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AN ASSESSMENT OF SOLID WASTE MANAGEMENT OF HOUSEHOLDS: A CASE STUDY IN KHULNA CITY

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ABSTRACT

Solid waste management (SWM) is the collection, transportation, and disposal of all non-liquid and non-gaseous specimens from residential, commercial, and institutional structures. The severe environmental repercussions of SWM, including the pollution of the air and water around landfills and the encroachment of landfills onto arable land, have reached critical stages. The study focuses on the current situation regarding household participation in SWM in Khulna city, where waste creation is irregular, resulting in heaps of waste, and the effectiveness of SWM is characterized in collection, transportation, and disposal. The research comprised 222 households from 12 different areas, which generate 336 kg of organic waste and 58 kg of plastic waste daily. The total organic and plastic waste generation in Khulna is estimated to be 360 tons and 63 tons, respectively. The majority of the families that responded used one or more of the eight different waste disposal methods.

***Keywords**: Environmental repercussions, waste disposal methods, solid waste management, recycle.*

INTRODUCTION

For the ecosystem and its population to be viable and healthy, solid waste management is essential. The main element in preventing the onset of other environmental problems is effective solid waste management. The issue of managing solid waste is one that affects different regions of the world on varying scales. The extent to which various nations are attempting to contain the solid waste issue determines the size of the difficulty. With Bangladesh's rapid population expansion, urbanization, and industrial development, the amount of waste produced annually is rising dramatically (Alam and Qiao, 2019). In underdeveloped nations like Bangladesh, the most common method of waste disposal is the disposal of non-segregated solid waste in landfills (Jahan et al., 2016). Solid waste disposal has been a persistent issue in the majority of developing nations, especially in locations with high population density, significant refuse output, and a lack of land suitable for landfills (Sadek and El-Fadel, 2000). Khulna, being a fast-growing city in Bangladesh, bears the burden of the ongoing issues brought on by the massive amount of waste that is produced and the dearth of waste treatment infrastructure, technology, funding, and management. Roughly 270–300 tons of rubbish are collected and deposited at the Rajbandh landfill dumping site in Batiaghata upazila, whereas Khulna city typically generates 500 tons of solid waste every day (Golder and Alamgir, 2018). The rest that is left scattered across the city poses a significant threat to the environment as a whole. In order to maintain ongoing development in that area, Adhikary et al. (2012) explained that Khulna City Corporation needs to have a socio-ecological equilibrium. To safeguard the country's natural resources and to promote sustainable growth, they emphasized, the ecological footprint must be maintained. According to Bari et al. (2012), KCC should play a significant role in raising health risks and sickness among the populace. Additionally, they stated that despite having the resources to fix any gaps in solid waste management, including those caused by the lack of dustbins, portable public restrooms, and sewers, they do not prioritize meeting community needs. This study aims to estimate the city of Khulna's output of organic and plastic trash, as well as waste disposal practices. Furthermore, to quickly assess Khulna's current solid waste management system and explore ways to improve it.

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METHODOLOGY

Figure 1: Khulna City (Google map)

Selected Study Areas

Khulna is Bangladesh's third-largest city, in the south-western part of the country, on the Rupsha and Bhairab Rivers; it covers an area of 59.57 sq km (Area, Population, and Literacy Rate by Paurashava, 2001). Through online and offline inquiries, 222 households from 12 different areas of Khulna were selected for the study. Data were collected from 222 families, consisting of 944 members, from every location in Khulna city.

Data Collection and Procedure

This research was started by conducting a reconnaissance survey in the selected 12 areas of Khulna city. It was difficult to gather information because the population varies from place to place, as does the economic status and waste type. To acquire the exact waste types and weight, a questionnaire was made. This questionnaire was used to collect waste patterns as well as waste volume via online and offline speculations. Additionally, the disposal methods of waste are also being collected with the help of the questionnaire. Subsequently, the collected data was then analyzed using the Excel software, where the volume of total organic waste and the volume of total plastic waste were determined. Furthermore, daily organic and plastic waste generation per capita is calculated. The data collection was done throughout the months of August and September of 2022. Finally, the current status of solid waste management (SWM) in Khulna city is observed.

RESULTS AND DISCUSSION

Evaluation of Waste Generation

A source reduction strategy, at-source sorting, and resident education are all important components of an integrated approach to solid waste management that goes beyond technology. Waste in both organic and plastic form was gathered from twelve different locations throughout Khulna. The following table provides an overview of waste collection for this study. For the 222 households, which included approximately 944 family members, the total volume of organic waste was determined to be 336.05 kg daily, and the total volume of plastic waste was estimated to be 58.321 kg daily.

Table 1: Details of study areas and collected information.

