of the generated waste, respectively [4].

PROCEDURE

To understand the prevailing Biomedical waste management (BMWM) scenario, research articles were scrolled from authentic websites such as Web of Science, Scopus, Google Scholar and Pubmed. Those literature contents dealing solely with BMW M issues were preferred. Next articles highlighting the BMW M issues in Asia and world were selected on priority basis. Lastly a comprehensive analysis of all these literature surveys was made to be presented in this article.

RESULTS AND DISCUSSIONS

BMW is a complex waste due to its categorial composition and also because it encompasses a significant quantity of hazardous substances. Poor management of BMW can result in serious environmental and human health risks and so it needs to be managed scientifically [5, 6]. It is to be noted that the quantity of BMW that is generated varies consistently. Globally there are 04 indices on which the quantum of BMW production depends. These being the ; Environmental performance index (EPI) which is based on the sustainable solid waste management practices adopted by a country, second being the Health development index (HDI), followed by Life expectancy at the birth and Health expenditure which is calculated as per capita of the gross domestic production (GDP) [7]. Based on the HDI (which takes into consideration living standards and development in the areas of education, life expectancy, and GDP), globally the countries have been ranked by the United Nations as high, medium and low. Also previous studies have highlighted the association between HDI and BMW production [8], as such in Table 1 we have depicted all these values with reference to Indian context.

Table -1

Average BMW generation in kg/bed/day	0.8
EPI index of SWM in %	16.1
HDI index	0.8
Life expectancy (LE) at birth	71 Years
Health expenditure (HE) per capita of GDP	70$

When all such data for developed countries was analysed , it was found that the quantity of BMW produced was far greater than the Indian context , but due to strict legislations & sustainable management practices followed for BMW disposal, these nations face least human and environmental hazards caused by the unsafe management of BMW in developing countries; to quote many of the Asian countries [9].

Table -2 BMW produced in different continents

Continent	BMW generated in kg/bed/day
Asia	1.0
Africa	1.8
Europe	2.0
America	8.0
Overall	1.5

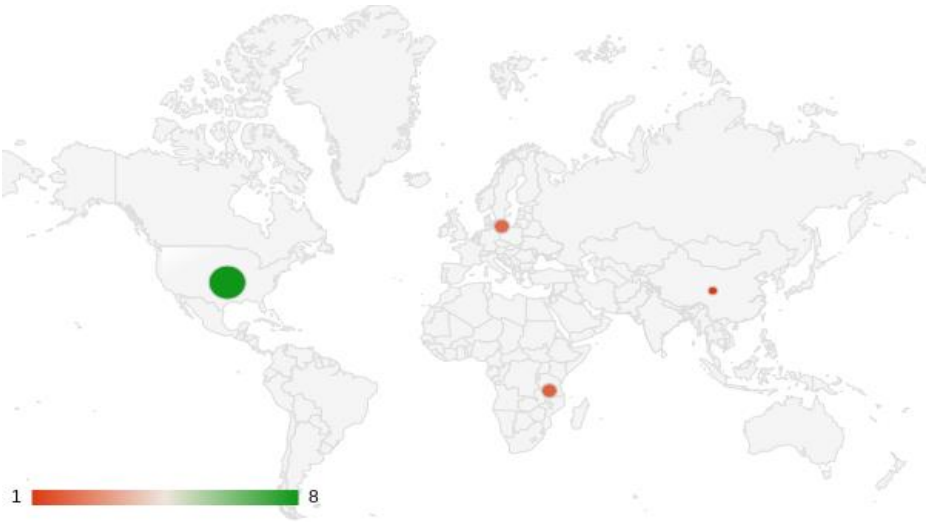

Fig. 3 Global BMW generation rates

Biomedical waste management (BMW M) includes the safe & secure disposal of the different categories of BMW [10]. Thus for various categories of BMW, different treatment options have been recommended which are henceforth described in Table 3.

