ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2521-0912 (Print)
ISSN: 2521-0513 (Online)
CODEN: JCOLBF

Journal Clean WAS (JCleanWAS)

DOI: http://doi.org/10.26480/jcleanwas.02.2021.62.67

RESEARCH ARTICLE

SOLID WASTE MANAGEMENT PRACTICES IN BIKANER CITY, RAJASTHAN (INDIA)

Leela Kaur*, Shivani Rajpurohit

Department of Environmental Science, Maharaja Ganga Singh University, Bikaner (Rajasthan), India
****Corresponding Author Email: leela.kaur@gmail.com***

ARTICLE DETAILS

Article History:

Received 06 October 2021
Accepted 09 November 2021
Available online 19 November 2021

ABSTRACT

Waste as one of the major environmental issues in the current world can be seen scattered ubiquitously. There is a dire need to properly manage the waste due to the negative effects on public and environmental health. The present study aims to do analysis of the solid waste management practices in Bikaner municipal area (Rajasthan). Solid waste samples were collected from 10 selected locations of the study area. Physical composition and physicochemical parameters of solid waste were determined. Physicochemical parameters such as pH, conductivity, total dissolved solids, salinity, moisture content and organic matter of solid waste were analyzed by using the standard methods. Organic matter made the highest content (27% to 76%) in the composition of all solid wastes. However, glass, metal and wood comprised the lowest content (1%). The pH range of samples was 5.1 to 7.5. Water holding capacity (%) was below 100 in all the samples though organic carbon ranged from 15.4 % to 19.6 %. Goga gate dumping site showed the highest solid waste content. It was found that waste management practices in Bikaner municipal area are not sustainable yet due to improper waste collection, waste dumping and lack of awareness among people. Solid waste need to be segregated at the source and segregation of recyclable waste should also be done for effective waste management. The organic fractions of solid waste could be utilized in composting.

KEYWORDS

Solid waste, waste collection, waste management, Municipal area, Bikaner.

1. INTRODUCTION

The present world is facing many environmental issues such as overpopulation and overconsumption of natural resources, pollution, improper waste management, climate change and many more. Waste generation is one of the prime problems to be fixed. The current corona pandemic has created awareness among society about the importance of sanitation, hygiene and waste management. We need sustainable waste management approaches for the survival of human being. Literature studies have shown that India is facing a big challenge to manage the municipal waste (Sharholy et al., 2008; Rajput et al., 2009; Kumar et al., 2017; Nandan et al., 2017, Priyadarshi and Jain, 2018; Kumar and Agarwal, 2020; Rani and Pandey, 2020; Priyadarshi et al., 2020). A group of researcher highlighted on urbanization and its role in enrichment of solid waste generation in India. According to them, solid waste generation rate in India is around 42 million tons annually (Rajput et al., 2009). Waste generation fluctuates from 200-600 Kg/capita/day and the range of collection efficiency from 50-90%. Urbanization and over-population are the main culprit of waste generation.

Some researchers generated Arc GIS maps of Lucknow city which provided municipal solid waste management problem such as the generation rate of municipal solid waste (MSW) in different wards, collection point locations, MSW transport means and their routes, and the number of disposal sites and their attributes (Francis et al., 2013). In other study, authors detailed about the challenges and opportunities associated with waste management in India (Kumar et al., 2017). There are prospects of waste to energy conversion in India but India is lagging behind in skilled people of the field. Rajasthan state does not have any waste processing facility indicating poor waste management. Further, they stated that along with private and government agencies, participation of organised informal sector of waste is an important facet to deal the waste management challenges and alter latent prospects for Indian cities (Kumar and Agarwal, 2020). Rani and Pandey emphasized on the technically sound, economically viable and green municipal waste processing for sustainability of Meerut city (Rani and Pandey, 2020). According to them, segregation, composting and waste to energy project should be promoted to overcome waste management problems. Public awareness and participation desires need to be stimulated. Few researchers reviewed on the characteristics, techniques, environmental and health impacts of solid waste in Aligarh city (Uttar Pradesh) (Priyadarshi et al., 2020).

