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# ASSESSMENT OF PHYSICAL COMPOSITION OF SOLID BIO-MEDICAL WASTE IN SELECT HOSPITALS IN PATIALA, PUNJAB, INDIA

## K.C. Goyal[*] and D.K. Mittal
Department of Zoology, Sri Satya Sai University of Technology & Medical Sciences, Sehore, (MP), India
* Corresponding author's E-mail: **kgcp9760@yahoo.com**

**Abstract:** The disposal of Bio-Medical Waste (BMW) in an unscientific manner can be very dangerous particularly when it gets mixed with Municipal Solid Waste (MSW) and is dumped in uncontrolled or illegal landfills. This can lead to a higher degree of environmental pollution of air, land and water apart from posing serious public health risks. Realizing the depth and importance of this problem, the present investigation has been carried out from January 2016 to December 2016 to assess the physical composition of BMW in three Private and four Government hospitals of Patiala in the state of Punjab in India. It was observed during the study that in most of the hospitals in Patiala, the facility available for the disposal of BMW is not up-to-date and satisfactory. Lack of concern, motivation, knowledge and awareness are some of the problems faced in the proper management of BMW. There are no defined methods for handling, storage and disposal of BMW as per BMW (Management and Handling) Rules, 1998/2016. The physical composition of solid BMW generated from different health-care units varies as it depends upon several factors such as number of people visiting the hospital, bed capacity of the hospital and the number of health-care facilities available for patients in the hospital.
**Keywords**: Bio-medical waste; Disposal; Health; Hospital; Segregation; Treatment.

**Postal Address:** #97, Dhaliwal Colony, Opp: IT Office, Patiala-147001, Punjab (India). Mobile: +91 98142-96086

## INTRODUCTION

Bio-Medical Waste (BMW) is defined as any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps. The Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India, has promulgated the BMW (Management and Handling) Rules, 1998/2016 for the proper management of health-care waste. These rules are meant to improve the overall waste management of health-care facilities in India. The rules also make it mandatory for the health-care facilities to segregate, disinfect and dispose their wastes in an eco-friendly manner. Disposal of BMW in a scientific manner is of paramount importance because of its infectious and hazardous nature. It has been emphasized (Summers, 1991) that for the proper disposal of BMW, introduction of laws is not sufficient. WHO

(1999) reported that 10–25% of health-care waste is hazardous, and if not properly segregated, the entire 100% will be converted into hazardous. The waste generated during the health-care activities carries a higher potential for infection than any other type of waste (Manohar *et al.,* 1998; Chauhan *et al.,* 2002; Joe Joseph and Krishnan, 2004). It is estimated that annually about 0.33 million tons of hospital waste is generated in India and the waste generation rate ranges from 0.5 to 2.0 kg per bed per day (Patil and Shekdar, 2001; Khajuria and Kumar, 2007). Bhide and Sundaresan (1983) reported that BMW is the major problem of developed as well as developing countries. The main sources of BMW are hospitals, medical clinics and laboratories. Improper disposal of BMW poses serious health risks, not only for the generators but also for the general community. The key to effective management of BMW is segregation and disposal of the waste in

accordance with BMW (M&H) Rules, 1998/2016. The present study has been carried out in three Private and four Government hospitals of Patiala in the state of Punjab in India. Patiala is one of the most important medical centers of the state of Punjab. As the health-care facilities have improved in the state, the generation of BMW has also swelled up. The present research study will definitely help to create awareness towards BMW management among the health-care personnel and citizens of Patiala.

## EPERIMENTAL

The present study was carried out in three Private and four Government hospitals of Patiala in the state of Punjab in India. The select hospitals for the study are Amar Hospital, Bank Colony (H1); Columbia Asia Hospital, Bhupindra Road (H2); Sadbhavna Hospital, Charan Bagh (H3); Rajindra Medical College and Hospital, Sangrur Road (H4); Mata Kaushalaya Hospital, Lohori Gate (H5); T.B. and Chest Diseases Hospital, Sheran Wala Gate (H6) and two Community Health Centers, Tripuri and Model Town (H7). BMW was quantified every month during the study period from January 2016 to December 2016. The solid BMW was weighed on weighing machine (kilograms). Each solid waste composite samples obtained every month from each sampling sites were then dried and segregated into its various components such as plastic, paper, rubber, food, glass, card board, inert material, radioactive waste, metals and miscellaneous wastes. The weight of the separated waste materials were taken in a rough balance and their contents were converted into percentage.

