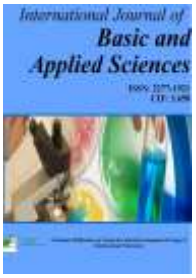
Content is available at: CRDEEP Journals
Journal homepage: http://www.crdeepjournal.org/category/journals/ijbas/

International Journal of Basic and Applied Sciences
(ISSN: 2277-1921) (Scientific Journal Impact Factor: 6.188)

UGC Approved-A Peer Reviewed Quarterly Journal



Full Length Research Paper

Municipal Solid Waste Management: A Case Study of Ghaziabad City

Arvind Kumar[1*] and Prof. A. R. Siddiqui[2]

[1-]Assistant Professor, Department of Geography, Sanatan Dharm College Muzaffarnagar, Uttar Pradesh, India.
[2-]Professor, Department of Geography, University of Allahabad, Prayagraj, Uttar Pradesh, India.

ARTICLE DETAILS

Corresponding Author:
Arvind Kumar

Key words:
Solid Waste Management, Urbanisation, Waste Composition, Ghaziabad District, Municipal Solid Waste, Zonal Analysis

ABSTRACT

Solid waste management has become a major environmental and urban challenge in rapidly growing cities of India due to increasing population, urbanisation, and changing consumption patterns. Ghaziabad district, located in the National Capital Region, is experiencing a continuous rise in municipal solid waste generation as a result of expanding residential, commercial, and industrial activities. The present study examines the status of solid waste management in Ghaziabad district with a focus on spatial variation in waste generation and composition across different municipal zones. Primary data were collected through field sampling from selected wards representing all five zones of the city, while secondary data were obtained from municipal records and official reports. The analysis reveals considerable inter-zonal variation in waste generation, with the City and Kavinagar zones contributing the highest share of total waste due to dense population and intense urban activities. Waste composition is dominated by biodegradable components, particularly food waste, along with a significant proportion of non-biodegradable materials such as plastic and polythene. The findings highlight issues related to inadequate segregation at source, limited treatment capacity, and dependence on landfilling. The study emphasizes the need for zone-specific planning, improved waste treatment infrastructure, and greater public participation to achieve sustainable solid waste management in Ghaziabad district.

1. Introduction

Solid waste management has emerged as a critical environmental and urban governance challenge in India, particularly in rapidly urbanising districts (Vij, 2012). Solid waste generated from households, industries, commercial establishments, and institutions has increased significantly due to population growth, changing consumption patterns, and accelerated urban development (Joshi & Ahmed, 2016). Effective solid waste management involves an integrated approach encompassing waste generation, segregation at source, collection, transportation, treatment, and final disposal in an environmentally sustainable manner (Memon, 2010). Proper management not only reduces environmental pollution but also promotes resource recovery through recycling, composting, and waste-to-energy practices, thereby supporting the principles of sustainable and circular economy (Shah et al., 2024).

Ghaziabad district, located in the National Capital Region and characterised by rapid industrial growth, high population density, and expanding urban settlements, represents a critical case for examining the status of solid waste management (Horo & Punia, 2019). The district generates a substantial quantity of municipal solid waste due to residential expansion, commercial activities, and industrial establishments, placing immense pressure on existing waste collection, treatment, and disposal systems (Rani et al., 2025). Inadequate treatment capacity and reliance on landfilling further aggravate environmental and health concerns in the region (Nanda & Berruti, 2021). Against this background, the present study seeks to assess the current status of solid waste management in Ghaziabad district, identify key challenges in waste

[1]Author can be contacted at: Assistant Professor, Department of Geography, Sanatan Dharm College Muzaffarnagar, Uttar Pradesh, India.
Received: 20-Nov-2024; Sent for Review on: 25-Nov-2024; Draft sent to Author for corrections: 12-Dec-2024; Accepted on: 18-Dec-2024; Online Available from 20-Dec-2024
DOI: 10.5281/zenodo.18169153.
IJBAS-9890/© 2024 CRDEEP Journals. All Rights Reserved.

handling and treatment, and highlight the need for improved planning, infrastructure development, and policy interventions to ensure sustainable urban environmental management

