



# Household Plastic Waste Mis-Management Effect On Environmental Plastic Pollution.

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## Research area:

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## ABSTRACT

The world today is facing the challenge of rational resource management and recovery for the huge amount of plastic waste. The lack of technical skills for hazardous waste management, inadequately developed recycling and recovery infrastructure, and, above all, a lack of knowledge about rules and regulations are key factors. Behind this huge accumulation of plastic waste. The severity of plastic pollution has detrimental effects on the environment and the entire ecosystem. In this study, domestic waste is one of the main sources of municipal solid waste including food waste, paper, plastic, rags, metal, and glass from residential areas. The main bottleneck lies in its removal. This study could provide the Jaipur government with background information to determine the future implementation of household waste segregation activities. This study also proposes to focus on community involvement in segregation at source, waste minimization, and recycling as a habit and way of life. Local governments can facilitate this by providing bins for sorting waste and by setting up waste banks and recycling facilities on a larger scale than those currently available. The indiscriminate disposal of plastic waste at an astonishing rate has led to the search for comprehensive, effective, and sustainable remediation studies in search of a practical alternative to the management, disposal, and destroy plastic debris. While there are a number of processes such as incineration, landfilling, and recycling already in place, they are unsustainable, expensive, and have serious impacts on the environment, wildlife, marine, and human health.

## KEYWORDS:

Plastic waste, household waste, waste separation, disposal of plastic, Environment

## Introduction:

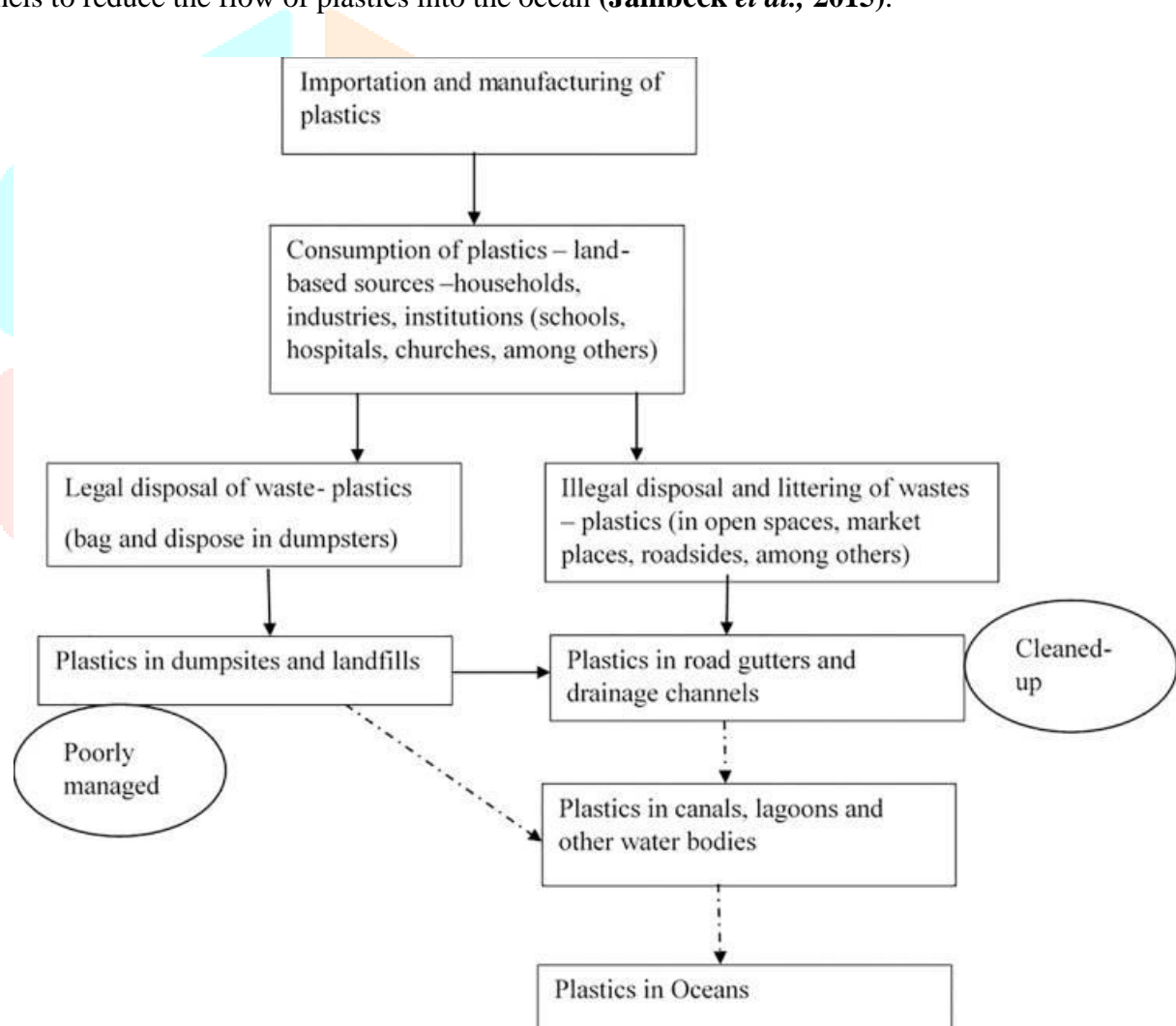
Plastic is the most useful manmade synthetic product, composed of ingredients taken from fossil fuel resources. It enabled the majority of the 21st-century economic and technical revolutions. Polyethylene (LDPE, MDPE, HDPE, LLDPE), polypropylene (PP), polystyrene (PS), polyvinyl chloride (PVC), polyurethane (PUR), polybutylene terephthalate (PBT), and nylons are all utilized extensively within the food, pharmaceutical, clothing, shelter, transportation, construction, medical, and recreational time industries over a period of 30 years considering these substances are lightweight, cheap to manufacture, highly resistant to damage, and relatively unbreakable (**Kumar et al., 2007**).

