



Assessment of Plastic Waste Management in Mymensingh City: Current Sources, Generation Trends, Management Practices, and Challenges

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Abstract: Plastic waste has become a critical environmental concern in urban areas of Bangladesh, with Mymensingh Municipal Area experiencing rapid growth in plastic consumption and disposal. This study investigates the sources, composition, and management practices of plastic waste in the region, while identifying the key challenges and potential solutions. The findings reveal that packaging materials are the predominant type of waste (43%), with single-use plastic bags contributing significantly (39%). Household consumption emerges as the leading source (46%), while community drop-off points serve as the primary collection method (52%). Major challenges include ineffective waste segregation (38%) and limited community engagement (29%), which hinder efficient management. The study highlights the urgent need for a holistic approach that integrates infrastructure development, public awareness campaigns, policy interventions, and community participation. Such measures can enhance the effectiveness of plastic waste management and promote the transition towards eco-friendly packaging practices, thereby reducing the adverse impacts of plastic pollution in Mymensingh city and beyond.

Keywords: Plastic Waste; Plastic waste generation; Waste management; Challenges; Mymensingh city.

INTRODUCTION

Plastic is a synthetic material that is widely used in many different sectors and plays a significant role in daily life. Plastics can be shaped into various forms while in a pliable state, solidifying into a rigid or slightly elastic state afterward. The distinctive characteristics of plastics, including their lightweight nature, affordability, durability, strength, resistance to corrosion, thermal and electrical insulation, and adaptable design capabilities, contribute to their widespread use (Thompson RC *et al.* 2009). Plastic

waste refers to any discarded or abandoned plastic material that has reached the end of its useful life cycle. This includes a wide range of items such as plastic bags, bottles, packaging, containers, and other products made from synthetic polymers that are no longer needed or wanted (Jambeck *et al.* 2015). Between 1950 and 2015, about 8,300 million tonnes (Mt) of virgin plastics were produced across the globe, generating approximately 6,300 Mt of plastic wastes, of which about 9% have been recycled, 12% incinerated, and 79% accumulated in landfills (Babayemi JO *et al.* 2019).

Bangladesh faces significant challenges related to plastic waste management due to rapid urbanization, industrialization, and population growth. Plastic waste is a pervasive issue in Bangladesh, with inadequate infrastructure for waste collection, recycling, and disposal. This has led to widespread littering and dumping of plastic waste in waterways, streets, and open spaces, contributing to environmental pollution and public health hazards (Rahman, M. M. et al. 2020). With the rapid development, the per capita consumption of plastics in Bangladesh has drastically risen from 2.07 kg in the year 2005 to 3.5 kg in 2014 with a cumulative production of 3000 tons of plastic waste every day, which is the 8% of total generated waste. Moreover, the per capita plastic consumption increased at a rate of 16.2% between the year 2005 and 2014, whereas the rate was around 25% throughout the world (Monjur M et al. 2017).

Mymensingh Municipality, located in Bangladesh, faces significant challenges regarding plastic waste management. With a growing population and urbanization, the municipality is grappling with the increasing accumulation of plastic waste, which poses environmental, health, and aesthetic concerns. Plastic waste, including single-use plastics such as bags, bottles, and packaging materials, often ends up clogging drains, polluting water bodies, and littering streets. Mymensingh City Corporation has 33 wards and generated 57.7 tons of plastic waste per day (Al-Amin et al. 2024). Plastic waste poses significant environmental challenges, including pollution of water bodies, soil degradation, and harm to wildlife. Understanding the management practices in Mymensingh can help identify effective strategies to mitigate these impacts, safeguarding local ecosystems and biodiversity. This research aims to find the current scenario of plastic pollution in Mymensingh municipal area, identify the sources of plastic waste generated, mismanagement status of plastic waste, suggestion and challenges. In the face of rapid urbanization and a burgeoning population, Mymensingh grapples with mounting challenges in handling its plastic waste. Effective plastic waste management in the Mymensingh municipal area is essential for protecting the environment, safeguarding public health, enhancing urban aesthetics, conserving resources, ensuring regulatory compliance, and advancing sustainable development goals.

