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ANALYSIS OF BIO-MEDICAL WASTE OF A PRIVATE HOSPITAL IN PATIALA CITY, PUNJAB, INDIA

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Abstract: Hazardous bio-medical waste (BMW) management is a concern for every health organization. Inadequate management of BMW may have serious health consequences and a significant impact on the environment as well. Therefore, disposal of BMW in a scientific manner is of paramount importance. The aim of the present study was to analyze (i) variation in quantity of solid BMW per bed per day, (ii) variation of physico-chemical parameters of BMW leachate. The various parameters studied in the present study were pH, SS, BOD, COD and O&G. This study was carried out from January 2016 to December 2016 at monthly interval in a 150 bedded Private Hospital of Patiala city in the state of Punjab in India. The waste generation rate was found to be 0.41 kg per bed per day. The BMW was treated in four categories – yellow, blue, white and red, as per Bio-Medical Waste Management Rules, 2016. The absence of proper waste management, lack of awareness about BMW and poor control of waste disposal are the most critical problems connected with healthcare waste. The results of the study demonstrate that the proper handling of BMW is very imperative.

Keywords: Bio-medical waste, Hazardous waste, Health, Hospital, Patiala city, Segregation.

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INTRODUCTION

Medical care is vital for our life, health and wellbeing. But the waste generated from medical activities represents a real problem of the living world. Bio-medical waste (BMW) carries a higher potential for infection than any other type of wastes (Chauhan and Kishore, 2002; Manohar *et al.*, 1998; Joe and Krishnan, 2004). The collection of BMW and its proper disposal has become a prime concern for both the medical and the general community. According to WHO (1999), 10–25% of healthcare waste is hazardous, and if not properly segregated, the entire 100% will be converted into hazardous. Hospital waste management has been brought into focus in India recently, particularly with the notification of Bio-Medical Waste (Management and Handling) Rules, 1998/2016. These rules apply to all those who generate, collect, store,

dispose, treat or handle BMW in any manner. The rules also make it mandatory for the healthcare facilities to segregate, disinfect and dispose their waste in an eco-friendly manner. The 2016 notification brings down the number of BMW categories to four– yellow, blue, white and red. Studies carried out in India showed that awareness and practices on BMW management among health care personnel is far below the acceptable level (Mathur *et al.*, 2011; Bansal *et al.*, 2011; Sharma, 2010; Saini *et al.*, 2012). It has been estimated that annually about 0.33 million tonnes 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). Lack of knowledge about segregation, collection, transport, storage, treatment and disposal of BMW has led to the accumulation of toxic heavy

metals from the hazardous BMW into the surrounding environment. When these elements exceed their standard value, they become toxic to environment and human health. The disposal of hospital waste can be very hazardous, particularly when it gets mixed with municipal solid waste and is dumped in illegal landfills. This can lead to a higher degree of environmental pollution, apart from posing serious public health risks such as AIDS, Hepatitis, Plague, Cholera, etc. (Acharaya and Singh, 2000; Neema and Gareshprasad, 2002). Alumneef and Memish (2003) reported that the total amount of municipal waste a city generates, only 1 to 1.5% is hospital waste of which 10–15% is considered infectious.

EXPERIMENTAL

Study Area: The present study has been carried out in a Private Hospital *i.e.* Amar Hospital (A.H.), Bank colony, Patiala city in the state of Punjab in India. The bed capacity of the hospital is 150. It is located on the globe in between 30°18' N to 30°22' N latitudes and 76°21' E longitudes. The city is in the south-east of Punjab state in northern India. Patiala is the fourth largest city in the state of Punjab and has emerged as a major education center. The climate of Patiala city is favorable for human comfort and also for cultivation of various crops.

