

ASSESSMENT OF HOUSEHOLD SOLID WASTE COMPOSITION AND MANAGEMENT PRACTICES IN URBAN AREAS: A CASE STUDY OF AHMEDABAD

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Abstract

The growing global population has driven an unprecedented demand for goods, resulting in the highest levels of waste production in history. While waste management is a longstanding challenge, its complexity has intensified in recent times. Results showed to analyse the composition and management of solid waste in Ahmedabad, with the goal of understanding the local situation, identifying problems, and exploring potential solutions. Conducted in Ahmedabad municipality, the research sought to uncover the reality of household waste management. Data were collected in November 2023 through household surveys and focused group discussions involving 75 households. The study categorized and weighed the waste collected from these households, identifying even types of household solid waste (HSW). The largest portion was organic waste (44%), followed by Plastic accounts for 13%, paper 11%, glass 10%, rubber 9%, various other waste 7%, and hazardous waste 6%. Albeit metropolitan specialists are ordinarily liable for strong waste assortment and removal, the scale of the issue in Kankaria Lake, Ahmedabad surpasses their capabilities. Residents have expressed significant dissatisfaction with the local government's waste management efforts. Considering the waste composition, home-level composting offers a viable and sustainable solution. However, the ongoing strong waste administration framework is inefficient and requires substantial improvement to address the community's needs effectively.

Keywords: Waste Transportation, Hand-driven Carts, Small Vehicles, Community Bins, Waste Storage Facilities, Cleanliness Comparison.

INTRODUCTION

The quick development of the worldwide populace has essentially expanded the age of Municipal Solid Waste (MSW), raising serious natural and general wellbeing issues worldwide. Various factors, including dietary habits, living standards, commercial activities, and seasonal variations, influence the volume of MSW produced. Solid waste encompasses waste generated from human activities and can be categorized by its composition (e.g., organic matter, glass, metal, plastic, paper) or by its potential hazards.

As global population growth continues, along with accelerated urbanization, improving living standards, and shifting consumption patterns, solid waste production is expected to rise further. In recent decades, strong waste administration has turned into a squeezing worry in many creating urban communities, adding to land corruption, biodiversity misfortune, air contamination, unfortunate sterilization, and the spread of irresistible sicknesses. [1-3]

In the modern era, managing waste has emerged as a crucial issue. The increasing volume of waste resulting from population growth and rapid urbanization presents serious dangers to both the climate and human wellbeing because of lacking waste assortment, treatment, and removal. To handle this issue, it is urgent to carry out compelling and feasible waste administration rehearses. Non-biodegradable waste can lead to soil, water, and air contamination (Khan et al., 2022). Hazardous chemicals within waste can damage natural ecosystems and pose health risks to humans. As consumption patterns evolve, addressing these challenges becomes increasingly important and disposal of goods continues to rise, it is crucial to develop management strategies that mitigate these negative impacts.

A sustainable approach to waste management integrates economic, social, and environmental considerations. This strategy aims to maximize long-term benefits while prioritizing resource efficiency and minimizing environmental harm (Silva et al., 2021). Efficient waste management involves using key resources to reduce waste and enhance the value derived from it. Innovative technologies play a pivotal role in discovering new recycling methods, converting, or repurposing waste into valuable resources. [4-7]

A study conducted by Mufeed Sharholy and colleagues points out that managing municipal solid waste (MSW) is a major environmental issue in Indian cities. The research shows that about 90% of municipal solid waste is disposed of in open dumps and landfills without proper scientific methods, which poses substantial risks to both public wellbeing and the climate. The audit tends to different parts of MSW in India, including its attributes, age, assortment, transportation, removal, and treatment advancements, and recognizes a few basic issues. Eminent discoveries incorporate the requirement for better-planned assortment receptacles, further developed upkeep of storerooms and transportation vehicles by city specialists, powerful source isolation of waste, and measures to lessen open unloading and further develop lacking removal practices to forestall serious wellbeing gambles to humans and animals. The study also underscores the significant disconnect between policy and the actual implementation of the SWM Rules 2016 [8-10]

Another study by Papiya Sarkar examines solid waste management in Delhi, uncovering significant insights into the effects of solid waste on different stakeholders, some groups like waste collectors. The study emphasizes the crucial role of information dissemination and the need to raise awareness about recycling. Enhanced awareness could lead to improved waste handling practices among households, thereby reducing occupational health risks and offering better working conditions and economic advantages for those involved in waste collection.