Table-3 BMW and its treatment methods

Category of BMW	Treatment options
Infectious waste	Incineration, autoclave, microwave & partially treated by chemical methods
Pathological waste	Incineration only
Sharps	Incineration, chemical disinfection
Pharmaceutical waste	Incineration, partial treatment by land filling
Genotoxic waste	Incineration
Chemical waste	Partial treatment by incineration
Heavy metals	Partial treatment by incineration & land filling
Radioactive waste	Incineration

BMW M starts from the point of waste generation to its final disposal [11]. Since this is a technical issue it involves a wide array of stakeholders. Typically speaking BMW M depends on the knowledge and awareness (KAP) regarding BMW (as already mentioned BMW is a complex waste & has 10 categories as per the BMW rules, 1998; each having its own segregation bins, storage and treatment option for final disposal) [12 - 14].

Table -4 BMW M scenario of India.

Reported injuries to HCWs	40%
KAP for BMW M	48%
Training for BMW	20%
BMW segregated	49%

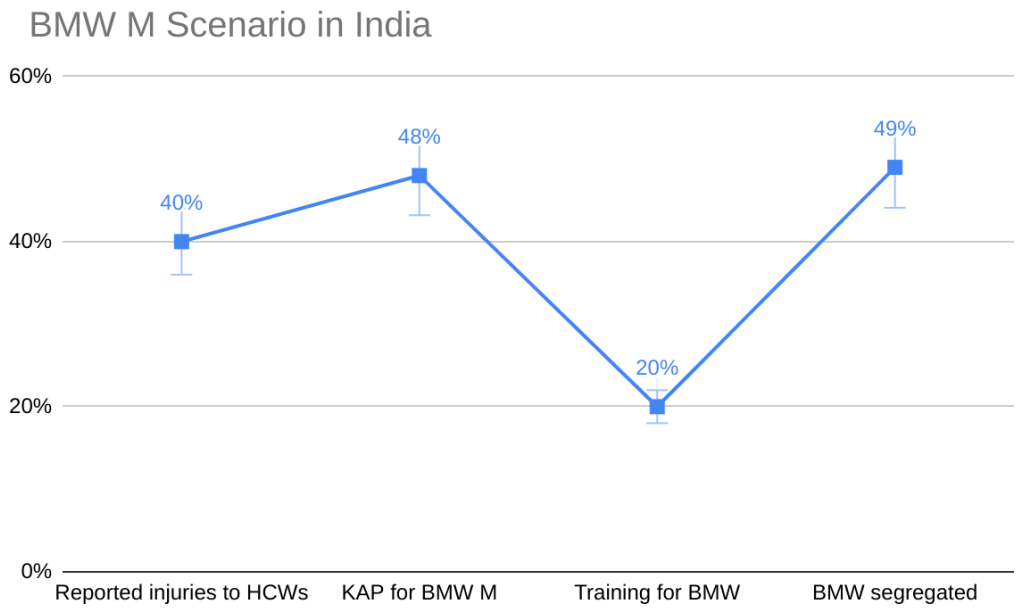

Fig. 4 Aspects of BMW M: Essential (training, segregation & knowledge and attitude) & negative (injuries caused due to mishandling).

CONCLUSIONS

The following conclusions can be drawn from the study

I The generation of medical waste averaged 1.5 kg/bed/day, ranging from 0.8 to 8.0 kg/bed/day, which includes an average 67% representing general waste, 27% infectious or toxic waste, and 4% sharps. Plastics represented about 36% of the total generated waste.

II The study highlights that there is a positive correlation between the medical waste generation rate and HDI, LE, and HE because these indices represent a better quality of life and healthcare services.

III Only 48% of workers are aware and knowledgeable about proper medical waste management. A meagre 20% of the health staff are trained for BMW M and only 49% of the BMW is segregated. Approximately 40% of the workers are injured during waste handling, including musculoskeletal disorders, eye injury, skin infection, and disability, which is a great matter of concern.

IV An immediate call for collective, voluntary, and effective measures to be initiated for environmentally sustainable management of Biomedical waste is the need of hour.

REFERENCES

[1]. S Zafar. Medical waste management in developing Countries. Bioenergy consult, 2019 [Accessed 12.12.2017].

