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Analysis the Management of Commercial Solid Waste: A Case Study of Dungarpur City, India.

Jayana Upadhyay[1], Sanju Purohit[2], B. Soni[3], Ramesh Chand Swami[4], C. S. Kapoor[1]

G.G.T. University, Banswara- Rajasthan, India[1].

Department of Environmental/Ecological Studies and Sustainability, Akamai University, Hawaii, United States of America[2].

Department of Research, LIPS Research Foundation India[3].

Maharaja Surajmal Brij University, Bharatpur-321201, Rajasthan, India[4]

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ABSTRACT:
Municipal solid waste management (MSWM) is a significant environmental issue in urban areas of India. Failure to properly manage municipal solid waste (MSW) poses risks to residents. Furthermore, the issue of municipal solid waste management is prevalent in the rapidly expanding town of Dungarpur. Therefore, the current research was conducted to identify the issues and future possibilities of municipal solid waste in Dungarpur, Rajasthan. An exhaustive examination was conducted on the qualitative and quantitative analysis of solid waste, as well as the procedures related to the origins, amount produced, collection, transportation, storage, and disposal of municipal solid waste in the jurisdiction. Data pertaining to Solid Waste Management (SWM) in Dungarpur was collected via individual field visits. The highest average percentage observed at all the research sites was 57.2 ±6.13% for compostable and combustible but not recyclable garbage, while the lowest proportion was recorded for recyclable but not compostable or combustible waste. The mean proportion of biodegradable garbage was recorded at 78.76 percent. Non-biodegradable garbage accounted for 16.56% of the total, with the smallest proportion being inert waste. Photographic documentation was also provided about the production, storage, collection, transportation, and disposal of municipal solid waste (MSW). This analysis reveals that the current MSWM system in Dungarpur does not meet the requirements of the Municipal Solid Waste (Management and Handling) Rules, 2000. The paper concludes with some valuable recommendations that may motivate the responsible authorities/researchers to strive for further improvement of the current system.

Introduction

Solid wastes refer to non-liquid or non-gaseous accumulations of materials such as durable products, non-durable goods containers and packaging, food scraps, yard clippings, and other inorganic wastes. The majority of municipal solid trash in low-income Asian nations is collected and disposed of on land with a certain level of efficiency. Insufficient waste management leads to significant environmental issues that impact the well-being of both people and animals, thereby resulting in substantial economic and other welfare losses. The environmental degradation cost resulting from improper and unscientific waste disposal can be quantified by the pollution of surface and groundwater through leachate, soil contamination through direct contact with waste or leachate, air pollution caused by burning waste, transmission of diseases by various vectors such as birds, insects, and rodents, or unregulated emission of methane through anaerobic waste biodegradation. Within urban areas, it is the urban poor who bear the brunt of the life-threatening consequences resulting from inadequate solid waste management (SWM) (Kungskulniti, 1990,

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Lohani, 1984). Municipal authorities often distribute their limited financial resources to wealthier regions with higher tax revenue, where citizens with more political influence reside. Typically, affluent residents use a portion of their money to mitigate direct exposure to environmental issues in their immediate vicinity. In such cases, the problems are relocated from their communities to other areas. Therefore, although environmental issues and concerns at the home or neighborhood level may decrease in higher income regions, overall environmental deterioration at a citywide and regional level continues or even intensifies owing to inadequate solid waste management.