METHODOLOGY

In Ahmedabad, Solid waste management (SWM) in the region is overseen by municipal entities: Ahmedabad Municipal Corporation (AMC) and the Ahmedabad Cantonment Board (ACB). The AMC handles about 95% of the city's area. These bodies receive assistance from various agencies. [11-14]

The AMC has divided Ahmedabad’s 12 areas into 4 zones for administrative purposes:

1. Sabarmati Ashram
2. Sabarmati Riverfront
3. Shree Swaminarayan Temple
4. Auto World Vintage Car
5. Jhulta Minar, Adalaj Stepwell
6. Law Garden, Jama Masjid
7. Kankaria Lake
8. Bhadra Fort
9. Sarkhej Roza
10. Teen Darwaza
11. Nagina Wadi
12. Manek Chowk

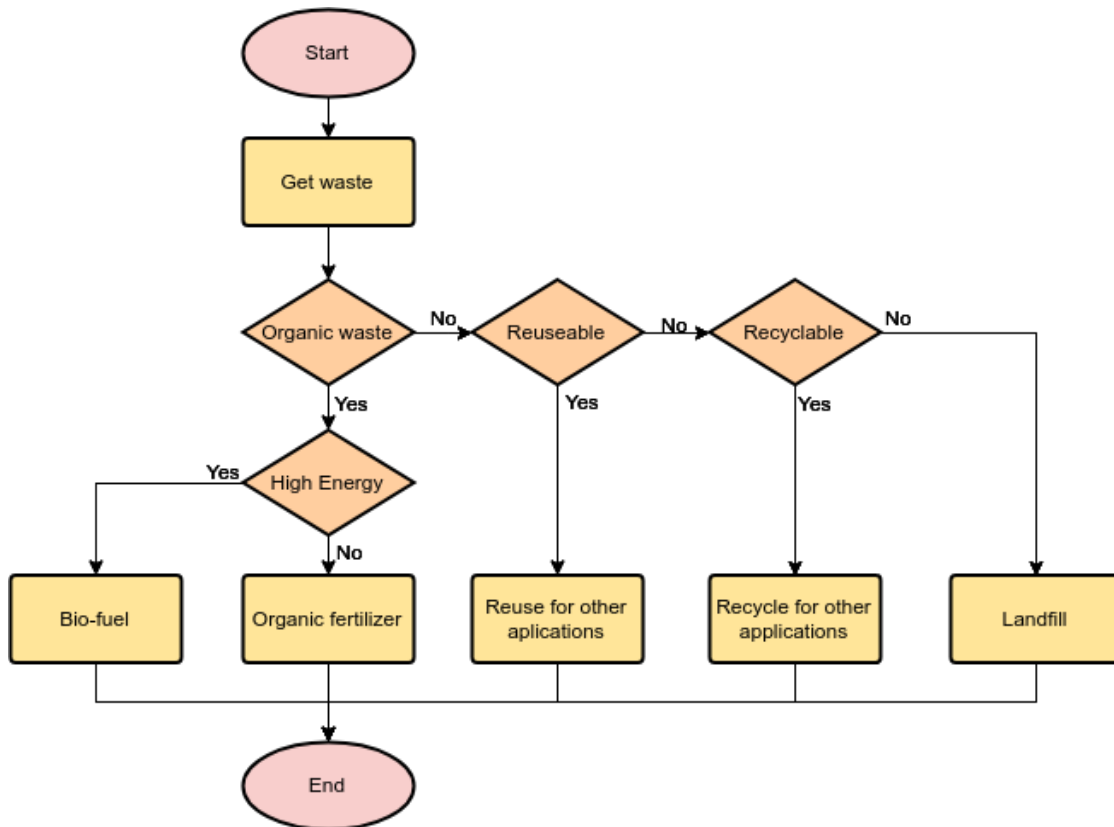


Figure 1: Solid waste management

Data Collection from Households:

In this study, we selected one colony from each category in every part using a random number generator. This method resulted in the selection of 30 colonies, calculated as $8 \times 2 + 7 \times 2$. Each colony had a sample size of three households, leading to an initial total sample size of 90 households (30 colonies \times 3 households per colony). However, few colonies from part A are identified as industrial areas rather than residential ones, and therefore, the survey was not conducted in these areas. This adjustment reduced the total sample size to 81. Out of these, responses were obtained from 72 households, making the final sample size 72.

