Household Waste Management in AychitMandir, Mahal, Nagpur: A Study on Generation, Segregation, and Disposal

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Abstract*: Household waste, comprising organic, plastic, metal, glass, and paper, is a growing concern due to improper segregation and disposal. This study analyzed waste management practices in AychitMandir, Mahal, Nagpur, covering 74 households across different socioeconomic groups. Waste was sorted,weighed, and classified daily for seven days. Door-to-door collection, transportation via tricycle rickshaws and tractors, and disposal at Bhandewadi dumping site were assessed. The average daily per capita waste generation was 0.634 kg/capita/day, with 63.6% organic waste being the largest component. 57% of households participated in collection, but only 7% were aware of environmentally safe disposal. Inconsistent segregation and open dumping were major challenges, despite community willingness for improved practices. The study highlights the need for awareness, better infrastructure, and systematic waste management for sustainability.*

Keywords: Household waste, Waste segregation, Waste disposal, Waste management, Organic waste

I. INTRODUCTION

Household waste management is a critical aspect of urban sustainability and environmental protection. The rapid increase in population, urbanization, and changing consumption patterns have led to a significant rise in municipal solid waste (MSW) generation worldwide. Effective waste management strategies are essential to mitigate environmental degradation, reduce health hazards, and promote resource conservation. In developing countries like India, waste management practices often face challenges such as improper disposal, inadequate segregation, and lack of public awareness. The present study focuses on household waste management in AychitMandir, Mahal, Nagpur, highlighting the waste generation pattern, segregation, collection, transportation, and disposal practices.

Proper management of household waste is crucial for maintaining hygiene, preventing pollution, and ensuring efficient resource utilization. The composition of household waste typically includes organic matter, plastics, paper, glass, and metals, among others. If not managed properly, waste accumulation can lead to various environmental and health issues, including air and water pollution, vector-borne diseases, and greenhouse gas emissions. Waste segregation at the source and its proper disposal or recycling can significantly reduce the burden on municipal authorities and enhance sustainability.

Nagpur is one of Maharashtra's rapidly growing cities, facing significant waste management challenges. Mahal, one of the oldest and densely populated areas in Nagpur, generates a substantial amount of household waste. The study focuses on AychitMandir, Mahal, where waste management practices are examined to understand existing issues and suggest improvements. The locality comprises diverse socioeconomic groups, which influence waste generation rates, segregation practices, and participation in waste management initiatives.

The primary objectives of this study are to analyze the composition and quantity of household waste generated in AychitMandir, Mahal, Nagpur, assess the waste segregation practices among households, evaluate the efficiency of collection, transportation, and disposal mechanisms, and determine the relationship between socioeconomic factors and waste generation rates. Additionally, the study aims to identify challenges in household waste management and propose solutions for sustainable waste handling.

ISSN
2581-9429
IJARSCT

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This research is significant as it provides insights into household waste generation and management in a densely populated area of Nagpur. The findings can help municipal authorities and policymakers develop efficient waste management strategies. By identifying key issues in waste segregation and disposal, the study aims to promote awareness and encourage sustainable practices at the household level. Additionally, the research contributes to understanding the impact of socioeconomic factors on waste generation and management behaviors.

II. MATERIAL AND METHODS

1. Study Area
The study was conducted in AychitMandir, Mahal, Nagpur, a densely populated urban locality with a mix of residential and commercial establishments. Mahal is one of the oldest areas in Nagpur, contributing significantly to household waste generation. The selected study site experiences varying waste management practices influenced by socioeconomic factors, infrastructure availability, and public awareness. The study area was chosen due to its diverse population, which provides a representative sample for analyzing household waste management practices.

2. Research Design
A cross-sectional survey-based study was conducted to assess the waste generation, segregation, collection, and disposal practices in the study area. The study involved both qualitative and quantitative approaches to obtain a comprehensive understanding of household waste management.

3. Sampling and Data Collection
- **Sample Selection**: A stratified random sampling technique was used to select households from different socioeconomic backgrounds. A total of *XX* households were surveyed to ensure a representative sample of the population.
- **Survey Methodology**: A structured questionnaire was designed and administered to the selected households. The questionnaire included sections on waste generation patterns, segregation habits, disposal methods, and awareness levels regarding waste management.
- **Household Waste Collection**: To determine the composition and quantity of waste, households were provided with waste collection bins and requested to segregate waste into organic, recyclable, and non-recyclable categories over a period of one week.

4. Waste Characterization and Segregation Analysis
- **Waste Collection Procedure**: Households were instructed to store their daily waste in separate bins, categorizing it into biodegradable (organic waste) and non-biodegradable (plastics, paper, glass, and metals).
- **Weighing and Classification**: The segregated waste was weighed daily using a digital weighing scale. The proportion of different waste components was analyzed to understand the composition of household waste.
- **Organic Waste Assessment**: The moisture content, degradability, and suitability for composting of organic waste were examined.

5. Waste Disposal and Management Practices
- **Collection and Transportation Survey**: Data on municipal waste collection frequency, transportation methods, and the role of informal waste collectors (ragpickers) were recorded.
- **Disposal Site Analysis**: The disposal site used by the local municipal authority was inspected to evaluate its environmental impact and waste treatment facilities.
- **Recycling and Reuse Practices**: Households were asked about their practices regarding recycling and reuse of materials such as paper, plastic, and glass.