Quantification of Solid BMW: The bio-medical waste (BMW) per bed per day was quantified every month during the study period from January 2016 to December 2016. The collected waste was segregated in containers of different colours namely, yellow, blue, white and red.

$$\text{BMW per bed per day} = \frac{\text{Total BMW per year}}{12 \times 30 \times \text{Number of beds @ 80\% bed occupancy}}$$

Qualitative Estimation of BMW Leachate: The qualitative analysis of BMW leachate was carried out every month from January 2016 to December 2016. Parameters studied were pH, suspended solids (SS), bio-chemical oxygen demand (BOD), chemical oxygen demand (COD) and oil and grease (O&G).

RESULTS AND DISCUSSION

The results of variation in BMW (category wise) generated in the Amar Hospital (A.H.) selected for the present study from January 2016 to December 2016 at monthly interval has been shown in Table 1 and Figure 1. Average BMW generated per bed per day @ 80% bed occupancy was 0.41 kg. This value is found within limits (0.5-2.0 kg/bed/day) as described in CPCB (2000) guidelines. Table 2 and Figure 2 depict the results of variation of BMW leachate at monthly interval from January 2016 to December 2016 for five different parameters – pH, SS, BOD, COD and O&G. Under experimental conditions, the pH of the leachate sample was found to be ranging from 6.70 – 8.50 with an average of 7.50. The pH has no direct effect on health. However pH below a certain limit can induce the formation of some toxic compounds. The value for SS varied from 153.00 mg/L to 238.00 mg/L with an average of 197.08 mg/L. The BOD and COD values indicate the extent and presence of organic matter in the leachate. The leachate samples were rich in organic matter. The experimental concentration range was between 112.00 mg/L to 154.00 mg/L with an average of 129.00 mg/L for BOD and 224.00 mg/L to 258.00 mg/L with an average of 243.58 mg/L for COD. The value for O&G ranged from 12.00 mg/L to 20.00 mg/L with an average of 16.25 mg/L. Chaurasia *et al.*, (2014) also depicted same type of results for a District Hospital Satna in MP in India. According to BMW Management Rules (2016), the effluent generated or treated from the premises of occupier or operator of a common bio-medical waste treatment and disposal facility, before discharge into the sewer should conform to the following limits:

Parameters	Permissible Limits
pH	6.5–9.0
Suspended solids	100mg/L
Oil and grease	10 mg/L
BOD	30 mg/L
COD	250 mg/L

It is very clear from the results of the present study that value for pH is within permissible limit but SS, BOD and O&G are very high than the

permissible limit. COD is also about to cross the upper limit. Fikru (2004) and, Yemane and Millogo (2000) observed that the open burning of wastes in holes or similar enclosures and incineration were the most common types of methods for disposal of wastes. Sandhu and

Singh (2003) emphasized that BMW management is not only for generator and operators but also for the general community. Pandey and Chaplot (2005) reported that even in metropolitan cities only a few hospitals strictly comply with BMW Rules, 1998.

Table 1. BMW Generated in kg (category wise) by Private Hospital (A.H.) in Patiala City (January 2016 to December 2016)

Month	Yellow	Blue	White (Sharp/Translucent)	Red	Total
January	674.43	656.95	138.41	0.00	1469.79
February	694.83	646.08	166.65	0.00	1507.56
March	512.08	544.87	104.28	0.00	1161.23
April	550.50	569.32	102.63	0.00	1222.45
May	697.32	613.68	92.33	0.00	1403.33
June	606.66	501.20	145.35	0.00	1253.21
July	648.50	571.67	116.51	0.00	1336.68
August	695.65	699.86	161.81	0.00	1557.32
September	770.19	699.86	170.04	0.00	1640.09
October	717.77	0.00	147.85	756.75	1622.37
November	798.75	0.00	164.21	723.52	1686.48
December	755.09	0.00	146.79	673.80	1575.68
Waste generated per year	8121.77	5503.49	1656.86	2154.07	17436.19
Waste generated per month	676.81	458.62	138.07	179.51	1453.01
Waste generated per day	22.56	15.29	4.60	5.98	48.43
Waste generated per bed per day	0.19	0.13	0.04	0.05	0.41