## RESULTS AND DISCUSSION

The percentage content of various physical components of the solid BMW samples collected from different sampling sites every month has been presented in Table 1. The Figures 1 and 2 depict the line diagram and pie diagram showing the average physical composition of the different components of solid BMW generated from different sampling sites. The physical analysis of solid BMW generated from the seven select hospitals revealed that plastics formed the major component of the waste stream (32.86%) and

occurred in the form of drip sets, blood bags, glucose bottles, catheters, disposable syringes etc. Cotton constituted 26.00% of the total solid waste. Food waste (15.45%) included mainly uneaten food, fruit peels and food preparation wastes. Paper is one of the important recyclable constituent and during the present investigation paper constituted 12.57% of the waste stream. Cardboard which is mainly used as packaging cartons was found in lesser amounts (2.70%), Glass and metallic waste constituted 1.81% and 1.52% of waste steam respectively. Both belong to the non-combustible waste category. Glass occurred in the form of vials, medicine bottles etc., and metallic waste included scalpels, surgical blades, needles etc. Rubber, inert material, radioactive waste and miscellaneous waste constituted 0.71%, 3.17%, 1.30% and 1.90% of waste stream respectively. Chih-shan and Fu-Tein (1993) after evaluating physico-chemical composition of BMW found that the waste consisted of 99.02% of combustible and 0.97% non-combustible components by mass. The combustible wastes constituted paper (16.17%), textiles (9.77%), cardboard, wood, and leaves (1.12%), food waste (21.51%), and plastics (50.45%). The non-combustible wastes included 0.40% metal and 0.57% glass. Same results were obtained by Elevli *et al.* (2002) in four major hospitals of Sivas Turkey. Nazir and Bhat (2012) also analyzed the physical composition of solid BMW generated in four major hospitals of Srinagar city and reported that predominant proportion comprised of 98.2% combustible waste and 1.3% non-combustible wastes. Several surveys show that generation of BMW waste differ not only from country to country but also within a country (Boatright et al, 1995). Yashpal and Mahajan (2006) reported that on an average, J&K hospitals generate 1.5–2.0 kg waste per bed per day. Different types of BMW have their own specific characteristics and might need different disposal methods. Altin *et al.* (2003) studied the daily waste generation rate of four hospitals which was 985 kg/day, projected to be 1267 kg/day in 2015. Pandey and Chaplot (2005) reported that even in the metropolitan cities, only a few hospitals strictly comply with BMW (Management and Handling) Rules, 1998. BMW programme cannot be

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successfully implemented without the willingness, self-motivation, co-operation and participation from all sections of employees of any health-care establishment (Chitnis et al., 2005). Medical waste typically consists of a small amount of plastic materials containing polyvinyl chloride (PVC) products. This may directly affect the health-care workers and the atmosphere (Glenn and Garwal, 1999). Plastic waste can also choke the sewerage channels and drains and cause serious health effects on animals when ingested along with food waste. Injuries from sharps are common feature-affecting animals.

**Table 1. Average physical composition of solid BMW (All values in percentage by dry weight)**

| Type of waste | Sampling sites | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|
| | H1 | H2 | H3 | H4 | H5 | H6 | H7 | |
| **Cotton waste** | 30.00 | 26.00 | 24.00 | 25.00 | 24.00 | 25.00 | 28.00 | 26.00 |
| **Plastic waste** | 28.00 | 34.00 | 37.00 | 35.00 | 34.00 | 35.00 | 27.00 | 32.86 |
| **Paper waste** | 17.00 | 14.00 | 11.00 | 12.00 | 10.00 | 10.00 | 14.00 | 12.57 |
| **Rubber waste** | 0.80 | 0.60 | 0.50 | 0.70 | 0.60 | 1.10 | 0.70 | 0.71 |
| **Food waste** | 13.00 | 13.20 | 14.00 | 15.90 | 17.00 | 17.00 | 18.00 | 15.45 |
| **Glass waste** | 1.80 | 1.90 | 1.20 | 1.90 | 2.10 | 2.00 | 1.80 | 1.81 |
| **Cardboard waste** | 2.20 | 1.80 | 4.00 | 1.70 | 4.10 | 2.60 | 2.50 | 2.70 |
| **Inert material waste** | 3.60 | 4.00 | 2.50 | 3.30 | 2.30 | 3.80 | 2.70 | 3.17 |
| **Radioactive waste** | 1.10 | 1.50 | 1.20 | 1.60 | 1.80 | 1.10 | 0.80 | 1.30 |
| **Metallic waste** | 1.70 | 1.20 | 2.10 | 1.70 | 1.10 | 1.40 | 1.50 | 1.53 |
| **Miscellaneous waste** | 0.80 | 1.80 | 2.50 | 1.20 | 3.00 | 1.00 | 3.00 | 1.90 |
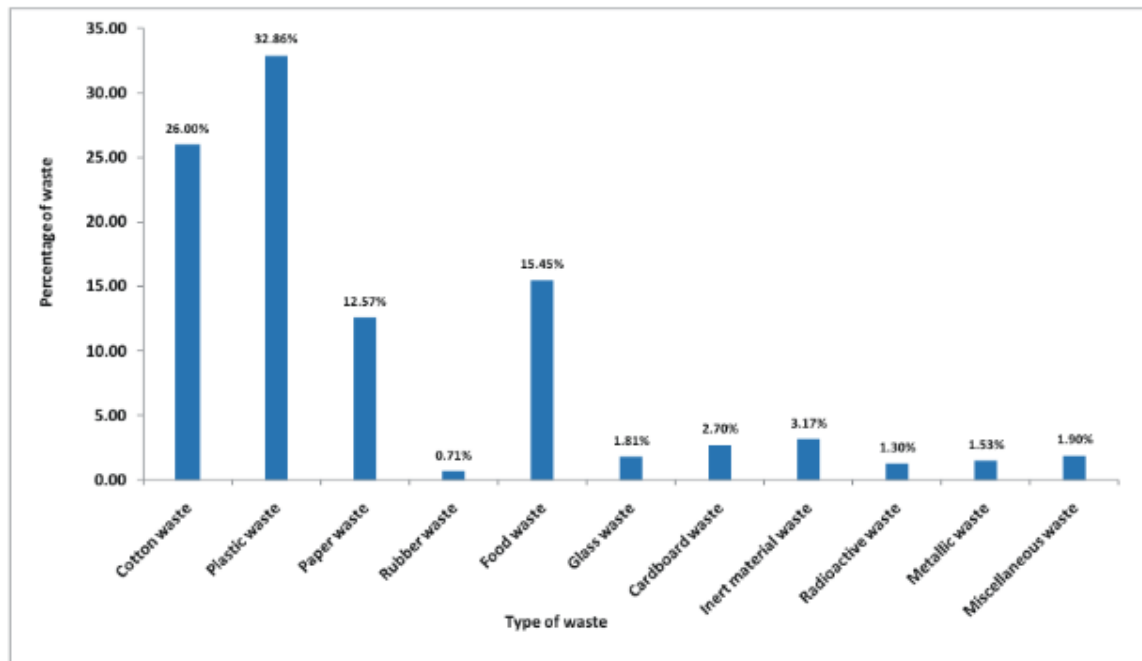