For data collection in each colony, we started by visiting a randomly chosen house and then proceeded to visit every 10th household. If a particular household did not respond, it was skipped, and the next 10th household was visited instead. The specific details of the colonies visited are documented separately. [15-18] The primary data source for this study is a survey conducted in various specified areas. To gather information on waste disposal practices, we conducted a household survey across categories A to H. This approach helps us understand how and where households dispose of their waste. The results are then compared across categories to determine if there are significant differences. Categories A&B, C, D&E, and F, G&H are organized for comparison purposes. Statistical significance tests are carried out for categories C, D&E, and F, G&H, but are not applied to A&B because of their samples.

Outcomes reveal waste disposal and collection at three levels: households, Dhalao workers, and segregators/waste collectors. We identified and analysed the disposal methods practiced by households. The primary data was collected through household surveys, which detailed the waste collection process, including transportation, storage, and segregation. The segregation process was scrutinized due to its increasing importance. Ideally, segregation should occur at the source, but this is not always the case. We examined various stages of waste segregation, whether done by household, waste collectors, or segregators. This exploration also traced the waste journey to its final destination, the landfill. Qualitative questions were posed to individuals involved in the segregation process to gain deeper insights into existing issues. We focused on the collection and segregation processes due to significant differences between residential and slums. The process at each stage is influenced by money, and survey outcomes also shed light on the role of authorities.

RESULTS FROM SURVEY:

A total of 174 households were visited, resulting in 76 respondents. This equates to a response rate of 44%.

Type	1&2	2,3&4	5,6&7	Sum/Average
Houses	34	68	72	174
No. of persons	9	32	36	77
Rate of response	26%	47%	50%	44%
Standard error	0.059	0.072	0.072	0.04

Variable Name	P1	P2	Null Hypothesis	Alternate Hypothesis	p-value
Sabarmati Ashram	22/31	24/31	$P1-P2=0$	$P1-P2\neq0$	0.3
Dust bins	4/31	3/34	$P1-p2=0$	$P1-p2\neq0$	0.89
From Houses	9/32	7/35	$P1-p2=0$	$P1-p2\neq0$	0.41
Dispensary	8/31	3/34	$P1-p2=0$	$P1-p2\neq0$	0.49
Efficiency	3/31	3/34	$P1-p2=0$	$P1-p2\neq0$	0.76

A total of 60 households reported the absence of different coloured bins. Additionally, it was noted that lower-income areas lacked bins entirely, making the provision of different coloured bins irrelevant. In such areas, open dumping is the most common practice due to the lack of bins. We inquired about the disposal methods for dry leaves in each area, motivated by the potential for dry leaves to serve as an inexpensive source of manure. In over eight areas, dry leaves are burned. In five areas, the leaves are either left on the roads or the residents are unaware of their disposal. Three regions, regions, the leaves are either left on the streets or the due to dense building developments and the absence of parks. Only a few areas utilize dry leaves for manure; otherwise, they are either swept away or mixed with other waste. [19-20]

Regarding household waste composition, the majority of the waste was kitchen and paper waste, though households could not specify the exact proportions. We also asked households about their waste segregation practices. The personal attributes of the individuals involved in segregation, such as income level and education, are directly linked to their waste management behaviours.

Twenty-one households provided details on their segregation practices, with each household mentioning multiple items they segregate. Most households reported segregating paper, primarily due to the potential for resale in the second-hand goods market. Kitchen waste was also commonly segregated due to the unpleasant odour it generates when mixed with other waste, and because it is classified as wet waste. Few houses segregate both dry and wet waste. Promoting the culture of waste segregation is essential, shifting from an incentive-based approach to one of responsibility.

We conducted a survey by the Doctors dispensaries, focusing on two areas: Bhadra Fort and Nagina Wadi. Unfortunately, the survey did not yield valuable information due to the doctors' reluctance to answer the questions. Since the study concentrated on government-provided health facilities, private doctors were excluded, and sampling issues arose. From the health department, we gather information for all zones of Ahmedabad. Ultimately, due to the lack of useful information, the survey was excluded from the survey.