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DOI: 10.48175/IJARSCT-23418

ISSN
2581-9429
IJARSCT

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6. Public Awareness and Socioeconomic Factors Analysis

- **Household Interviews**: Interviews were conducted to assess public awareness regarding waste management policies, government initiatives, and willingness to participate in waste reduction programs.
- **Socioeconomic Data Collection**: Factors such as household income, education level, and occupation were recorded to analyze their influence on waste generation and management behavior.

7. Data Analysis

Statistical Tools: Data collected from surveys and waste composition analysis were analyzed using Microsoft Excel and SPSS software. Descriptive statistics, correlation analysis, and regression models were used to examine relationships between waste generation, socioeconomic factors, and management practices.

III. RESULT AND DISCUSSION

1. Household Waste Generation and Segregation Practices

The study found that household waste in AychitMandir, Mahal, Nagpur, is primarily collected using tricycle vehicles, where waste is segregated into dry and wet categories before transportation. The waste is initially dumped at the Junimanglwadi area, where it is transferred from small vehicles to larger transport vehicles. These larger vehicles then dispose of the waste at the Bhandewadi dumping site, the primary landfill for the city.

The results showed that the average daily per capita household waste generation in the study area was 0.634 kg/capita/day. This value is higher than the city's overall per capita waste generation of 0.29 kg/person/day, which may be attributed to differences in income levels, consumption habits, and waste segregation practices across various zones.

Area	Paper and Cardboard	Plastic	Metal	Food and Kitchen
Kunbhipura area	6-7%	3%	2.6%	70-80%
Mahal area	6%	5-6%	3%	80-85%
AychitMundhir area	3-4%	4%	2%	75%

2. Variation in Waste Generation by Income Groups

A statistical analysis revealed significant variations in per capita waste generation across different income groups:

- A statistically significant difference was observed between household size and per capita waste generation in high-income groups, indicating that wealthier households generate more waste due to higher consumption and packaging waste.
- A slight significant difference was noted in medium-income groups, suggesting moderate variations based on household size and consumption patterns.
- No statistically significant difference was found in low-income groups, where waste generation remained relatively uniform due to limited disposable income and consumption.

These findings align with previous studies indicating that higher-income households contribute more to waste generation, particularly in non-biodegradable categories such as plastics and packaging materials.

3. Waste Collection, Transportation, and Disposal

The study found that 37% of households participated in door-to-door waste collection services by paying a fee. However, despite formal waste collection services, a significant portion of waste was found to be disposed of improperly.

Common waste disposal practices included:

- Dumping in communal bins – Practiced by most households.
- Indiscriminate dumping – Some households dumped waste in open spaces, gutters, streets, and bushes.
- Lack of awareness – Many residents were unaware of proper disposal methods or the environmental impact of improper waste management.

The waste disposal system in Nagpur follows a three-tier approach:

- Primary Collection – Households dispose of their waste in tricycle vehicles, which transport waste to transfer points.
- Secondary Transportation – Waste is transferred from Junimanglwadi to larger vehicles for disposal.
- Final Disposal – The waste is ultimately dumped at the Bhandewadi landfill, where open dumping is the primary disposal method.

The low per capita waste generation (0.225 kg/person/day) in the core zones suggests better waste sorting practices compared to outer zones, where open spaces allow for more waste generation. This aligns with the finding that waste segregation is highest in the core city zones due to a longer history of waste management challenges.

4. Public Perception and Willingness to Improve Waste Management

The community expressed a strong willingness to improve waste management practices, provided there was better infrastructure, education, and municipal support. Key observations included:

- Many residents were unaware of the final disposal sites. Even those who knew the locations were uncertain whether disposal practices were environmentally safe.
- Indiscriminate dumping remains a concern, highlighting the need for better enforcement of waste management regulations.
- Residents showed interest in using communal bins and regular collection services, suggesting that enhanced waste collection infrastructure could significantly improve waste management outcomes.

IV. CONCLUSION

The study provides critical insights into the household waste management system in AychitMandir, Mahal, Nagpur. The findings indicate that:

- Organic waste dominates household waste composition (70-85%).
- Segregation practices remain low, leading to inefficient waste disposal.
- Higher-income groups generate more waste, while core city zones exhibit better waste sorting.
- Public awareness and participation in waste management remain limited, requiring stronger education programs and policy interventions.

By implementing improved collection services, recycling programs, and awareness campaigns, municipalities can significantly enhance waste management efficiency and reduce environmental hazards. Addressing these challenges requires collaborative efforts from households, local authorities, and waste management service providers.

Recommendations for Effective Waste Management

Based on the findings, the following recommendations can improve household waste management in the study area:

- Strengthening Awareness and Education Programs – Public education campaigns should focus on the importance of waste segregation, composting, and responsible disposal practices.
- Improving Door-to-Door Collection Services – Expanding coverage and ensuring regular waste collection can prevent indiscriminate dumping.
- Introducing Financial Incentives – Encouraging households to segregate waste through reduced waste collection fees or rewards for proper segregation.
- Enhancing Recycling and Composting Facilities – Establishing decentralized composting units and community recycling centers to process organic and recyclable waste efficiently.
- Enforcing Municipal Regulations – Strengthening waste management policies and imposing penalties for illegal dumping can improve compliance.
- Integrating Informal Waste Collectors – Recognizing and formalizing their role can enhance recycling efficiency while improving livelihoods.

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DOI: 10.48175/IJARSCT-23418

ISSN
2581-9429
IJARSCT

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