2. Materials and methods

2.1 Study Area

The study area, Ghaziabad district, lies in the western part of Uttar Pradesh within the National Capital Region (NCR) (Mookherjee, 2020). It measures 37 kilometres in width and 72 kilometres in length. It is situated between 77°26' and 78°10' East longitude and latitude of 28°30' to 28°59' North. It is bounded by Meerut district in the north, Bulandshahr in the east, Gautam Buddha Nagar in the south, and Delhi in the west. The district forms part of the gently sloping alluvial plain of the Ganga–Yamuna Doab and is primarily drained by the Hindon River and its tributaries, including the Kali (West) and Krishni rivers, which flow from north to south and constitute the main drainage pattern (Singh, 2022). Ghaziabad is one of the most densely populated districts of Uttar Pradesh, with a very high population density and a predominantly urban population concentrated in Ghaziabad city, Sahibabad, Loni, and adjoining industrial–residential zones, while rural population is distributed in peripheral blocks and riverine areas (Randhawa & Mehra, 2023).

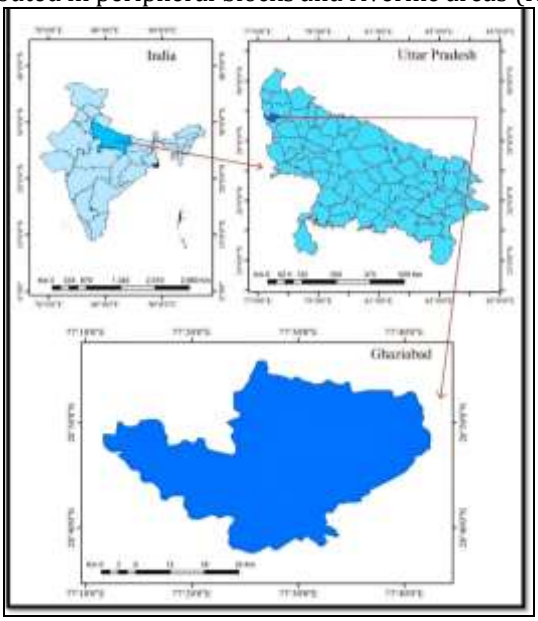


Fig 1: Location Map of The Study Area (*Source: Survey of India*)

2.2 Objectives

The main objective of this research is to conduct a comparative assessment of the water quality of the Hindon River in Ghaziabad district based on Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Total Coliform, and Fecal Coliform parameters during the pre-monsoon and post-monsoon periods.

2.3 Data Source & Research Methodology

To understand the nature of waste generation, a spatial assessment of solid waste composition at the source was conducted in selected wards, distinguishing biodegradable and non-biodegradable components. Urban solid waste mainly consists of paper, food waste, textiles, plastics, glass, metals, ash, sludge, and other discarded materials, with its composition varying spatially, temporally, and according to socio-economic conditions. The 80 wards of the city are divided into 5 zones. 5 wards from each zone have been selected as sampled wards. Therefore, a total of 25 wards has been selected from all the zones so that the solid waste samples collected for the study are not homogeneous in nature. 2kg solid waste was collected from each sample wards, so the total quantity of solid waste collected was 50kg. The waste was categorised into biodegradable components such as paper, cardboard, food waste, cloth, and organic matter, and non-biodegradable components including plastic, polythene, glass, metal, rubber, and other synthetic materials.

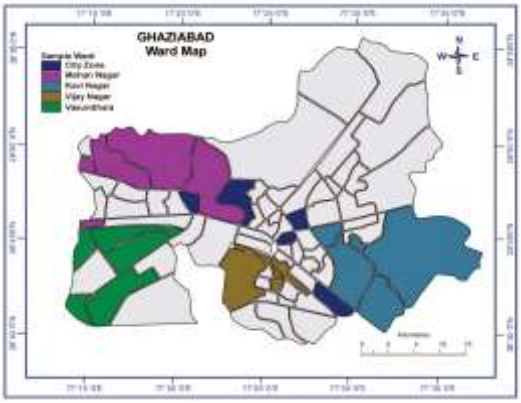


Fig-2: Sample Ward of Ghaziabad City for Solid Waste Generation

3. Result

The researcher has discussed here the zone wise nature and distribution of solid wastes, such as-

3.1 Solid Waste Characteristics in Mohannagar Zone

Based on the field survey 2021, an attempt has been made to collect solid waste from various wards in Mohan nagar Zone. There are 5 wards selected within the zone for the purpose of this study and to obtain heterogeneous samples. The samples are collected from 5 wards namely- Karehera, New Karehera, Harsh Compound, Rajiv Colony (ward 17), Raghuveer Enclave, Krishna Vihar (ward 24), Sheed Nagar (ward 44), Garima Garden (ward 46), Tulsi Niketan (ward 48).