Area in Khulna Metropolitan	Number of households	Number of family members	Organic waste (Kg) daily	Plastic waste (Kg) daily
Fulbarigate	16	78	26.85	3.67
Khalishpur	16	64	21.8	5.64
Daulatpur	22	83	18.9	2.25
Boyra	12	53	15.25	3.04
Sonadanga	14	63	18.5	4.15
Sheikhpara	21	90	41.2	8.315
Basupara	9	40	13.9	1.88
Gollamari	15	58	13.25	1.311
Nirala	33	137	51.9	10.77
Purbo Bania Khamar	27	127	42.8	5.565
Tootpara	19	74	34.5	6.82
Rupsha	18	77	37.2	4.91
12 Areas	222 Families	944 Members	336.05 Kg	58.321 Kg

Table 1 elicits the fact that the organic waste was found to be greatly higher than the plastic waste. According to the survey and analysis, the total amount of organic waste production for the population of Khulna city is expected to be 360 tons, and the total amount of plastic waste production for the population of Khulna city is expected to be 63 tons. Consequently, it is projected that the daily per capita organic and plastic waste generation is 0.356 kg per person and 0.062 kg per person, respectively.

Determination of Organic Waste Generation

Materials originating from living things are found in organic waste. Municipal solid waste, industrial solid waste, agricultural residues, and wastewater all contain various types of organic pollutants. Although organic wastes are frequently burned or dumped alongside other rubbish in landfills, some organic wastes can be composted or applied to the ground since they decompose naturally.

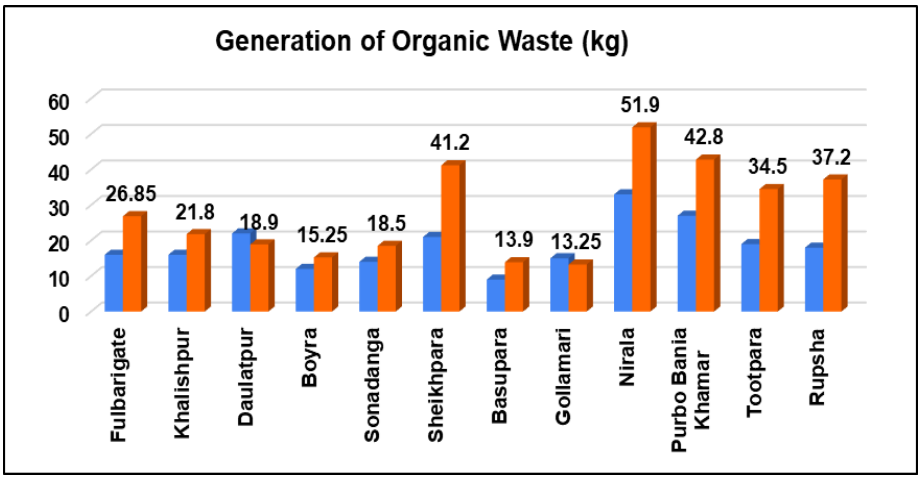

Figure 2: Volume of produced organic waste.

Figure 2 depicts that the volume of organic waste generated can vary from house to house. As the total number of family members varies and the usage of daily household products also changes, the wastage also decreases or increases day to day. However, according to the research, it is evident that the volume of organic waste is higher than that of plastic waste.

Determination of Organic and Plastic Waste Generation

One of the most typical materials to be discovered in household trash is plastic. The buildup of plastic objects and particles, such as bottles, bags, polythene, plastic cutlery, masks, etc., is known as plastic pollution. Chemically robust synthetic and semi-synthetic materials are used to make plastic. Plastics are, therefore, quite challenging to get rid of.

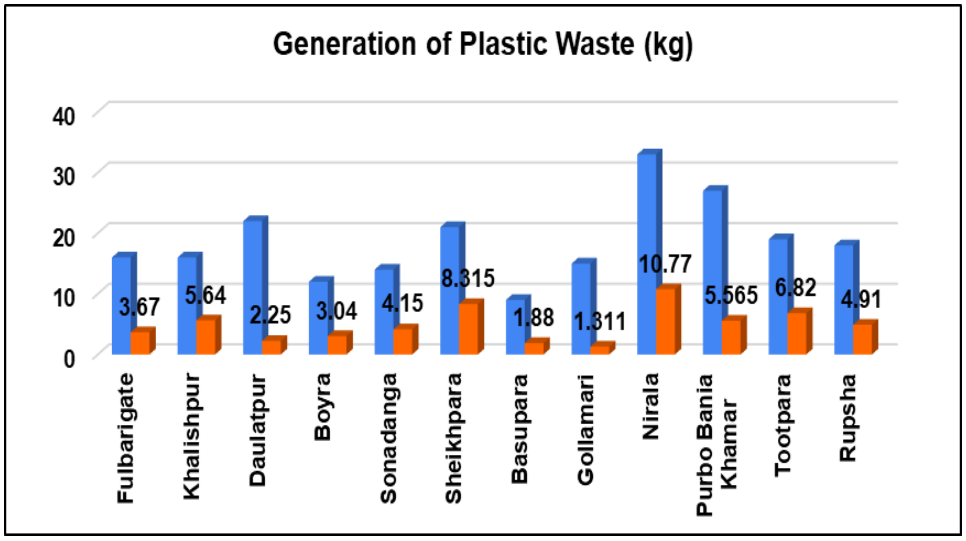

Figure 3: Volume of produced organic waste.