Number of Beds: 150 (Occupancy @ 80% = 120)

Table 2. Analysis of BMW Leachate of Private Hospital in Patiala City (January 2016 to December 2016)

Month	pH	SS (mg/L)	BOD (mg/L)	COD (mg/L)	O&G (mg/L)
January	6.70	153.00	112.00	242.00	18.00
February	7.30	168.00	124.00	252.00	16.00
March	7.20	208.00	154.00	234.00	14.00
April	7.00	238.00	126.00	236.00	20.00
May	7.80	212.00	134.00	248.00	18.00
June	7.30	178.00	138.00	245.00	16.00
July	7.30	198.00	112.00	242.00	12.00
August	8.50	178.00	122.00	224.00	14.00
September	7.70	210.00	124.00	240.00	18.00
October	8.20	216.00	136.00	248.00	17.00
November	7.80	192.00	126.00	258.00	14.00
December	7.20	214.00	140.00	254.00	18.00
Mean	7.50	197.08	129.00	243.58	16.25
Permissible limit	6.50-9.00	100.00	30.00	250.00	10.00

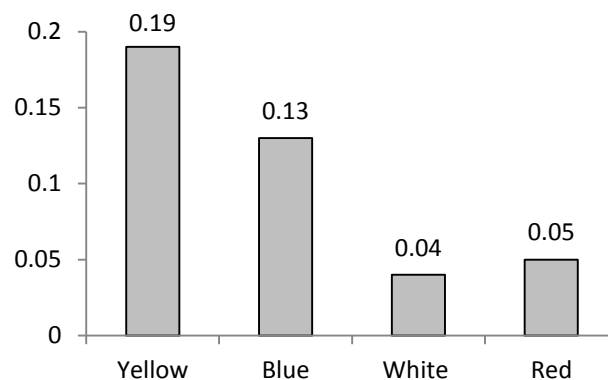


Figure 1. BMW (category wise) Generated (kg) per bed per day

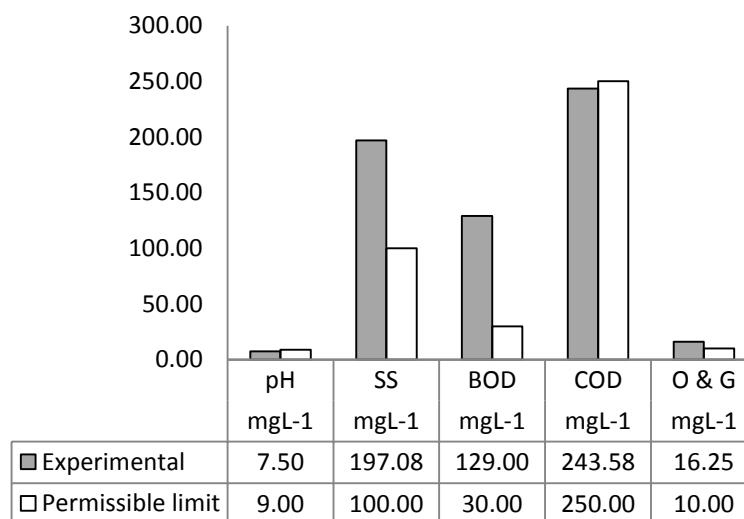


Figure 2. Average qualitative analysis of BMW Leachate (category wise) generated (kg) per bed per day

CONCLUSION

The solid BMW and BMW leachate may be very harmful for the society and the environment. Appropriate education and training of the healthcare personnel is required for effective hospital waste management in Patiala city. It is the ethical and social responsibility of all dealing with medical care to dispose-off the BMW in a scientific manner. BMW should be segregated into different colored containers/bags at the point of generation in accordance with schedule II of BMW Rules. A safe and reliable method for handling of BMW is essential.

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