**Figure 1. Average percentage physical composition of solid BMW**

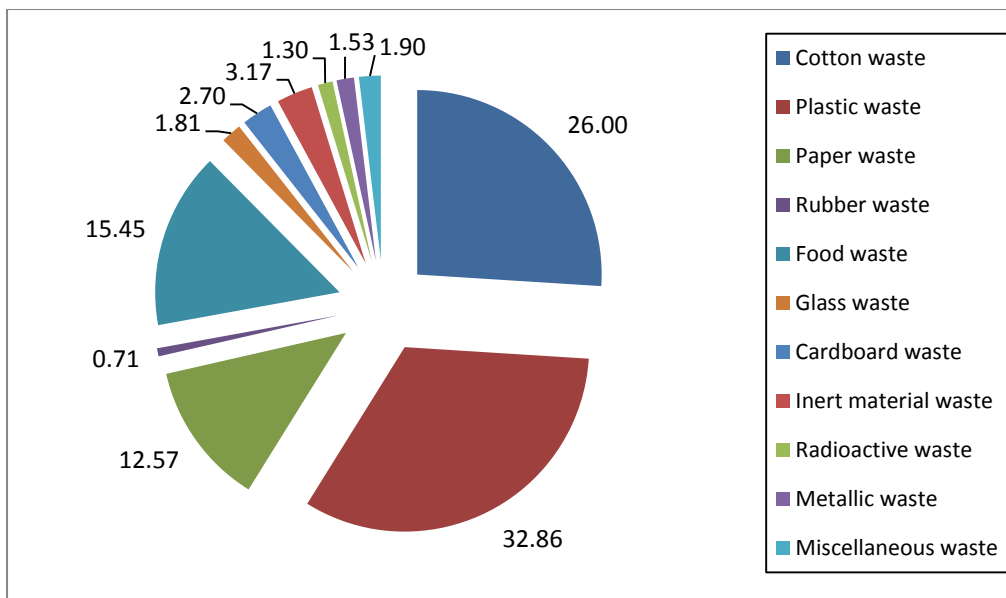*Oct. Jour. Env. Res. Vol 5(4): 270-274*

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**Figure 2. Pie diagram showing average physical composition (%) of solid BMW**

## CONCLUSION

The results give an insight regarding the percentage of composition of the different components of solid BMW generated from different sampling sites in Patiala. The physical composition of solid BMW generated from different health-care units varies as it depends upon numerous factors such as established waste management methods, type of hospitals, specialization, type and number of patients treated on daily basis. The study revealed that plastic waste followed by cotton and food waste is generated in highest quantity in all the sampling sites under study in Patiala as compared to other components of solid BMW. Rubber waste is generated in lowest quantity. The detailed analysis of the composition of wastes helps in selecting suitable management practices for waste disposal. The awareness of people regarding the reduce; reuse and recycling activity can lead to considerable decrease in the waste load without the involvement of municipal services. There is a need to create awareness among the health-care personnel regarding the importance of management of BMW. The proper handling and disposal of BMW is of prime importance and is the need of the day.

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