The use of plastic has increased intensively in daily life due to its durability, lightweight, easy availability, and inexpensiveness. The problem that occurs is that they are not highly stable and not easily degraded, thus accumulating in our environment and causing pollution (**Vijaya & Reddy, 2008**). Most of the plastic used is inert, which due to improper waste management and uncontrolled littering accumulates in our environment, leading to ecological and health-related problems (**Comăniță et al., 2016**).

Considering stability and flexibility, the plastics are impeccably adequate for use with numerous accomplishments (**Hossain et al., 2021; Klemeš et al., 2021; Joseph et al., 2021**). Plastics are now the world's third-largest production material, second only to concrete and steel (**Watts, 2019**). Similarly, due to its widespread applications across the globe, plastic manufacturing may continue in the future (**Mihai et al., 2021; Kumar et al., 2021**). The manufacturing and use of plastic products on a global level have been on the rise since 1950. Approximately 8300 million tons of plastic were made, and 6300 million tons of plastic waste were thrown in landfills or dispersed into the environment (**Boucher et al., 2017; Watkins et al., 2019**). In addition, about 415 million tons of plastic are produced annually worldwide (**Azoulay et al., 2019**). The contribution of plastic waste to municipal solid waste (MSW) is significant and cannot be ignored (**Barchiesi et al., 2021; Xu et al., 2020**). The recycling of plastic waste is nearly 14–18% (**Haward, 2018**). Likewise, part of recycling, 24% of plastic waste is managed through energy recovery, and the remaining 58–62% has directly been disposed of in landfills or open environments (**Geyer et al., 2017**). Due to the poor global waste management policies, around 10–12 tons of non-degradable harmful plastic waste have been dumped in water bodies (**Hu et al., 2021; Bulannga et al., 2022**). It is also estimated that 1.2–2.4 tons of plastic waste enter the ocean from rivers annually (**Maghsodian et al., 2022; James et al., 2022**).