Table 1: Mohan Nagar Zone - Composition of Solid Waste (in Percent)

Non-Biodegradable	% of Composition	Biodegradable	% of Composition
Plastic	19.74	Paper	16.36
Polythene	36.71	Cardboard	17.81
Glass	7.64	Food Waste	35.63
Metal	8.49	Cloths	8.60
Miscellaneous	27.42	Miscellaneous	22.20

Source: Solid Waste samples collected during the field survey were analyzed.

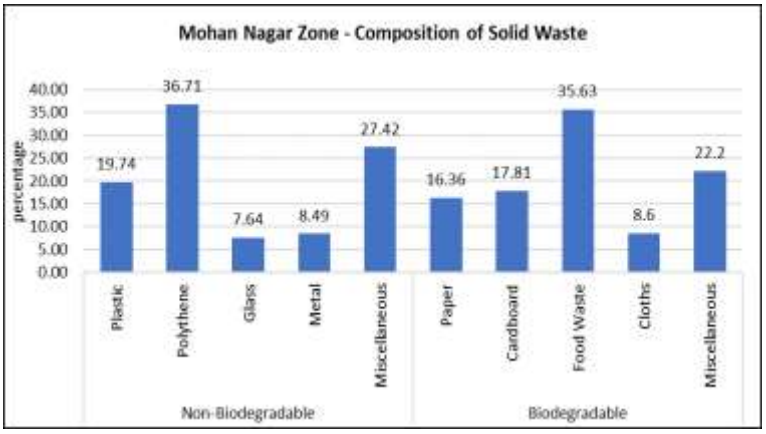


Fig 3: Mohan Nagar Zone - Composition of Solid Waste

Table-1 shows a detailed percentage composition of waste under each category. From the collected sample of non-biodegradable category 19.74 percent of waste is plastic, 36.71 percent is polythene, 7.64 percent is glass, 8.49 percent is metal and 27.42 percent ismiscellaneous. Under the biodegradable category 16.36 percent is paper, 17.81 percent is cardboard, 35.63 percent is food waste, 8.60 percent is cloths and 22.20 percent falls under miscellaneous. This zone is located in the Industrial The zone is of very dense population distribution and has unsanitary condition and lack of proper sewage disposal. The food waste is also high due to dense residential areas where garbage is thrown on the streets or in the drains directly. The population living here includes mainly the low- and medium-income groups so the waste generation is higher as compared to areas of high-income groups of population.

3.2 Solid Waste Characteristics in Kavinagar Zone

The solid waste sample was collected from 5 wards in this also. These wards include Gagan Enclave, Pandav Nagar (Ward 16), Shastri Nagar Block K To M, Baghwali Colony (Ward 21), Lal Kuan (Ward 38), Vivekanand Nagar (Ward 67), Kavinagar Block A To M (Ward 79). It has been observed that polythene generation is lower than the first zone. Polythene waste was reported at 29.84 percent, plastic was 21.32 percent, glass was 13.91 percent, metal was 9.58 percent and miscellaneous waste was 25.35 percent. Under the biodegradable category paper was 17.62 percent, cardboard was 19.28 percent, food waste was 31.71 percent, cloths were 10.45 percent and miscellaneous waste was 20.94 percent out of the sample collected. The slightly less polythene and plastic generation can be contributed to the fact that this zone has more residential areas as compared to commercial sites so a lower plastic and polythene generation

Table 2: Kavi Nagar Zone - Composition of Solid Waste (in Percent)

Non-Biodegradable	% of Composition	Biodegradable	% of Composition
Plastic	21.32	Paper	17.62
Polythene	29.84	Cardboard	19.28
Glass	13.91	Food Waste	31.71
Metal	9.58	Cloths	10.45
Miscellaneous	25.35	Miscellaneous	20.94

Source: Solid Waste samples collected during the field survey were analyzed.