MATERIALS AND METHODS

Study Area

The research methodology employed in this study involved the selection of sites, observation, and the collection of data through a combination of questionnaire

surveys and interviews in both formal and informal settings. Data has been collected from primary and secondary sources. Primary data were collected through the questionnaire survey. The study focused on the

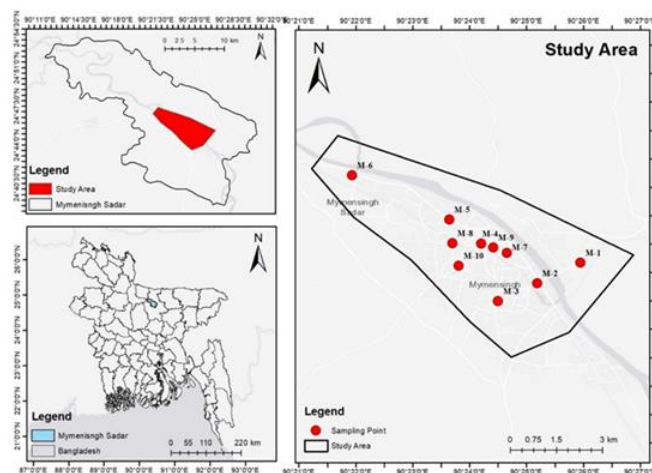


Figure 1. Study area (Mymensingh Municipal area)

Mymensingh city area within the Mymensingh Municipal Area (latitude: 24°45'0.00"N, longitude: 90°25'0.12"E) in Mymensingh District, situated along the Old Brahmaputra River Figure 1. Preliminary information about the study area was gathered through initial investigation. The survey period, conducted from January 2024 to March 2024, involved careful adherence to the study's aims and scope. A total of 50 interview schedules were prepared, with 30 designated for retailers and 40 for consumers. Prior to finalizing the schedule, a pre-test was conducted to assess its suitability, leading to necessary corrections and modifications. Rigorous checks were conducted after each interview to ensure accurate recording of information. Analysis of the compiled data utilized statistical software like SPSS 14.00 for Windows 11 and Microsoft Office Excel 2021.

The primary methods of data collection

The most common types of plastic waste collection methods in Mymensingh Municipal Area is community Drop-off point, constitutes 52% of the plastic waste, mixed waste collection represents 31% and Door-to-door

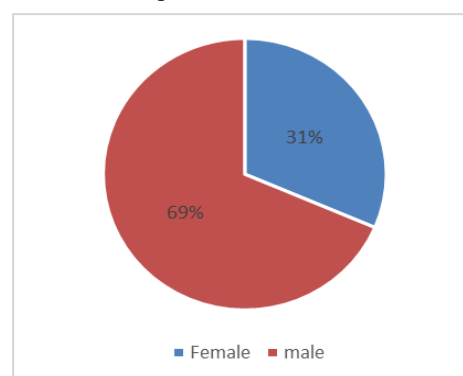


Figure 2. Male and Female participants in Mymensingh

collection makes up 17% of the all plastic.

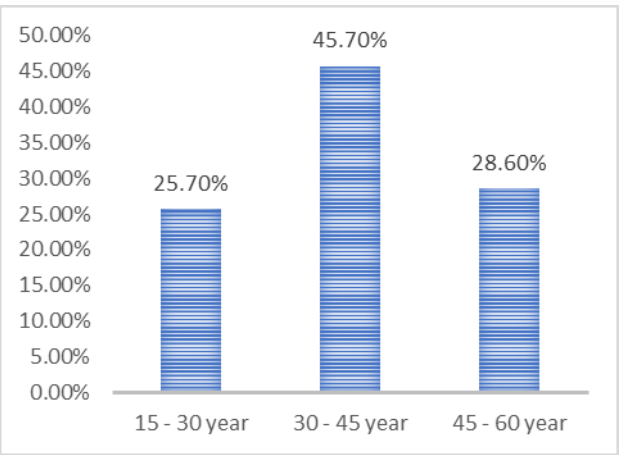


Figure 3. Interviewed participants in Mymensingh

The research included both male and female participants for data collection, comprising males (69%) and females (31%). The respondents' educational background were categorized into five groups: only signature, primary, secondary, higher secondary, graduate. Among them, major respondents were secondary 28% and minor was only signature 6%. Other respondents were 26% higher secondary, 23% primary and 17% graduate. We collected majority of data from male respondent because of their occupation which is related with our study. We had considered mostly a range of 30-45 years interval as respondent because of considering mature one. Ages 15-30 years this group constitutes 25.70% of the respondents, Ages 30-45 years: The largest group, accounting for 45.70% of the respondents and Ages 45-60 years is a group comprises 28.60% of the respondents.