The production of municipal solid waste (MSW) in India has shown a substantial rising trend throughout the last several decades. Over the period from 1991 to 2001, the production of municipal solid waste (MSW) in urban India rose from 23.86 million turns per year to over 39 billion tons per year (Sharholy et al., 2007). The per capita production of municipal solid waste (MSW) in Indian cities is projected to rise by 1-1.33%. Projections indicate that during the next two decades, the yearly garbage creation is expected to expand by more than five times the current level (Singhal and Pandey, 2001). While the current per capita waste generation figures in developing countries like India are relatively modest compared to industrial countries, the rapid urbanization has made the issue of effective urban waste management a crucial long-term concern from the standpoint of Public Health and the sustainability of urban environments. Historically, the Solid Waste Management Service in India has been far from being efficient. In Rajasthan, like in other Indian states, disposal of waste is prevalent in many locations, including streets, nallahs, and open areas. An analysis conducted by Gupta and Sambyal (2007) examined the solid waste management in Samba town and found that 57.62% of the garbage consisted of vegetable materials. 11.64 percent paper bags 10% polymers 4.02% metallic content Crystals account for 3.76% and inert and other materials for 12.52%. The study region has seen rapid expansion as a large urban center due to human migration from nearby communities. Consequently, the town consistently has a significant level of activity and traffic. Although several efforts have been made by different individuals in India and overseas to address different elements of solid waste, there seems to be a lack of research specifically focused on the municipal solid waste of Dungarpur. The present research was undertaken to investigate the management of commercial solid waste in Dungarpur city. The study will serve as an inventory of different trends in Municipal solid waste production and disposal. This will enable the management to identify the pertinent issues that arise from these trends, which are relevant not only to the specific area of the research but also to other regions of our country and other developing nations. Hussein I. et al. (2018) extensively examined the problem of solid waste. The management of solid wastes, including its sources, composition, disposal, recycling, and valorization, is a pervasive and challenging issue in urban and rural regions of several industrialized and developing nations. The collection and disposal of municipal solid waste (MSW) is a significant issue in present-day metropolitan environments across most nations globally. Management options for municipal solid waste (MSW) must be economically viable, technically achievable, socially and legally acceptable, and ecologically beneficial. Effective management of solid waste is a significant problem for authorities in both small and large communities. A study conducted by Abubakar IR et al. (2022) documented the environmental sustainability consequences of solid waste management methods in developing countries. Proper solid waste management (SWM) is a crucial duty of municipal authorities and a reliable indicator of good governance. The implementation of efficient solid waste management (SWM) helps to reduce negative health and environmental effects, save resources, and enhance the quality of urban life. Nevertheless, unsustainable solid waste management efforts, worsened by fast urbanization and financial and institutional constraints, have a detrimental effect on public health and environmental sustainability. This review paper evaluates the effects of solid waste management (SWM) methods on human and environmental health in cities of the Global South, which are expected to emerge as the future of global urbanization. The study utilizes a desktop research approach characterised by thorough examination of secondary data and literature, including government papers and published publications. The study reveals that the prevailing solid waste management (SWM) methodologies include the

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combination of domestic and commercial refuse with hazardous waste throughout the processes of storage and processing.

Materials And Methods

The study area Dungarpur town is located in the southern part of Rajasthan between 23° 21’ to 24 N latitude and 73 22’ to 74 23' E longitude. The study area comprised of 377 shops and was divided into four sides for the purpose of collection of data for the present work. S in the commercial area were divided into different type of shops that is Kirana tea stall stationery shops etc. Two samples per month of solid waste generation were taken from each type of shop. During each sampling the total solid waste generated per shop during 24 hours were collected in a bag and segregated into biodegradable non biodegradable and inert solid waste and weighted separately with the help of spring balance for a period of one year that is from April 2023 to March 2024. Data of solid waste generation of two samples from each type of shop was compiled to calculate average solid waste (gm/day and kg/month) generation along with the standard deviation to each type of waste generated. This average value was multiplied by total number of shops to calculate the average total solid waste generation in various study sites in the commercial area.

Average Total Solid Waste(kg/day) = Average Solid Waste(kg/day)

Generation in the Commercial Area × Total number of shops

Result And Discussion

An first analysis of the table 1 reveals that the total amount of solid trash generated in one year was tracked to be 99034.32 kg, with an average value of 2063.215 ± 395.465 kg per month per site. In addition, it consists of 1632.68 kg of biodegradable garbage, 336.73 kg of non-biodegradable waste, and 91.79 kg of inert waste, with a range of ± 369.88 kg. A comparative analysis of solid waste production and composition at several research sites revealed that the highest average monthly solid waste generation at site one was 254, or 4.37 kg. Site two had an average total solid waste generation of 2068, or 107 kg, while site three had an average of 206, or 4.69 kg. The lowest result of 1575.73 kilogrammes was provided by site 4. Table 2 shown that the percentage generation of various waste categories exhibits a hazard pattern of growth or decline at different sites over the course of one year of the study period. Specifically, the percentage generation of combustible, compostable, and recyclable waste, such as paper and cardboard, was highest at site second at 22.86 percent and lowest at site first at 18.13 percent.
The highest proportion of recyclable and combustible but not compostable bottle plastic polythene was generated at side II, at 6.31%. The highest percentage of recyclable but not compostable or commutable metallic trash was 6.92% at site second, while the lowest percentage was 2.95% at site first. The highest percentage of compost table and combustible but not recyclable organic waste was observed at site third, at 63.42%. As for commutable but not compostable or recyclable plastic polythene and wood, the highest percentage was 15.47% at site four, while the lowest percentage was 11.35% at site three. The category of garbage that is compostable and combustible but not recycled had the highest average percentage of 57.2 ± 6.13% compared to the category of waste that is recyclable but not compostable or combustible, which reported the lowest percentage in all four investigations.