Figure 3 illustrates that the volume of plastic can also vary from family to family, like the organic waste. Although the volume of plastic waste is quite low compared to organic waste, even some houses don't produce plastic waste every day.

Waste Disposal Methods

The data that was collected from the 222 households delineates that people usually follow eight procedures to dispose of the waste generated in their house. Although most families use more than one method to throw away waste. A brief description of the disposal methods as well as the percentages of using each method are illustrated as follows:

a) Dispose waste in a specific dustbin

Many people take their waste to the nearest trash can and throw it there. Although it is a good method to dispose of waste, they do not appropriately follow the method. They randomly throw waste here and there.

b) Dispose waste to a local sewage

Some people throw away their waste into the local drain. Hence, the drain gets blocked, and the water flow rate gets hampered. As a result, during the rainy season, the level of waste in the drains rises and spills onto the roads. As the government became strict in this regard, the rate of this disposal method decreased over time.

c) Give waste to a waste collector

As KCC introduced waste collectors, the majority of people now dispose of their trash this way. It is simple to dispose of the waste produced in this manner. Hence, people have adapted it quite well.

d) Incinerate waste

A few people burn their waste if they get the chance. It is prohibited by the government to burn, especially plastic waste, as it creates fumes that pollute the environment.

e) Compost Organic Waste for Gardening or Fuel

Some people use organic waste as a natural fertilizer, which is a good thing. Moreover, a few people compost the organic waste for biofuel. Although the rate of composting organic waste has decreased over time.

f) Feed Organic Waste to Animals

Few people use their organic garbage as a means of providing food for domestic animals. They feed animals such as cows, goats, chickens, ducks, and so on.

g) Recycle Plastic and Electronic Waste

Some people nowadays recycle their waste. The government and other organizations are increasingly recommending that people reuse their waste, and more people are eager to do so.

h) Sale Plastic and Electronic Waste

Many people sale their electronic and some usable plastic waste to the local vendors. It is common among the people, as by doing it they can earn money and get rid of their waste at the same time.

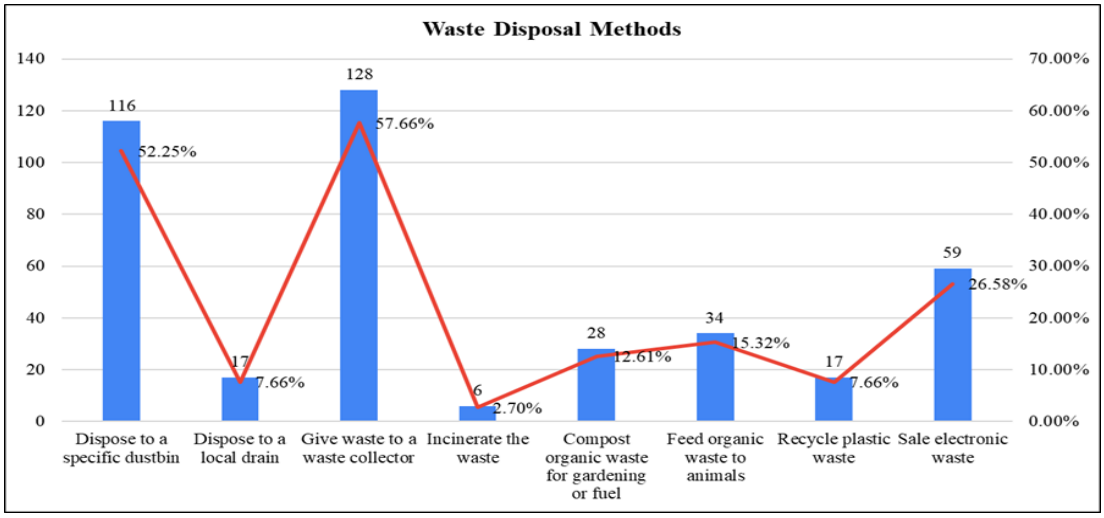

Figure 4: Percentage of different waste disposal method

Figure 4 illustrates the various ways people dispose of their garbage. However, the vast majority of people dispose of their waste in a variety of ways. Many people, for example, give their organic waste to waste collectors and sell their electronic and plastic waste to local vendors. The majority of the 222 families (944 respondents) that responded used one or more of the eight different waste disposal methods, with 128 (57.66%) and 116 (52.25%) of the families providing their trash to a waste collector assigned by the KCC and/or disposing of waste in a designated dustbin, respectively. Subsequently, 28 (12.61%), 34 (15.32%), and 59 (26.58%) families, respectively, dispose of waste via composting for gardening or fuel, feeding domestic animals, and/or reselling plastic and electronic garbage to local vendors. In addition to recycling plastic and electrical garbage,

17 families (7.66%) also dump their trash into the local sewage system. Finally, 6 families (2.70%) out of 222 incinerated their waste.