Product characterization

To estimate plastic waste (PW) from total solid waste (TSW), we use the following simple equation:

PW=TSW×P plastic

Where:

PW = Plastic Waste (kg)

TSW = Total Solid Waste (kg)

P plastic = Percentage of plastic waste in total solid waste

RESULTS AND DISCUSSION

The primary source of plastic waste in Mymensingh Municipal Area

The pie chart you provided illustrates the primary sources of plastic waste in Mymensingh Municipal Area. The chart is divided into four segments, each representing a different source of plastic waste Household consumption in the largest segment, colored in grey, constitutes 46% of the plastic waste. Commercial establishments the orange segment represents 5%. Public events and gatherings the yellow segment accounts for 6% of the total waste and in the blue segment, labeled as “All,” represents the remaining 43%. The pie chart, there’s text that reads “Figure 4 the primary source of plastic waste in Mymensingh Municipal Area,” indicating that this is the fourth figure in a series of data visualizations.

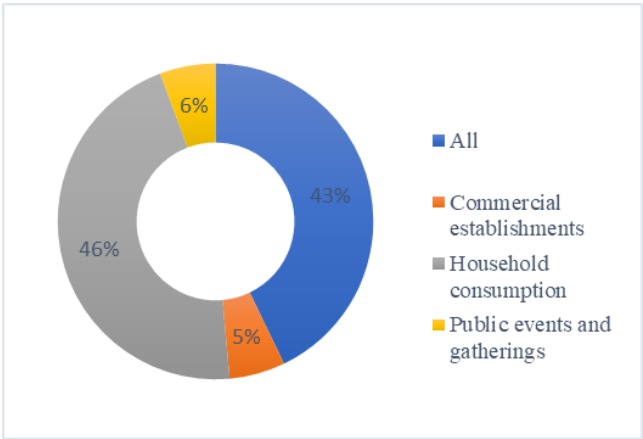


Figure 4. The primary source of plastic waste in Mymensingh Municipal Area

Major types of Plastic waste generated in Mymensingh

Different types of plastic waste found in Mymensingh city which includes six major types of plastic wastes. Major plastic wastes are- polythene bags, plastic wrappers, disposable cups, plates, and cutlery, straws, plastic packaging, water bottles, soft drinks bottles, oil, shampoo, detergent bottles, Plastic buckets, mugs, furniture, Toys, household items, Medicine blister packs, Plastic gloves, PPE waste, Plastic fishing nets and ropes etc. Table 1.

It consists of three segments, each corresponding to a most common type of plastic waste. Plastic waste and Percentages: Packaging materials the largest segment represents 43% of the plastic waste generation. Plastic bottles, is a smallest corresponds to 18% of the plastic waste generation. Single-use plastic bags can be Contribute 39% in the plastic waste in Mymensingh Municipal Area.

Table 2. shows that most common type of plastic waste found in Mymensingh Municipal Area.

Major plastic waste	Types of Plastic waste
Single-Use Plastics	• Polythene bags • Plastic wrappers (food, snacks, etc.) • Disposable cups, plates, and cutlery • Straws and stirrers • Sachets and multilayer plastic packaging
Hard Plastics	• PET (Polyethylene Terephthalate) water, soft drinks bottles • HDPE (High-Density Polyethylene) containers (oil, shampoo, and detergent bottles) • Plastic buckets, mugs, and furniture • Toys and household items
Plastic Packaging	• films and wraps for food packaging and carry bags • chips packets, biscuit wrappers • food containers and protective packaging
E-Waste Plastics	• Plastics from old electronic devices (laptops, mobile phones, televisions) • Cables and circuit board plastics
Medical & Pharmaceutical Plastics	• Syringes and IV bags • Plastic gloves and PPE waste
Fishing & Agricultural Plastics	• Plastic fishing nets and ropes • Mulching films used in agriculture

Plastic waste generation in Mymensingh city

This pie chart illustrates the distribution of plastic waste generated per family in Mymensingh City. The blue color in a largest segment, occupying 57%, represents families that generate approximately 1 kg of plastic waste, the orange segment represents families generating approximately 2 kg, accounting for 29%, and the gray segment indicates families generating more than 3 kg of plastic waste contribute to 14% of plastic waste generated in Mymensingh city weekly. From total solid waste, plastic waste percentage calculated 12.4% in Mymensingh.