[2]. M Ansari, M H Ehrampoush, M Farzadkia & E Ahmadi. Dynamic assessment of economic and environmental performance index and generation, composition, environmental and human health risks of hospital solid waste in developing countries; A state of the art of review. Environment International, 2019, 132, 105073. https://doi.org/10.1016/j. Envint.2019.105073

[3]. B A Khan, L Cheng, A A Khan & H Ahmed. Healthcare waste management in Asian developing countries: A mini review. Waste Management & Research: The Journal of the International Solid

Wastes and Public Cleansing Association, ISWA, 2008, 37(9), 863–875. https://doi.org/10.1177/0734242X19857470

[4]. R R A Data. Medical Waste Management Market Size, Share, Demand, Analysis, By Waste Type (Sharps), By Treatment Site (On-site), By Treatment Type (Chemical), By Service Type (Recycling), By Nature of Waste (Hazardous & Non- hazardous), By Waste Generator (Hospitals), And Segment, Forecasts To 2027, 2020, https://www.reportsanddata.com/ report-detail/medical-waste-management-market.

[5]. V Kumar, S B Singh & S Singh. COVID-19: Environment concern and impact of Indian medicinal system. Journal of Environmental Chemical Engineering, 2020, 8(5), 104144. https://doi.org/10.1016/j.jece.2020.104144

[6]. M Zamparas, V Kapsalis, G Kyriakopoulos, K Aravossis, A Kanteraki, A Vantarakis & I Kalavrouziotis. Medical waste management and environmental assessment in the Rio University Hospital. Sustainable Chemistry and Pharmacy, 2019, 13, 100163. https:// doi.org/10.1016/j.scp.2019.100163

[7]. M Minoglou, S Gerassimidou & D Komilis. Healthcare waste generation worldwide and its dependence on socio-economic and environmental factors. Sustainability, 2017, 9(2), 220. https://doi.org/10.3390/su9020220

[8]. P Datta, G K Mohi & J Chander. Biomedical waste management in India: Critical appraisal. Journal of Laboratory Physicians, 2018, 10(1), 6–14. https://doi.org/10.4103/ JLP.JLP_89_17

[9]. C Dieng, B Mberu, Z T Dimbuene, C Faye, D Amugsi & I Aboderin. Biomedical waste management in Dakar, Senegal: Legal framework, health and environment issues; policy and program options. Cities & Health, 2020, https://doi.org/10.1080/ 23748834.2020.1786228

[10]. M O Harhay, S D Halpern, J S Harhay & P L Olliaro. Health care waste management: A neglected and growing public health problem worldwide. Tropical Medicine & International Health: TM & IH, 2009, 14(11), 1414–1417. https://doi.org/10.1111/j. 1365-3156.2009.02386.x

[11]. E Oruonye & A Ahmed. Covid-19 and challenges of management of infectious medical waste in Nigeria: A case of Taraba State. International Journal of Waste Resources, 2020, 10, 1–5.

[12]. J Peng, X Wu, R Wang, C Li, Q Zhang & D Wei. Medical waste management practice during the 2019-2020 novel coronavirus pandemic: Experience in a general hospital. American Journal of Infection Control, 2020, 48(8), 918–921. https://doi.org/10.1016/j. ajic.2020.05.035

[13]. D K Singh & A K Singh. An overview of the new legal regime of bio medical waste management in India. Asian Journal of Multidimensional Research (AJMR), 2018,7, 32–45.

[14]. E S Windfeld & M S L Brooks. Medical waste management - A review. Journal of Environmental Management, 2015, 163, 98–108. https://doi.org/10.1016/j.jenvman.2015.08.013

[15]. WHO. Water, sanitation and hygiene in health care facilities: Status in low and middle income countries and way forward, 2015

[16]. WHO. Safe health-care waste management. https://www.who.int/news-room/factsheets/detail/health-care-waste, 2018

[17]. WHO. Definition and characterization of health-care waste. https://www.who.int/ water_sanitation_health/medicalwaste/002to019.pdf. 2019

[18]. WHO. Application of treatment and disposal methods to health-care waste categories.2020a https://www.who.int/water_sanitation_health/medicalwaste/113to129.pdf?ua=1