Various studies have been done in Rajasthan to study the waste management practices in different cities such as Ajmer, Alwar, Jaipur and Jodhpur (Sharma, 2008; Upadhyay et al., 2012; Ambade et al., 2013; Dabi and Chouhan, 2014; Kumar et al., 2016; Yadav and Choudhary, 2020; 2021). The objective of the present study is the investigation of solid waste management practices in Bikaner municipal area of Rajasthan. The specific objectives were to assess the physical composition and physicochemical properties of solid waste and to evaluate the possibilities of solid waste processing.

2. MATERIALS AND METHODS

2.1 Study Area

Quick Response Code	Access this article online	
	Website: www.jcleanwas.com	**DOI:** 10.26480/jcleanwas.02.2021.62.67

Bikaner city is spread over the area of 270 Square Kilometre with a population estimate of 6.44 lakhs (BMC, 2021). The density of city is 4,157 persons per square Kilometre which is very high when compared to state average of 201 persons/square Kilometre (Census of India, 2011). Municipal boundary has an area of 155 Square Kilometre (Rohilla et al., 2016). As per the Bikaner municipal Corporation, 150 tonnes per day solid waste is generated in Bikaner city (BMC, 2021). Bikaner city has a geographical location of East longitude 28°1' and North latitude 73°19'. It is situated in the middle of the Thar Desert and has a hot semi-arid climate with very little rainfall and extreme temperatures. The severity of waste problem in Bikaner can be understood by the fact that currently, Bikaner produces about 50 metric tons of solid wastes every day. On an average, around 62% of the waste is collected and disposed off by the municipality. Bikaner municipality has demarcated about 1.4 acres of land which is used as the dumping ground. The dumping ground is located in ward number 18, which is close to the town and is named as Goga gate dumping ground.

2.2 Physico-chemical Analysis of Solid waste

The present study was carried out during November, 2016 to March, 2017. Ten prime locations of the city were selected for the study which are shown in Table 1. Figure 1 shows the disposal site of Bikaner municipal area. 1.0 Kg of well-mixed solid waste samples were collected from these sampling sites. The solid waste samples were segregated properly, and each component was weighed by using weighing balance. The physico-chemical parameters of solid waste were analysed using standard methods such as physical composition, pH, conductivity, total dissolved solids (TDS), salinity, moisture content and organic matter content (Maiti, 2003). pH was measured by pH meter. Moisture content was assessed by gravimetric method. Electric conductivity, total dissolved solids (TDS) and salinity were estimated by water analyser kit. While, organic matter content was assessed by Walkley-Black method.

Table 1: Sampling sites with GPS location of the study area.

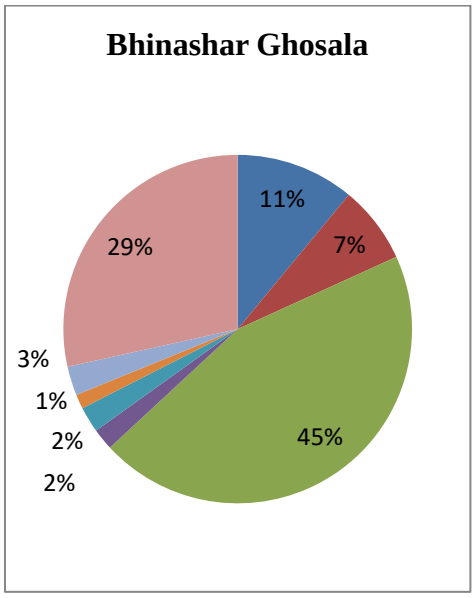
Sampling site number	Sampling site name	GPS location
1	Bhinasar Gaushala	N-27°58'10.7" E-073°18'30.4"
2	Shiv Valley	N-27°59'56.1" E-073°18'43.5"
3	Bichwal	N-28°05'05.0" E-073°21'03.9"
4	Pawanpuri Railway crossing area	N-27°58'46.6" E-073°20'31.7"
5	Backside of Nagnechi Temple	N-27°59'31.3" E-073°20'08.5"
6	Shivbari	N-28°00'22.8" E-073°21'18.6"
7	Medical college ground area	N-28°00'11.1" E-073°19'41.9"
8	PBM Hospital	N-28°00'38.1" E-073°19'42.9"
9	Goga gate dumping ground	N-28°00'04.3" E-073°18'41.0"
10	Laxminath temple mines area	N-28°00'02.8" E-073°18'12.5"