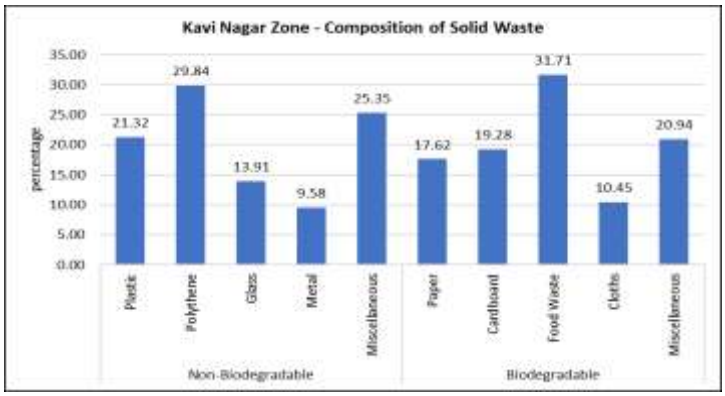


Fig 4: Kavi Nagar Zone- Composition of Solid Waste

3.3 Solid Waste Characteristics in Vijaynagar Zone

The selected sampled wards in this zone Aremata Colony Sec 12 (ward 8), old Vijiay Nagar Sec-9 (Ward 2), Lailash Nagar (Ward 13), Sundrpuri, Madhopura, (Ward15), Pratapvihar Sec-11, Block E (Ward 66). The waste composition in this zone reported 16.38 percent plastic, 27.18 percent polythene, 11.42 percent glass, 8.51 percent metal and 36.51 percent miscellaneous waste under the non-biodegradable category. In the biodegradable category the composition was 15.14 percent paper, 18.91 percent cardboard, 33.68 percent food waste, 13.77 percent cloths and 18.50 percent miscellaneous waste.

Table 3: Vijaynagar Zone - Composition of Solid Waste (in Percent)

Non-Biodegradable	% of Composition	Biodegradable	% of Composition
Plastic	16.38	Paper	15.14
Polythene	27.18	Cardboard	18.91
Glass	11.42	Food Waste	33.68
Metal	8.51	Cloths	13.77
Miscellaneous	36.51	Miscellaneous	18.5

Source: Solid Waste samples collected during the field survey were analyzed.

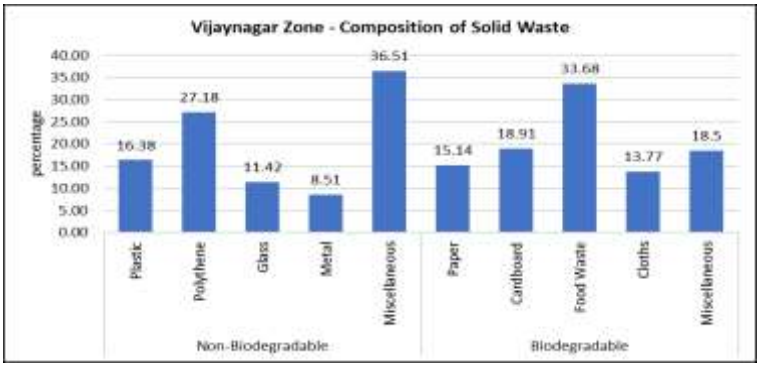


Fig 5: Vijaynagar Zone - Composition of Solid Waste

3.5 Solid Waste Characteristics in Vasundhara Zone

The selected sample wards in this zone Shaibabad, Jhandapur, Peer Colony (Ward 36), Kaushambi (Ward 41), Commercial Area Sec 1 To 9 (Ward 58), Brij Vihar Rampur (Ward72) Chander Nagar, Ramprasth, Suryanagar (Ward 78). The non-biodegradable waste composition in this zone includes plastic 18.88 percent, polythene 28.37 percent, glass 8.47 percent, metal 7.59 percent and miscellaneous waste 36.69 percent. In the biodegradable category there is paper 15.94 percent, cardboard 21.26 percent, food waste 29.49, cloths 14.69 percent and miscellaneous waste 18.62 percent.