CURRENT STATUS OF SOLID WASTE MANAGEMENT IN KHULNA CITY

The primary responsibility for the collection and disposal of all waste types in Khulna falls on the Khulna City Corporation (KCC). These responsibilities and actions are handled by numerous different divisions within the city corporation. According to Halim (2021), in this department, more than 356 employees and more than 50 authorities are working to find a solution to the solid waste crisis in Khulna City. Around 114,000 homes and 790 different small- and medium-sized manufacturing businesses have garbage that they are gathering, removing, and disposing of. According to this study, a single person in Khulna generates on average 0.356 kg of solid garbage. However, the scenario is dissimilar from the real-world example. The amount of solid trash being transferred to the disposal area is only 0.2 kg, and KCC does not properly manage or treat the remaining solid waste. KCC has hired individuals to work on the area-based garbage collection currently being implemented. Initially, waste collectors would visit residences and offices every day to collect trash. They must receive 50 to 100 BDT in pay each month, and they get one day off every week. They transport the recyclables to secondary waste dumping sites using a local waste collection van. The trash is then transferred from the masonry and secondary bins to Khulna's primary waste dumping site, known as Rajbandh, by KCC-approved trucks. The Rajbandh landfill site lies nine kilometres from the centre of Khulna city in a rural area. It is claimed that the 504.31 crore BDT budget for the 2020–2021 fiscal year, coupled with the 462 cleaners and 25 transport trucks, is insufficient to support KCC's solid waste management (Talukdar, 2020).

WAYS TO IMPROVE THE SOLID WASTE MANAGEMENT SYSTEM

In Khulna city, solid waste management is an ongoing challenge caused by the huge amount of waste generated and the lack of waste treatment facilities, technologies, finance, and management. Despite these challenges, KCC as well as the public can improve the solid waste management system by implementing the following methods:

- ❖ Ensure that all household and office garbage is collected by waste collectors.
- ❖ Keep the waste collection fee as low as possible. The government can raise funds for public waste collection.
- ❖ Make strict laws and regulations and put them in place to ensure that proper waste disposal techniques are followed.
- ❖ Prohibit everyone from throwing trash here and there, incinerating waste, or throwing it in the local sewage.
- ❖ Implement laws such as fines and even jail time for those who are not following the appropriate waste disposal procedure.
- ❖ Ensure that the hawkers and vendors also follow these laws in collecting, buying, or disposing of garbage.
- ❖ Construct covered trash cans every few blocks throughout the city so that people can dump their trash there as well.
- ❖ Introduce a biodegradable waste recycling system so everyone can use it for biofuel.
- ❖ Make the waste collection vehicles (i.e., truck, van) more suitable for the environment.
- ❖ Ensure that the waste at the main landfill area is properly disposed of.
- ❖ Separate organic and inorganic waste and dispose of or treat them in accordance with expert recommendations.
- ❖ Promote and raise general awareness about the advantages of an appropriate waste management system and how to select one.
- ❖ Install a waste treatment plant to properly dispose of the waste as well as produce biofuel if possible.

CONCLUSION

The generation, collection, and disposal of trash as well as the institutional and infrastructural capability for waste management have all been identified as crucial factors for solid waste management. Participation is also essential for the management of solid waste to be successful. People in developing nations like Bangladesh want to live in an environment that is unpolluted, hygienic, and secure. If the government and the people don't step up, it will be difficult to develop an efficient garbage collection and disposal system, which is necessary to make these goals a reality. Understanding the advantages, one would experience and having a positive attitude concerning solid waste management are key factors in determining one's intention to assist and take part in any activity. It is vital to assess the existing state of waste-related issues before choosing the best waste management strategy. It comprises information such as how much trash is produced, what types of garbage are generated most frequently, how it is maintained, who is accountable for managing it, what resources these actors already have available to manage the waste, etc. It is crucial to find answers and put them into action right away since, as Khulna's population grows, so does the amount of waste produced there. The government and other charitable organizations ought to contribute to the required funding and increase public awareness. The only way to prevent the consequences in the future is to take immediate action.

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