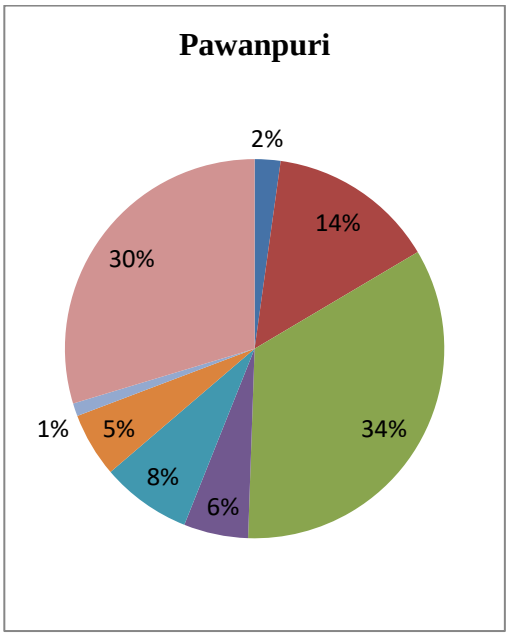
Figure 1: (a) and (b) Goga gate waste dumping site in Bikaner; (c) Plastic waste concentrated at municipal solid waste site.

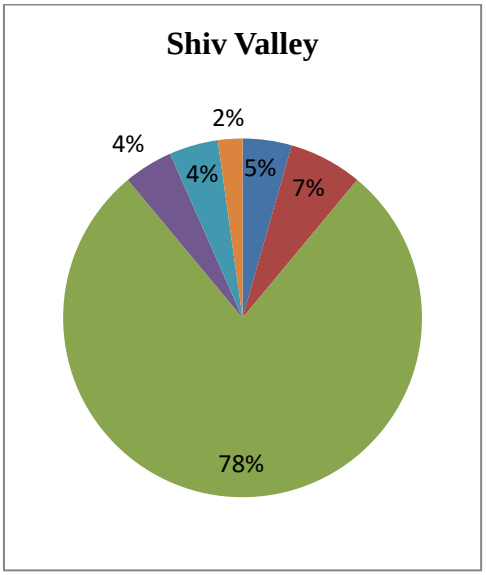
3. Results and Discussions

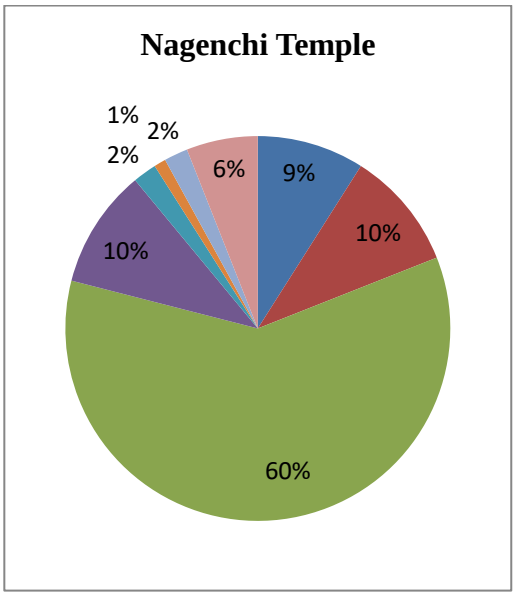
Physical composition of solid waste in selected sites of the study area are shown in Figure 2. Organic matter made the highest content in the composition of all solid wastes. The range of organic matter was found from 27% (Site-4) to 76% (Site-3). Which suggests it can be used in composting and anaerobic digestion as organic matter is biodegradable. However, glass, metal and wood comprised the lowest content and it was 1%. The Physico-chemical parameters of waste samples are represented in Table 2. The range of pH was 5.1 to 7.5. The highest pH was found in Goga gate dumping ground (Site- 9) i.e., 7.5 and the lowest pH in Pawanpuri site (Site-4). Electrical conductivity (EC) was highest in site-9 (6.9 S/m). The study observed values of Total dissolved solids (TDS) in the range of 5.6 mg/l to 8.9 mg/l. The range of salinity was found 3.2 ppt to 5.8 ppt in sites 1 and 9 respectively. Moisture content of waste was in the range of 4.3% to 7.3%.