Empirical evidence indicates that the proportion of various waste types adheres to a hep hazard trained model of either growth or decline, but not a consistent pattern of growth or decline. The highest proportion of trash was recorded at site second, of 82.5%, while the lowest percentage was found at site second, of 75.69%. The overall average % The observed proportion of biodegradable trash in was 78.76. In terms of biodegradability, organic waste exhibited the highest average percentage of 62.91% at site 3rd and the lowest percentage of 48.6% at site 2nd. The non-biodegradable composition has an average percentage of 16.56%, with a maximum percentage of 20.45% at site two and a minimum percentage of 13.64% at site one. Plastic garbage accounted for the highest average percentage of 4.59%. The existence of Kirana sugarcane juice, fruit and vegetable stores, and the location of vehicle spare part shops, electrical shops, and other similar establishments contribute to the prevalence of organic trash among biodegradable garbage in all the studies. Polythene trash is the dominating kind of non-biodegradable garbage. The higher proportion of

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organic waste among the many categories of biodegradable trash is seen at all locations due to the prevalence of organic waste generating establishments. Biodegradability is the predominant characteristic of the waste at all the research locations. From 2001 to 2003, the City of Bhubaneswar had the highest proportion of biodegradable garbage, as reported by Panda. By 2007, the Janipur business sector in Jammu should have achieved the highest possible proportion of biodegradable garbage. Gupta and Manhas (2008). In 2009, the residential area of Sainik Colony Jammu produced the highest proportion of biodegradable trash. The procedure for solid waste management lacks systematicity. Shopkeepers dispose of their garbage by disposing of it beside the drains or hips of their stores. Most stores do not open before 9:00 a.m. and so do not dispose of their garbage until that time. Consequently, the majority of rubbish is left on the normal collection services and is often visible on the streets. The rubbish collected dump is swiped by sweepers or Swabber into temporary collecting locations. The business sector in Dungarpur Municipal Council lacks the provision of metal beans for the purpose of solid garbage collection. Open dumping of solid trash is a prevalent practice in which UMC using open body trucks collects rubbish from temporary collection locations and transports it to the ultimate disposal site,

Table:1 Average solid waste (Kg/Month) generation and composition in the study area.

Sites	SITE-1	SITE-2	SITE-3	SITE-4			Total	Grand total
Categories of SW	*AV.	*AV.	*AV.	*AV.	*AV./M/S	*SD	*AV.x12	Totalx4
Biodegradable	2099	1565.33	1666.5	119991	1632.685	369.87	19592.22	783687.88
Non-Biodegradable	347.03	422.89	296.57	280.46	336.737	64.05	4040..85	16163.4
Inert Waste	96.79	74.26	101.96	94.16	91.792	12.12	1101.51	4406.04
Total	25.44	2068. 07	2064.69	1575.73	2063.215	395.46	24758.58	99034.32

*AV-average; *AV./m/s- Average /month/site; *SD- Standard deviation

Table 2: Percentage variation in different categories of waste at different study sites.

Waste Categories	SITE-1	SITE-2	SITE-3	SITE-4	Average
	Percentage of Solid waste				
Combustible, Compostable and Recyclable (Newspaper. Cardboard etc.)	18.13	22.86	15.06	18.24	18.57 ± 3.22
Recyclable and Combustible but not Compostable (Cloth bits, Bottles, Cotton, Polythene)	5.67	6.31	6.12	5.59	5.92 ± 0.35
Recyclable but not compostable or Combustible (Metallicwaste)	2.95	6.92	3.97	5.25	4.77 ± 1.71
Compostable & Combustible but not Recyclable (Veg./Fruit waste etc.)	60.41	49+.38	63.42	55.6	57.2 ± 6.13
Combustible but not Compostable or Recyclable (Plastic, wood etc.)	12.88	14.57	11.35	15.47	13.57 ± 1.83