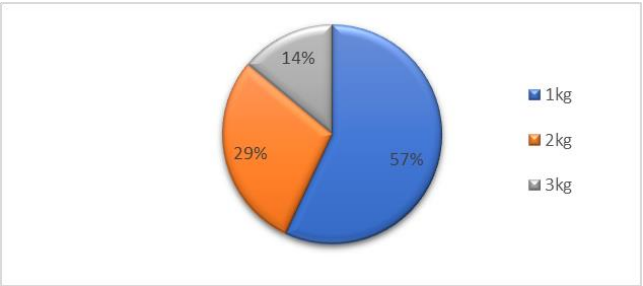


Figure 5. Plastic waste generation by each family Mymensingh city weekly

Table 3. Percentages of Plastic waste generation in Mymensingh per day

Most common type of plastic waste	Percentage
Single-use plastic bags	39%
Plastic bottles	18%
Packaging materials	43%
Total	100

Table 2. The most common type of plastic waste found in Mymensingh

Sample	Total Solid Waste (kg)	Plastic Waste (kg)	Percentage of plastic waste
Sample-1	2	0.23	11.5
Sample-2	3	0.37	12.3
Sample-3	4	0.49	12.25
Sample-4	5	0.62	12.4
Average	3.5	0.48	
Total	14	1.71	
Percent	100	12.2	

Current Management Process of plastic waste in Mymensingh

Plastic waste management from households in Mymensingh municipal area. The chart illustrates plastic waste management in Mymensingh households. Locally recycled waste accounts for 14.70%, landfill disposal dominates at 82.40%, and 2.90% is used for energy generation. While recycling efforts exist, improvement is needed. Incineration offers energy recovery but requires careful management. The chart visually represents waste distribution, emphasizing the need for better recycling practices.

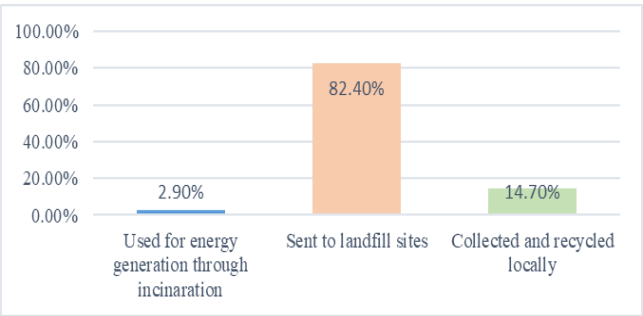


Figure 6. Plastic waste managed from households in Mymensingh Municipal Area

The management of plastic waste generated in shops

The bar chart illustrates plastic waste management in shops within the Mymensingh municipal area. The largest portion (58%) is burned due to limited waste management infrastructure or awareness of alternatives. Municipal waste management services collect 21%, reflecting some efforts toward responsible disposal, though this remains low. Around 18% is discarded in regular trash bins, often out of convenience or lack of awareness. Only 3% is recycled through local facilities, highlighting the need for improved recycling infrastructure. Addressing these disparities requires promoting sustainable practices and enhancing recycling efforts.

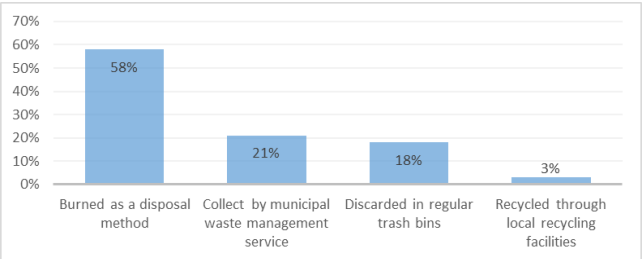


Figure 7. The management of plastic waste generated in shops

Table 4. Sustainable Substitutes for Plastic in Mymensingh Municipal Area, highlights the distribution of eco-friendly materials. Biodegradable polymers dominate at 56%, followed by eco-friendly alternatives (26%), recycled paper products (15%), and plant-based packaging (3%). The preference for biodegradable polymers indicates a shift toward sustainability, reducing plastic usage.