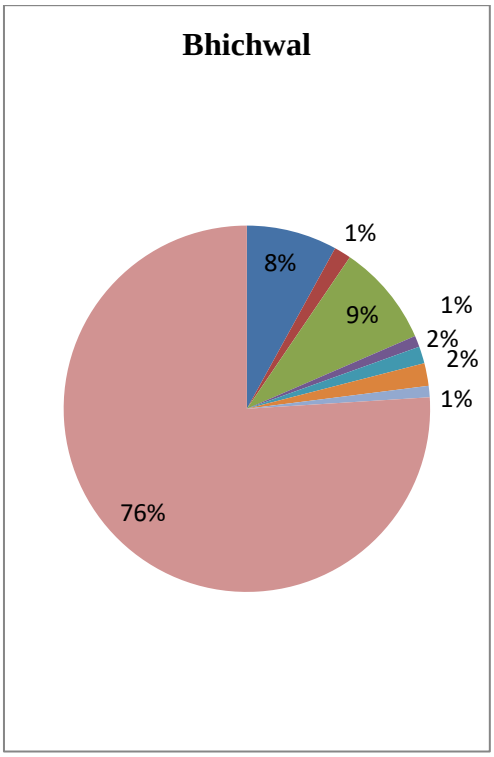
The range of water holding capacity (WHC) was 4.3% (site-1) to 12.96% (site-9). Organic matter ranged from 26.5% to 33.7% and the range of organic carbon was 15.4% to 19.6%. Bulk density was ranged from 1.27% to 1.33%. Bikaner MSW have high content of organic matter. After segregating inorganic fractions from the waste, the organic fractions could be used in organic fertilizer manufacturing. As per the solid waste Management Rules (2016), solid waste can be processed into organic compost with certain standard parameters (Table 3). All the physico-chemical parameters of solid waste are approximately within the limit given for organic compost. Hence, there is a possibility to utilize the organic waste in composting. Compost would reduce the quantity of dumping waste as well as enhance the fertility of the soil. In addition, the efficacy of compost as fertilizer is decided by two indices i.e., Fertility Index and Clean Index (Sharma et al., 2019).