The use of plastics is deeply embedded in our daily lives, in everything from grocery bags and cutlery to water bottles and sandwich wraps. But the quest for convenience has gone too far and we are failing to use plastics efficiently, wasting valuable resources and harming the environment. Plastic overconsumption and mismanagement of plastic waste is a growing menace, causing landfills to overflow, choking rivers, and threatening marine ecosystems (**Plastics Europe, 2015**). Asia has emerged as a hot spot for plastic pollution because of rapid urbanization and a rising middle class, whose consumption of plastic products and packaging is growing due to their convenience and versatility. But local waste management infrastructure has not kept pace, resulting in large quantities of mismanaged waste.

Household waste is one of the primary sources of Municipal Solid Waste comprising food waste, paper, plastic, rags, metal, and glasses from residential areas (Abdullah *et al.*, 2017). After a single use, these plastic products are either properly disposed of or littered and dumped in open places, roadsides, market places, among others. Properly disposed ones are collected by municipal waste collectors and disposed of in dumpsites and landfills. The illegally disposed and littered ones are blown by the wind or stormwater into road gutters and drainage channels through which they end up in canals, lagoons, other water bodies, and the ocean. Limiting illegal waste, especially plastic waste disposal would limit their entry into the oceans, hence to need to find a way to limit illegal disposal. Also, given poor management, some of the plastic wastes at the dumpsites are dispersed by wind and found in drainage channels and waterways, ending up in the ocean. However, cleaning up road gutters and drainage channels before the onset of rains, as indicated in **Figure.1**, will reduce the flow of plastics into waterways and oceans. Hence this study estimates the factors that influence the willingness of households to participate in the clean-up of road gutters and drainage channels to reduce the flow of plastics into the ocean (Jambeck *et al.*, 2015).



**Figure.1:** Conceptual framework showing the pathway of generation of plastic waste in the environment and their flow into the oceans.

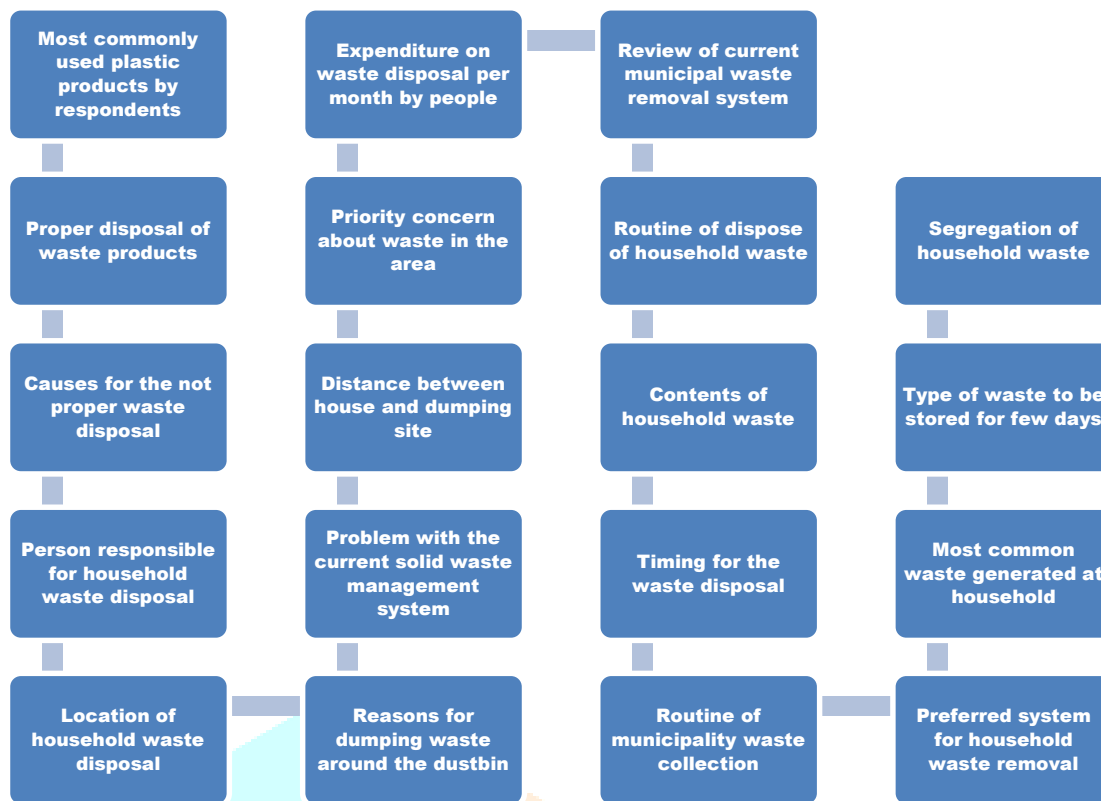
## Material and Methods:

### Data collection:

Data were collected from 160 respondents. The study subjects were selected using a random sampling technique. A deductive approach was selected to gather the data. The target population was comprised of all the households in Jaipur city (a population of 3.1 million) but it was impossible to do an investigation with such a large number population therefore, a multi-stage random sampling technique was employed to select an appropriate sample to evaluate the objectives of this study. Therefore, in the initial stage, 4 major areas with respect to each direction (Jaipur East, Jaipur West, Jaipur North, and Jaipur South) were randomly selected in Jaipur City. In the second stage, 4 minor areas from each direction (Jaipur East, Jaipur West, Jaipur North, and Jaipur South) were randomly selected out of all the major areas. The localities in east Jaipur were Adarsh Nagar, Malviya Nagar, Sikar Road, and Subhash Nagar. In the north were Bani Park, Shivaji Nagar, Jhotwara, and Shastri Nagar. In the south were Babu Nagar, Sanganer, Jawahar Nagar, and Jagatpura; and in the west were Nirman Nagar, Mansarovar, Vaishali Nagar, and Vivek Vihar. In the third stage, 10 households from each minor area were eventually selected as the sample size from neighboring households which were in the distance of 100 to 200 m far from each other. Among the visited households, at least one member of the family was picked randomly for the study regardless of his/her age, educational status, sex, and occupation as long as he/she was willing.

### Methods:

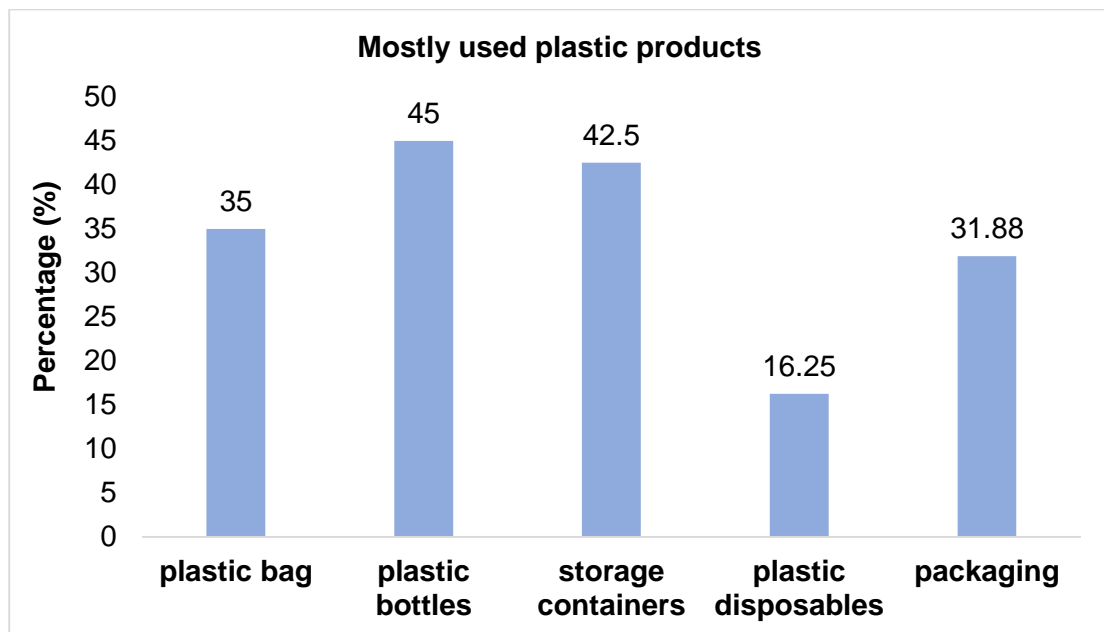
The data for the study of the nature, pattern, quantum, and variability of plastic intake in each household was obtained from the sampling technique. The most commonly used plastic products were categorized on the nature of plastics such as plastic bags, plastic bottles, storage containers (buckets, bins, barrels, etc.), plastic disposables, and packaging materials (sachets, food packets, food containers, and others). The data of the survey was represented in the form of a bar graph diagram. For the study of plastic use, disposal, and management by each household, an online survey was also conducted which consisted of 30 questions in it regarding the use of plastic at different levels at home and their disposal of, people's behavior regarding plastic use, disposal, its effects on nature, their dependency on it, and various things which were covered in the questionnaire. Data from the survey was represented in the form of a pie diagram. During the online survey, numerous questions were asked in various formats:



## RESULT & DISCUSSION:

### A) Use of plastic products survey

Of the 160 respondents, the largest proportion of them (45%) used plastic bottles at high frequency as compared to other plastic products. Despite being aware of the severe impacts of plastics on human health and the environment, the reasons for preferring plastic products are their cheap cost, light weight, durability, easy availability, and lack of alternative materials. The most commonly used plastic products are bottles, storage containers, carry bags, and packaging materials (**Figure.2**). This was followed by the usage of plastic storage containers (buckets, barrels, and baskets) (42.5%), plastic bags (35%), plastic packaging products (31.88%) and plastic disposables (16.25%). These results revealed that the majority of the respondents in each category use plastic bottles in their daily life. The results also indicated that the usage of plastic bottles is high among residents of Jaipur City, and the residents noticed the increasing trend of usage of plastic bottles from time to time.



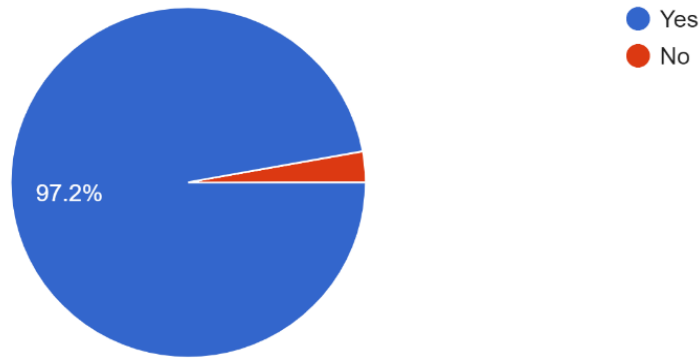
**Figure.2:** Most commonly used plastic products by respondents