Table 4: Vasundhara Zone - Composition of Solid Waste (in Percent)

Non-Biodegradable	% of Composition	Biodegradable	% of Composition
Plastic	18.88	Paper	15.94
Polythene	28.37	Cardboard	21.26
Glass	8.47	Food Waste	29.49
Metal	7.59	Cloths	14.69
Miscellaneous	36.69	Miscellaneous	18.62

Source: Solid Waste samples collected during the field survey were analyzed.

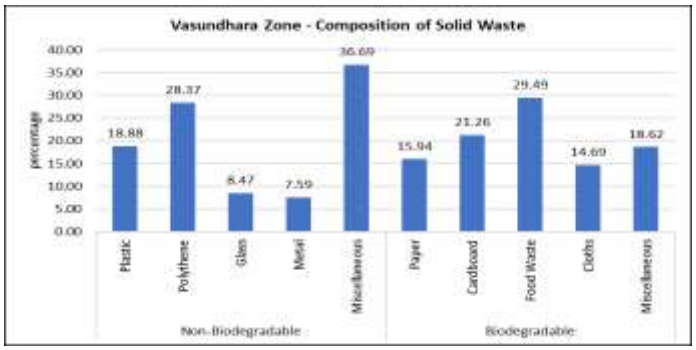


Fig-6: Vasundhara Zone - Composition of Solid Waste

3.6 Solid Waste Characteristics in City Zone

The wards selected for sample collection in this zone include Daulatpura (Ward 7), Nandgram (Ward 10), Richpalpuri, Chandarpuri (Ward 54), Lal Quarte, Laohiya Nagar (Ward 61), Gandhi Nagar, Purva Ismail Khan (Ward 77). The waste includes 13.66 percent plastic, 20.10 percent polythene, 14.38 percent glass, 14.54 percent metal and 37.32 percent miscellaneous waste under the non-biodegradable category. Further the biodegradable category includes 15.28 percent paper, 18.76 percent cardboard, 23.61 percent food waste, 12.72 percent cloths and 29.63 percent miscellaneous waste. The non-biodegradable waste composition in this zone includes plastic 19.18 percent, polythene 25.61 percent, glass 14.41 percent, metal 12.69 percent and miscellaneous waste 28.11 percent. In the biodegradable category there is paper 17.39 percent, cardboard 20.17 percent, food waste 31.53, cloths 11.36 percent and miscellaneous waste 19.55 percent.

Table 5: City Zone Composition of Solid Waste (in Percent)

Non-Biodegradable	% of Composition	Biodegradable	% of Composition
Plastic	19.18	Paper	17.39
Polythene	25.61	Cardboard	20.17
Glass	14.41	Food Waste	31.53
Metal	12.69	Cloths	11.36
Miscellaneous	28.11	Miscellaneous	19.55

Source: Solid Waste samples collected during the field survey were analyzed.

Fig 7: Vasundhara Zone - Composition of Solid Waste

Table-6 presents the zone-wise estimation of total solid waste generation in Ghaziabad City for the year 2021 and clearly brings out spatial variations in waste generation in relation to population concentration and urban intensity. The City Zone emerges as the largest contributor to municipal solid waste, generating 491,668.8 kg/day, which accounts for 30.48% of the total waste produced in the city. This high share can be attributed to its highest population (702,384), the largest number of wards (24), and intense commercial, administrative, and residential activities concentrated in the core urban area.

Kavinagar Zone ranks second in waste generation with 330,675.8 kg/day, contributing 20.50% of the total waste. Despite having a relatively lower population than the City Zone, its extensive area (65.47 sq. km) and mixed residential–industrial land use significantly influences waste generation. Vijaynagar and Mohannagar Zones generate comparable amounts of waste, contributing 17.55% (283,107.3 kg/day) and 17.41% (280,929.6 kg/day) respectively. These zones exhibit moderate population levels and relatively compact spatial extent, indicating a fairly proportional relationship between population size and waste generation.