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which is located at the confluence of Mulla Ghanti and Manak Chowk. Approximately one-third of the material is deposited directly into the Hanuman Chowk, a revered lake in Gab Sagar. This lake is severely contaminated as a result of the dumping of solid waste and the urban sprawl. It should be noted that the Hanuman Chowk region is located on a rather gently inclined landscape. By exploiting the uneven topography, a certain amount of waste is ultimately transported to the Gab Sagar Lake through the combined effects of gravity, wind, rainwater, or small gulis. This contributes to the pollution of the sacred lake, which negatively impacts its plant and animal life as well as the residents of the downstream areas. The produced trash is either permanently stored in dams across unoccupied floats or at the designated primary disposal location chosen by the Municipal Corporation. The rag pickers are seen gathering a variety of marketable raw materials such as plastic, glass, rubber, metal, paper, and so on. For the purpose of being sold in the market and then used for recycling. It has been observed that animals such as God dog pictures and rats consume the solid waste originating from the open landfills. The majority of trash dumps containing polythene bags are incinerated, resulting in the emission of toxic volatiles such as dioxins and furans, which are known to be carcinogenic. Inadequate disposal of solid waste results in the emission of strong unpleasant odors surrounding the disposal site. Additionally, the growing buildup of garbage at these sites poses a constant risk of epidemic transmission in the vicinity. Khan D et al. (2016) documented the influence of socioeconomic level on the rate of municipal solid trash production. Many environmental and societal variables were anticipated to cause the solid waste production rate to differ across various socioeconomic classes. This study presents an evaluation of solid waste production measured by several socioeconomic factors such as education, employment, family income, and number of family members. An empirical survey was carried out in the research region to ascertain the various socioeconomic categories that might influence the pace and content of solid waste production. Using input-output indices, Bolingbroke D et al. (2021) investigated the measurement of solid waste management system efficiency. A study conducted by Fadhullah, W., Imran, N.I.N., Ismail, S.N.S. et al. (2022) examined the habits and attitudes of inhabitants on the east coast of Malaysia about the management of household solid trash. Deficiencies in waste disposal methods impede the development of a comprehensive solid waste management system in residential settings. A comprehensive understanding of present practices and public opinion on home solid waste management is essential for making precise decisions in the transition towards a more sustainable strategy. The present research aims to examine the household waste behaviors and associated attitudes towards waste management in Panji, a sub-district located in Kota Bharu, Kelantan, Malaysia. Gour and Singh (2023) provide a comprehensive analysis of solid waste management in India. Anunay. Analysing the present situation of solid waste management in India and the associated difficulties, with a focus on the potential advantages for emerging and low-income nations. The primary factor contributing to trash production is the expanding population and the corresponding changes in lifestyle resulting from the rise in per capita income. Therefore, the volume of solid waste is consistently increasing in tandem with its variety of compositions. In previous times, the waste materials were of an organic nature and could be easily deposited in low-lying regions without negative consequences for the ecosystem. However, throughout time, the proportion of organic waste has significantly decreased while the proportion of inorganic trash has multiplied. Furthermore, the environment and public health are significantly impacted by solid waste generated by industry, hospitals, building sites, residences, and many other sources.

The current method of collecting and transporting solid waste leads to time inefficiency and therefore raises the collection service costs. Typically, the majority of transport trucks used for garbage collection are open-type and have limited capacity, which poses health risks. Poorly controlled solid wastes provide a significant risk to public health and the overall well-being, particularly for the socially and economically disadvantaged segments of the population. The municipality used the open dumping technique for trash disposal. Residents in the region express dissatisfaction with persistent odour, infestation of insects and rats, and substandard water quality. The predominant solid waste management system in the region indicates that the

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municipality is not in compliance with the municipal solid waste management and handling regulations of 2000. Hence, based on the aforementioned analysis, it can be inferred that the current solid waste disposal method is unsuitable due to the associated health risks. In the commercial area of Udaipur, the municipal solid waste is characterized by a significant proportion of decomposable organic material. The existing disposal methods employed by the municipal corporation are unhygienic for the workers and contribute to several health risks and environmental issues. An effective management approach to address this issue should include the amendment of existing management legislation and enhancement of the present management system.

Based on for going observation and conclusion the following recommendations have been made:

1. The appropriate management of trash produced in the study area is necessary to sustain the cleanliness of the region and the hygiene of the residents.
2. The traditional practice of openly disposing of the city's solid waste should be substituted with sanitary landfills and energy recovery systems. This approach will not only be environmentally benign but also significantly mitigate soil and water contamination issues.
3. Compulsory and rigorous adherence to solid waste segregation at its origin should be implemented.
4. The community should be incentivized to minimize the reuse and recycling of solid waste to the greatest extent feasible.
5. Landfill sites should be chosen by rigorous scientific examination.
6. The civic authorities should be granted enough authority to prosecute the perpetrators.
7. Residents should be knowledgeable about the correct suitable disposal of garbage.
8. Public awareness campaigns on the detrimental impact of solid waste should be implemented.
9. It is necessary to establish systematic and consistent national waste management policies.
10. Municipal authorities shall ensure the proper storage of facilities to prevent unclean and unsanitary atmospheres.
11. Either the authority state pollution control board UMC or both shall provide sufficient dustbins in the street to eliminate the need for merchants to transport waste over long distances inside the straight or on any other street.
12. To raise awareness among business proprietors, local residents, and sanitary personnel, it is necessary to regularly and repeatedly organize seminars, symposiums, meetings, workshops, and trainings. This will help them understand the advantages of cleanliness and the negative effects of inadequate waste management in the area.

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