### B) Plastic waste management at household level survey

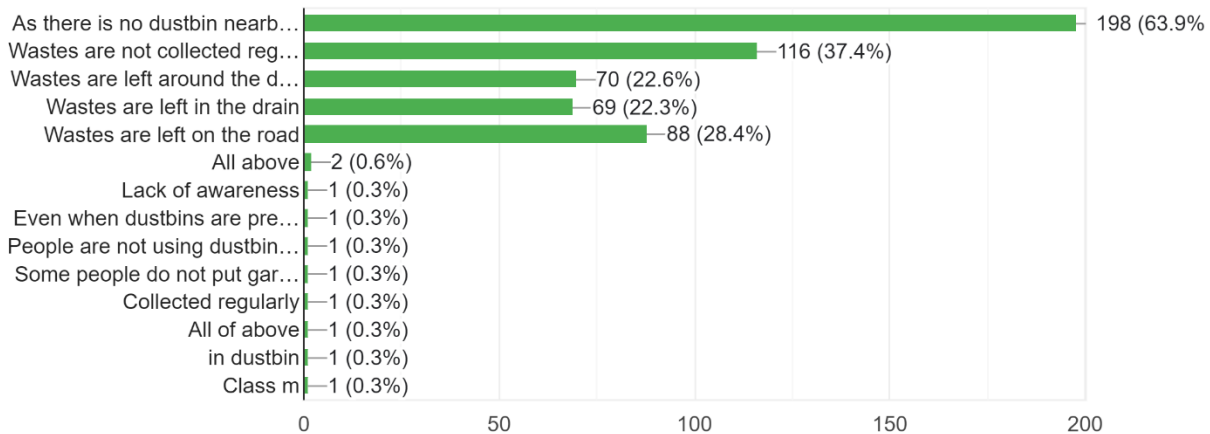
For the study of plastic use, disposal, and management by each household, an online survey was also conducted and 317 responses were collected. During the survey, it was found that solid waste management was done by the Jaipur Nagar Nigam municipality in all the areas. The majority of the head of the household respondents were literate (**94%**) and were well aware of the solid waste management system. The survey's findings showed that the majority of city residents utilized plastic items extensively in their daily lives, irrespective of gender, education level, age group, or occupation. It is understood that plastic products quickly turn into waste after being used. As a result, the respondents were also questioned regarding the methods they utilized to get rid of waste plastic products.

The respondents were asked if the waste is not disposed of properly, it can pollute the environment (**Figure.3**), and **97.2%** of the respondents agreed and answered the question yes, that plastic is harmful to the environment and human health if not disposed of properly. The main cause for this problem was investigated and responses were collected (**Figure.4**). The majority of **63.9%** population is not able to discard the waste as there is no availability of dustbins nearby. **37.4%** population finds it hard to dispose of plastic waste as it is not collected on a regular basis. **28.4%** of respondents have observed that the waste is left on the road.



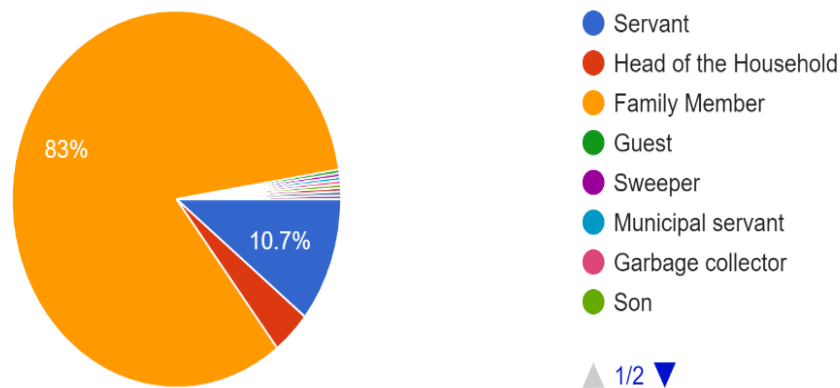


**Figure.3:** Proper disposal of waste products



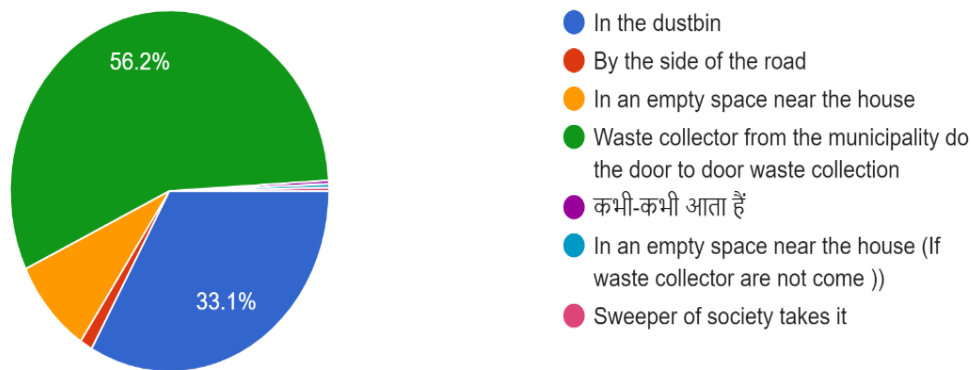
**Figure. 4:** Causes for the not proper waste disposal