Vasundhara Zone contributes the least to total waste generation, producing 226,879.8 kg/day, which constitutes 14.06% of the city's total waste. This lower share is associated with its smaller population and fewer wards compared to other

zones. Overall, the table highlights that solid waste generation in Ghaziabad City is closely linked with population concentration, number of wards, and the intensity of urban activities

Table 6: Zone Wise Estimation of Total Solid Waste Generation in Ghaziabad City (2021)

Zone	No. of Wards	Total Population of Zone	Area of Zone (sq. km)	Total Waste Generation in zone (kg/day)	Percent Waste Generation
Mohannagar	14	401328	19.01	280929.6	17.41
Kavinagar	17	472394	65.47	330675.8	20.5
Vijaynagar	14	404439	18.74	283107.3	17.55
Vasundhara	11	324114	35.45	226879.8	14.06
City	24	702384	41.64	491668.8	30.48
Total	80	2304659	180.31	1613261.3	100

Source: Solid Waste samples collected during the field survey were analyzed.

Fig 8: Zone Wise Estimation of Total Solid Waste Generation (in Percent)

4. Discussion

The findings indicate significant spatial variation in solid waste generation and composition across different zones of Ghaziabad city, largely influenced by population density, land use, and socio-economic conditions. Zones with dense residential and commercial activities, particularly the City and Kavinagar zones, generate the highest quantity of solid waste, while Vasundhara zone contributes the least. The dominance of biodegradable waste, especially food waste, reflects the residential character of most zones, whereas the substantial presence of plastic and polythene highlights growing consumption and inadequate segregation practices. Overall, the study suggests that ineffective segregation at source and limited treatment facilities are key challenges, emphasizing the need for zone-specific waste management strategies and improved municipal planning.

5. Conclusion

The study reveals that solid waste management in Ghaziabad district faces serious challenges due to rapid urbanisation, population growth, and industrial expansion. Solid waste generation varies across zones, with the City and Kavinagar zones contributing the highest share because of dense population and intense urban activities. The waste composition is dominated by biodegradable matter along with a significant proportion of plastic and polythene, indicating the need for effective segregation, recycling, and composting. Inadequate treatment facilities and continued dependence on landfilling increase environmental and health risks. Therefore, improved infrastructure, zone-specific planning, and active public participation are essential for achieving sustainable solid waste management in Ghaziabad district.

References

Horo, J. P., & Punia, M. (2019). Urban dynamics assessment of Ghaziabad as a suburb of National Capital Region, India. GeoJournal, 84(3), 623-639.

Joshi, R., & Ahmed, S. (2016). Status and challenges of municipal solid waste management in India: A review. Cogent environmental science, 2(1), 1139434.

Memon, M. A. (2010). Integrated solid waste management based on the 3R approach. Journal of Material Cycles and Waste Management, 12(1), 30-40.

Mookherjee, D. (2020). The national capital region, Delhi, India: an empirical exploration. In The Asian megacity region: a conceptual approach (pp. 149-202). Cham: Springer International Publishing.

Nanda, S., & Berruti, F. (2021). Municipal solid waste management and landfilling technologies: a review. Environmental chemistry letters, 19(2), 1433-1456.

Randhawa, P., & Mehra, R. (2023). Fragmented Planning and Splintered Urbanism: A Spatio-temporal Study of Ghaziabad. Nidān: International Journal for Indian Studies, 8(2), 71-92.

Rani, U., Matlovicova, K., Pandey, B. W., Vaishnav, H. K., Saini, R., Dey, S. K., ... & Mishra, P. K. (2025). Informal urban livelihoods and environmental inequality: Occupational health risks among waste pickers in Ghaziabad, India. Geojournal of Tourism and Geosites, 61(3), 1859-1874.

Shah, H. H., Amin, M., Pepe, F., & Tregambi, C. (2024). Sustainable waste management and waste-to-energy in the context of a circular economy through various waste management technologies. Environmental Science and Pollution Research, 1-20.

Singh, R. V. (2022). Drainage System and Settlement Pattern in the Yamuna-Hindon Doab: An Archaeological Perspective. Sri Lanka Journal of Advanced Research Studies in Humanities and Social Sciences, 53.
Vij, D. (2012). Urbanization and solid waste management in India: present practices and future challenges. Procedia-Social and Behavioral Sciences, 37, 437-447.