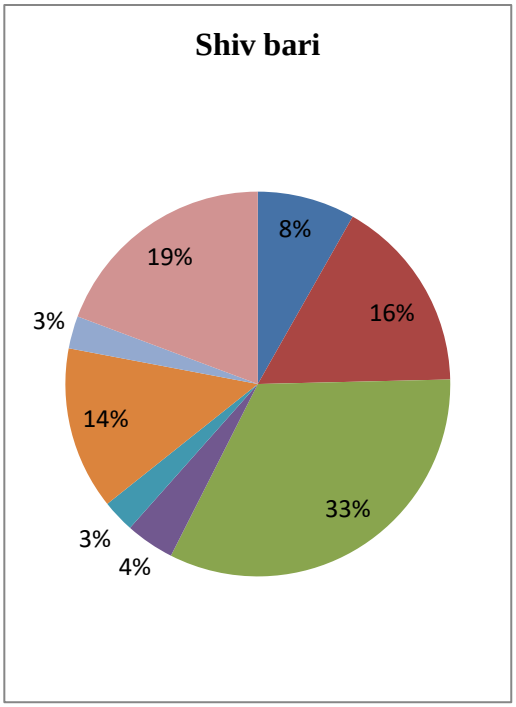

Bhinashar Ghosala
11%
7%
45%
2%
2%
1%
3%
29%

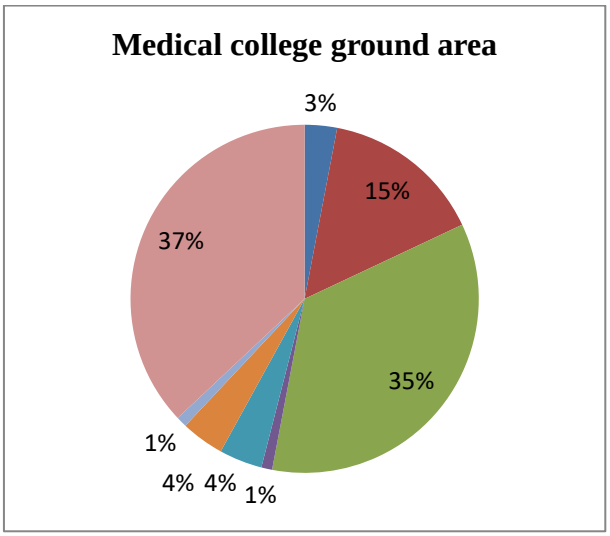

Pawanpuri
2%
14%
34%
6%
8%
5%
1%
30%

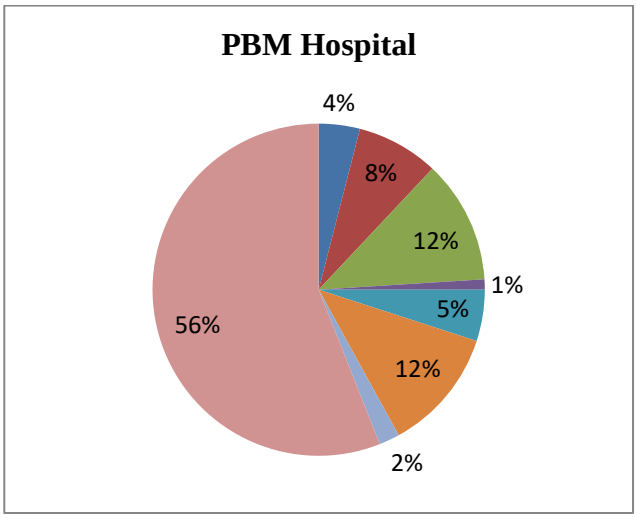

Shiv Valley
78%
7%
5%
4%
4%
2%

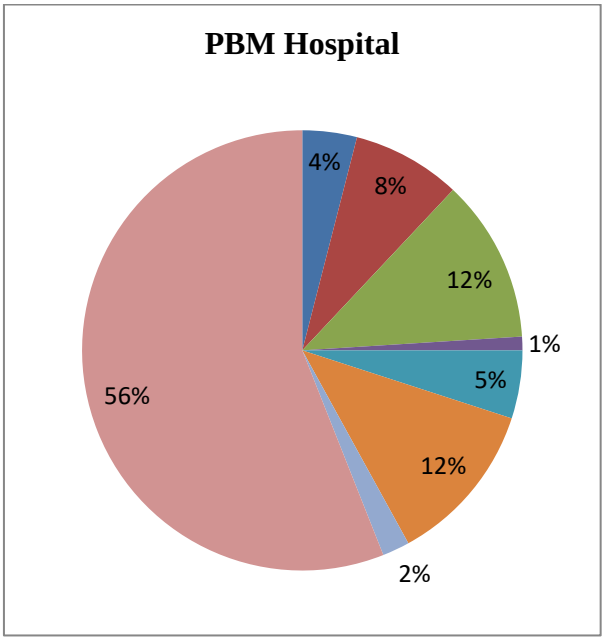

Nagenchi Temple
60%
10%
10%
9%
6%
2%
2%
1%

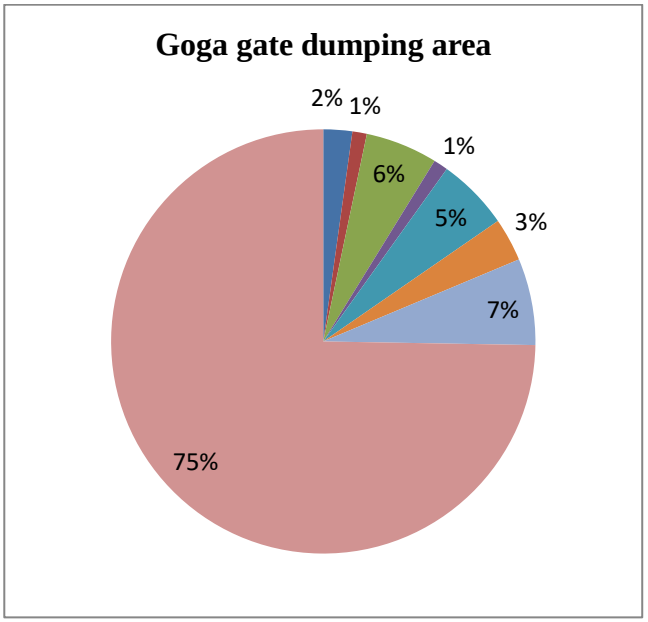

Bhichwal
76%
8%
9%
1%
2%
2%
1%
1%

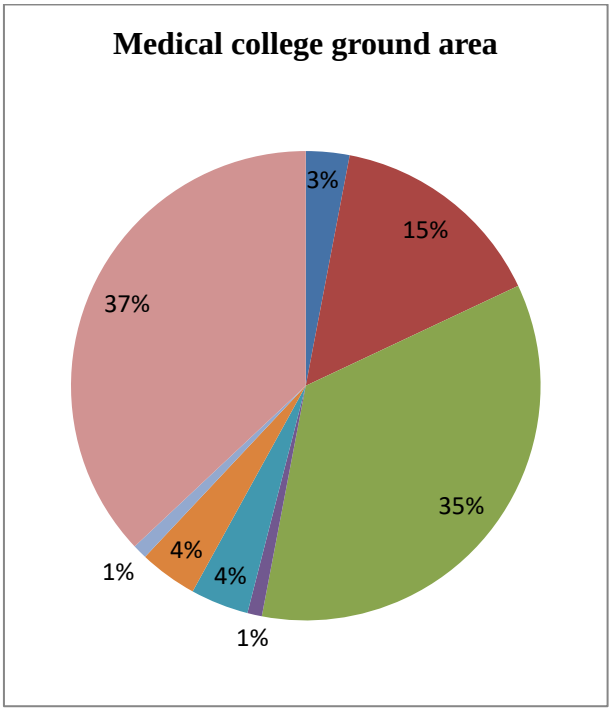

Shiv bari
33%
16%
8%
4%
3%
14%
3%
19%











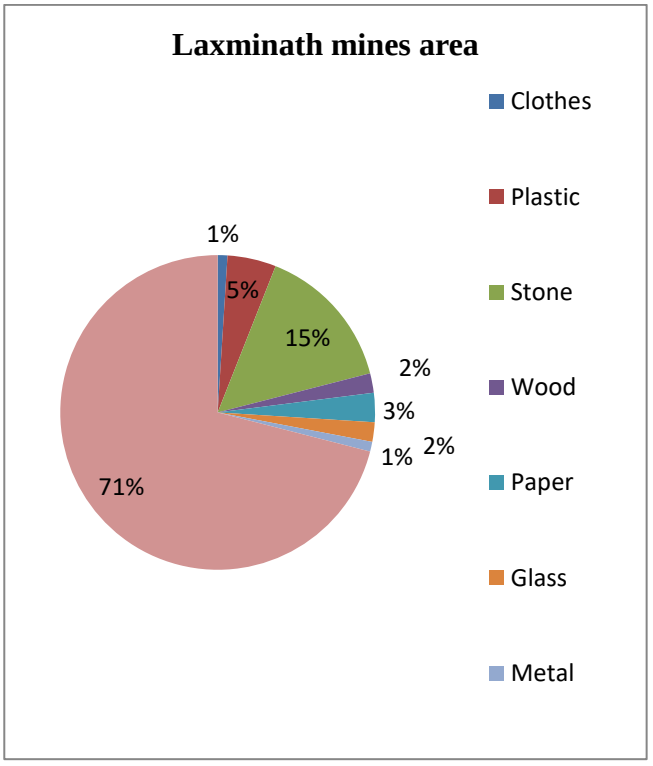


Figure 2: Physical composition of solid waste in selected sites of the study area.

Table 2: The Physico-chemical parameters of waste samples.

Sampling site number	pH	EC (S/m)	TDS (mg/l)	Salinity (ppt)	WHC (%)	Soil moisture (%)	Organic matter (%)	Organic Carbon (%)	Bulk density (%)
1	6.2	2.5	5.6	3.2	68.2	4.3	26.5	15.4	1.27
2	6.2	2.8	5.9	3.9	60.9	4.6	28.4	16.5	1.25
3	6.0	3.8	6.5	4.2	61.3	5.6	31.3	18.2	1.31
4	5.1	4.8	5.5	4.4	52.6	5.9	30.4	17.7	1.29
5	5.5	3.4	6.9	5.2	65.2	5.5	32.3	18.8	1.27
6	5.4	3.9	7.2	4.1	68.6	6.3	26.8	15.6	1.22
7	5.6	4.5	7.1	4.9	42.9	6.3	32.0	18.6	1.26
8	5.7	3.5	7.7	5.5	42.8	5.8	30.2	17.4	1.30
9	7.5	6.9	8.9	5.8	69.7	7.3	33.7	19.6	1.33