Most of the household waste is disposed of by the family member (83%) in Jaipur city and in many houses by the servants (10.7%). (Figure.5)



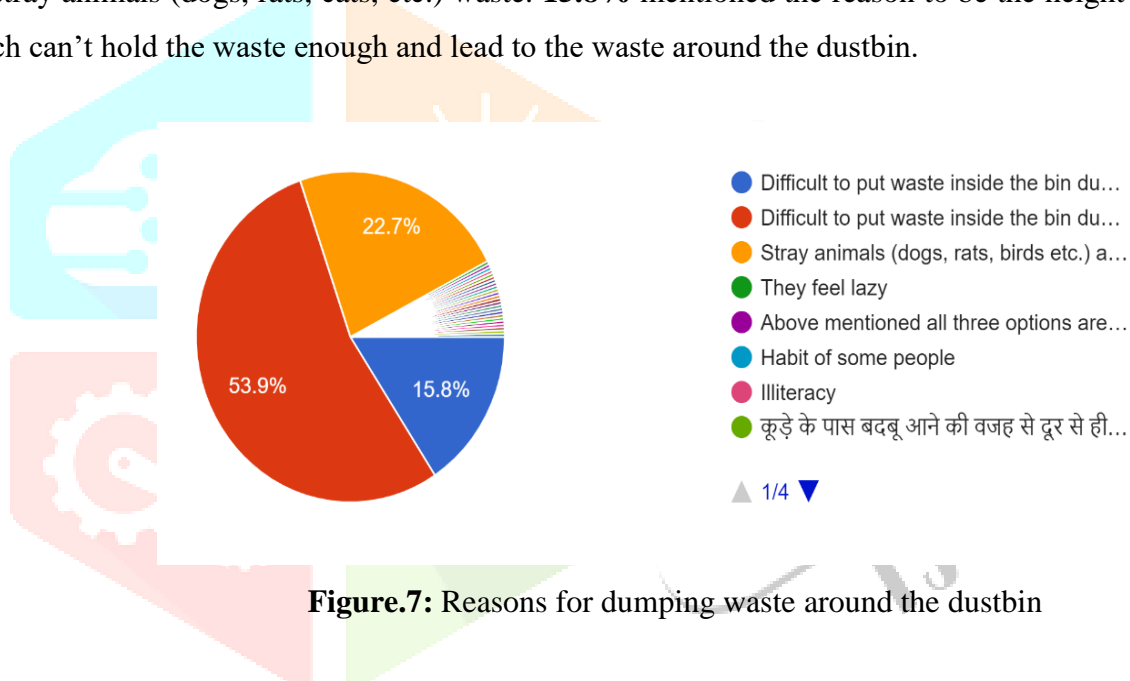
**Figure.5:** Person responsible for household waste disposal

In the survey (Figure.6), 56.2% of waste is collected from door to door by the Jaipur Nagar Nigam Municipality. 33.1% of the waste is dumped and collected from public dustbins.