Therefore, the outcomes regarding health impacts are derived from household reports, with limitations such as a small sample size and a minimal number of households responding to this part of the questionnaire. When asked about their choice of medical care during illness, 55 households stated they go to a private doctor or hospital, whereas

only 12 households reported visiting a government dispensary. Additionally, four households mentioned that they "can't afford" medical treatment.

The commutation expenses to the dispensary due to low income and distance. Two households reported "self" either because they were doctors themselves or. A two-tailed test for proportions was conducted, which turned out to be insignificant.

We further inquired if the government provided free health facilities to households. Fifty-five households responded "no," and again, a two-tailed test for proportions was conducted, yielding insignificant results. Regarding diseases affecting children under five, only 16 out of 72 households responded. We faced several limitations, including:

Inadequate responses from households with children under five.

Lack of knowledge about the names of diseases.

Inability to recall the frequency of disease recurrence.

Due to the inability to gather concrete results, the findings are not included.

Households perceived that the diseases because of improper management all types of waste include diarrhoea, breathing problems, infections, illnesses, eye problems.

According to 54 households, waste is typically transported by small vehicles in many areas.

The existence of AMC collection points was found to be significant, especially in categories C, D, and E, compared to categories identified by household F, G, H. However, the presence of local community bins was found to be insignificant.

A test comparing the cleanliness of storage facilities set up by AMC revealed no significant difference between categories C, D, and E, and variations E, F, and G. Additionally, a notable misunderstands among households about the existence of waste storage facilities in their area.

Fifty-nine households reported the absence of different coloured bins. Moreover, the lack of bins in the few categories makes the question of various colours irrelevant. Open dumping is most prevalent in areas without any bins.

There is no observable trend in paper prices in the second goods market across different types, and responses about plastic prices were either absent or improper. Discrepancies were noted between the values reported by goods and separators, with the maximum value reported by segregators being lower than the minimum price reported by households. This is due to the lack of a perfect market mechanism and the inability of employee to balance for higher prices.

The improper disposal of construction leads to issues such as blocked roads and drains, particularly during the rainy season when water cannot pass through blocked drains. This issue was observed in Law Garden, Jama Masjid The ongoing construction across this area is a common problem in many areas. There is a general unawareness about privatization among households.

CONCLUSIONS

Waste Transportation: In most areas, scrap is primarily sent using hand-driven carts or small vehicles, as reported by the majority of households. This indicates a reliance on manual and small-scale waste transportation methods. **AMC Collection Points:** The presence of AMC collection points is significantly higher in categories C, D, and E compared to F, G, and H. This suggests a disparity in waste collection infrastructure across different categories. However, local community bins are generally insignificant, indicating a potential area for improvement in community waste management facilities. **Cleanliness of Storage Facilities:** There is no valued change in the cleanliness of storage facilities maintained by the AMC cross different categories. A notable issue is the lack of awareness among households regarding the existence of these storage facilities, pointing to the need for better communication and awareness campaigns by the authorities.

Absence of Colour-Coded Bins: The lack of different coloured bins, especially in lower categories, and the practice of open dumping where no bins are available, highlight the deficiencies in the waste segregation and disposal system. This underscores the necessity for the implementation of a more systematic waste segregation approach, including the provision of color-coded bins. **Market Discrepancies in Second Goods:** There is no consistent trend in the value of paper in the market, and responses about plastic prices were either absent or improper. The observed discrepancies between household-reported prices and those reported by segregators indicate a dysfunctional market mechanism. The inability of workers to negotiate higher prices further exacerbates the issue, suggesting the need for regulatory intervention to ensure fair market practices.

Construction Debris Management: The improper disposal of construction debris is causing significant problems such as blocked roads and drains, particularly during the rainy season. This issue is exacerbated by the extensive construction activities related to the Commonwealth Games, making debris management a critical concern. Effective strategies for managing construction debris are urgently needed to prevent these issues. **Lack of Awareness Segregation of Waste:** There is a general lack of awareness about the Segregation of Waste among households, indicating a gap in public knowledge and communication. This calls for efforts to educate and inform the public about the Segregation of Waste and their implications.

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