10	5.5	4.9	5.9	4.0	52.6	4.7	29.2	16.9	1.20

Table 3: Standards of organic compost processed from solid waste (Adapted from Solid Waste Management Rules, 2016)

S.N.	Parameters	Organic Compost
1	pH	6.5 to 7.5
2	Conductivity (dS/cm)	<4.0
3	Moisture (percent by weight) Maximum	15 to 25
4	Bulk density (g/cm) Maximum	<1.0
5	Total Organic Carbon (percent by weight) Minimum	12.0

From the study, it was found that waste management is not efficient in Bikaner and the major glitches of waste management in Bikaner are as follows:

I. Improper waste collection and transfer of waste to the waste disposal site.
II. Goga gate municipal dumping site is already overburdened.
III. Waste treatment technology are not available in Bikaner city.
IV. Waste is not reused properly.

These issues of waste management in Bikaner can be resolved with the help of public participation and appropriate implementation of waste management practices such as proper collection of solid waste, use the "3Rs (Reduce, Reuse and Recycle)" principle of waste management, suitable selection of landfill site and adoption of proper waste treatment technology. The open dumping sites should be transformed into sanitary landfills to prevent disease spreading. The major portion of solid waste is organic waste with fertilizer potential. Henceforth, composting facilities should be made for sustainable wate management in Bikaner.

4. Conclusion

Present waste management practices in Bikaner city are inadequate. Solid waste is not treated and is dumped at the Goga gate dumping site. It was observed that segregation of recyclable waste is not done in Bikaner municipal area. Hence, waste segregation and waste treatment facilities should be adopted for efficient waste management. It is recommended to utilize organic solid waste in composting.

References

Ambade, B.R., Sharma, S., Dass, A., Sharma, Y., 2013. Municipal solid waste management in Jodhpur city, Rajasthan (India)-Current status. International Journal of Environment and Waste Management, 11, Pp. 430-440.

BMC, 2021. Bikaner Municipal Corporation. Accessed from: http://bikanermc.org/UI/Static/StaticPages.aspx?pageid=6 on 20 August, 2021.

Census of India, 2011. House listing and housing data: Households by availability of type of latrine facility. Accessed from: http://www.censusindia.gov.in/DigitalLibrary/TablesSeries2001.aspx on 18 August, 2021.