Table 4. Sustainable substitute for plastic in Mymensingh Municipal Area

Sustainable substitute for plastic	Percentage
Biodegradable Polymers	56%
Eco-Friendly Alternatives	26%
Recycled Paper Products	15%
Plant-Based Packaging	3%
Total	100

Community initiatives aimed at reducing plastic waste in Mymensingh

Community initiatives aimed at reducing plastic waste in Mymensingh. Here strongly support and participate the larger portion about 66% of respondents who actively support and participate in these initiatives, smaller segment accounts for 34% of respondents who express support and may potentially participate in these efforts.

Table5. The current status of plastic waste management system in Mymensingh

Current status of plastic waste management system	Percentage
Somewhat satisfied	24%
Very satisfied	6%
Unsatisfied	55%
Very unsatisfied	15%
Total	100

Table 5. illustrates public satisfaction with plastic waste management in Mymensingh. The majority (55%) are unsatisfied, 24% are somewhat satisfied, 15% are very unsatisfied, and only 6% are very satisfied. The data reflects community concerns about the system's effectiveness.

Common plastic waste open burning in Mymensingh Municipal Area

The pie chart illustrates the frequency of plastic waste open burning in Mymensingh. Frequent burning accounts

for 74%, occasional burning 23%, and rare occurrences 3%. The data underscores the need for improved waste management to mitigate environmental harm.

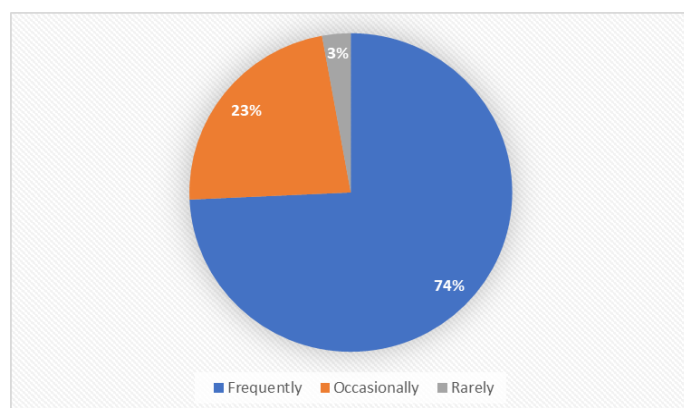


Figure 8. Common plastic waste open burning in Mymensingh Municipal Area

The primary challenge in the current plastic waste management system

The pie chart highlights key challenges in plastic waste management in Mymensingh. Lack of public awareness and insufficient waste collection infrastructure each account for 38%, followed by inadequate government regulation (18%) and limited recycling facilities (6%). Addressing these issues is vital for effective waste management.

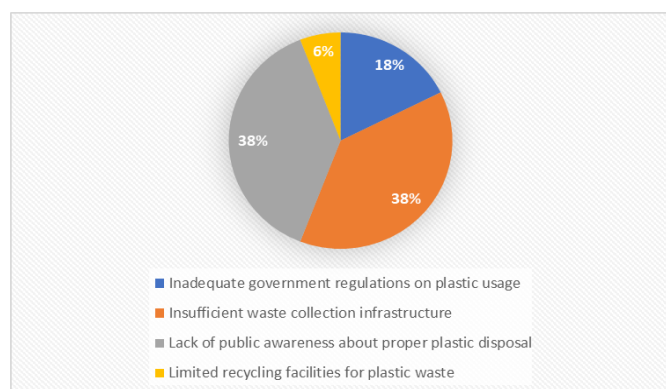


Figure 9. The primary challenge in the current plastic waste management system

CONCLUSIONS

The research highlights the need for a comprehensive plastic waste management strategy in Mymensingh Municipal Area. Packaging materials make up the largest share of plastic waste (43%), followed by single-use plastic bags (39%) and plastic bottles (18%). Waste collection primarily relies on community drop-off points (52%),

mixed waste collection (31%), and door-to-door services (17%). Most families generate 1 kg of plastic waste (57%), while 29% produce 2 kg and 14% exceed 3 kg. Households are the main waste source (46%), with commercial establishments (5%) and public events (6%) contributing. Mismanagement stems from poor waste segregation (38%), limited community engagement (29%), lack of business incentives (21%), and weak enforcement of anti-littering laws (12%). Plastic waste open burning is frequent (74%). Urgent action is needed through policy reforms, public awareness, and sustainable waste management to curb plastic pollution and protect the environment.

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Conflict of Interest

There are no conflicts of interest declared by the authors.

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