Dabi, N., Chouhan, P., 2014. Solid waste collection and segregation: A case study of JIET (Co-ed) Campus. International Journal of Engineering Research & Technology, 2 (3), Pp. 54-58.

Francis, R.C., Singh, L.P., Prakash, E.V., 2013. Solid waste management and characteristics in Lucknow, Uttar Pradesh, India. International Journal of Scientific & Engineering Research, 4 (11), Pp. 1645-1648.

Kumar, A., Agrawal, A., 2020. Recent trends in solid waste management status, challenges, and potential for the future Indian cities – A review. Current Research in Environmental Sustainability, 2, Pp. 100011.

Kumar, S., Sharma, S., Jaluthriya, S., 2016. Solid Waste Management: A case study of Jaipur city. International Journal of Engineering Research & Technology, 4 (23), Pp. 1-4.

Kumar, S., Smith, S.R., Fowler, G., Velis, C., Kumar, S.J., Arya, S., Kumar, R., Cheeseman, C., 2017. Challenges and opportunities associated with waste management in India. Royal Society Open Science, 4, Pp. 160764.

Maiti, S.K., 2003. Handbook of methods in environmental studies Vol 2: (Air, Noise, Soil and Overburden analysis). ABD Publishers, Jaipur, India.

Nandan, A., Yadav, B.P., Baksi, S., Bose, D., 2017. Recent scenario of solid waste management in India. World Scientific News, 66, Pp. 56-74.

Priyadarshi, H., Jain, A., 2018. Municipal solid waste management study and strategy in Aligarh city, Uttar Pradesh India. International Journal of Engineering Science Invention, 7 (5), Pp. 29-40.

Priyadarshi, H., Priya, S., Jain, A., Khursheed, S., 2020. A Literature Review on Solid Waste Management: Characteristics, Techniques, Environmental Impacts and Health Effects in Aligarh City, Uttar Pradesh, India, in: Ameen, H., Jamiolkowski, M., Manassero, M., Shehata, H. (Eds.) Recent Thoughts in Geoenvironmental Engineering. GeoMEast 2019. Sustainable Civil Infrastructures. Springer, Cham, Pp. 79-90.

Rajput, R., Prasad, G., Chopra, A.K., 2009. Scenario of solid waste management in present Indian context. Caspian Journal of Environmental Sciences, 7 (1), Pp. 45-53.

Rani, U., Pandey, B.W., 2020. Studying the municipal solid waste management system in Meerut city, Uttar Pradesh. Journal of Global Resources, 6 (1), Pp. 58-63.

Rohilla, S.K., Luthra, B., Varma, R.S., Padhi, S.K., 2016. SFD Report Bikaner, India. Centre for Science and Environment (CSE), New Delhi.

Sharholy, M., Ahmad, K., Mahmood, G., Trivedi, R.C., 2008. Municipal solid waste management in Indian cities – A review. Waste Management, 28, Pp. 459-467.

Sharma, A., Ganguly, R., Gupta, A.K., 2019. Spectral characterization and quality assessment of organic compost for agricultural purposes. International Journal of Recycling of Organic Waste in Agriculture, 8, Pp. 197-213.

Solid Waste Management Rules, 2016. Central Pollution Control Board, India. Accessed from: https://cpcb.nic.in/uploads/MSW/SWM_2016.pdf on 22 August, 2021.

Upadhyay, V., Jethoo, A.S, Poonia, M.P., 2012. Solid Waste collection and segregation: A case study of MNIT campus, Jaipur. International Journal of Engineering and Innovative Technology, 1 (3), Pp. 144-149.

Yadav, A.K. and Choudhary, M.P., 2020. Municipal solid waste management practices in Alwar, Rajasthan, India. International Journal of Engineering and Advanced Technology, 9 (3), Pp. 3244-3249.

Yadav, A.K., Choudhary, M.P., 2021. Status of municipal solid waste management and potential of waste to energy in Alwar, Rajasthan. Indian Journal of Environmental Protection, 41 (4), Pp. 397-402.