**Figure.6:** Location of household waste disposal

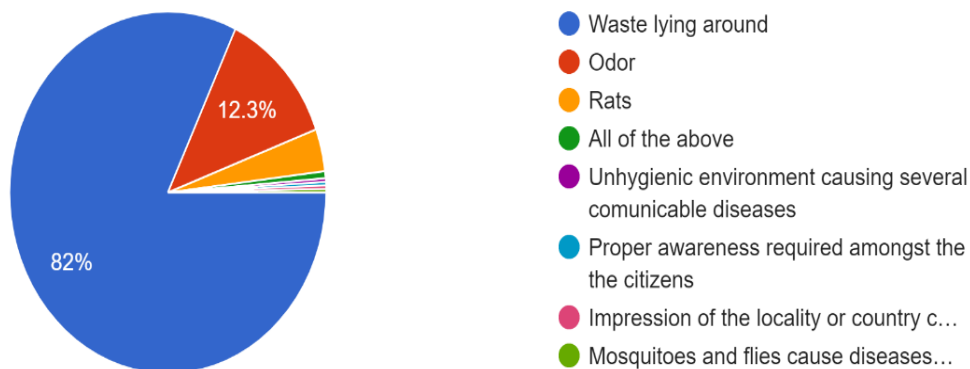
It is commonly noticed that most of the waste is dumped around the dustbin rather than put inside it. The cause was analyzed (**Figure.7**) and **53.9%** responded that it is difficult to put the waste inside the dustbin due to the garbage and litter spread around the bin. **22.7%** of respondents identified the reason to be due to the stray animals (dogs, rats, cats, etc.) waste. **15.8%** mentioned the reason to be the height of the dustbin which can't hold the waste enough and lead to the waste around the dustbin.



**Figure.7:** Reasons for dumping waste around the dustbin

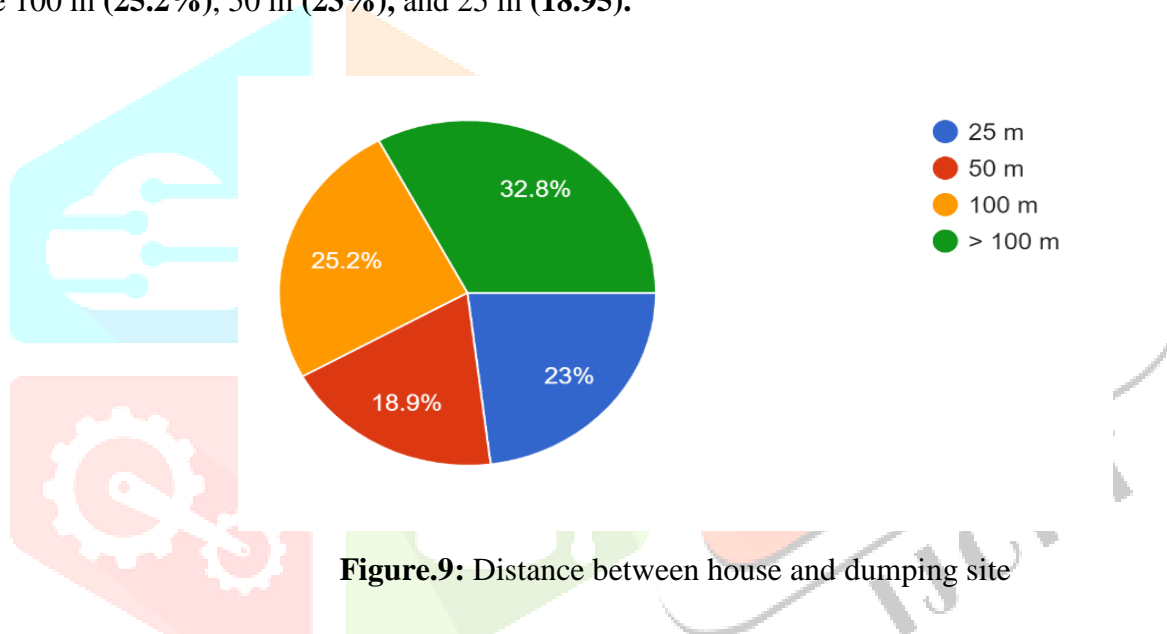
A worldwide environmental problem is determining how to manage the growing amounts of solid garbage pollution. In addition to the rising amounts, an insufficient management system is largely to blame for the generated waste. Due to inadequate knowledge of guidelines, waste management generally lacks organization and planning. To identify the main problem respondents were asked about their view on the issue with the current solid waste management system (**Figure.8**). Due to the ignorance of the solid waste management system, several problems to the environment and human health occur, such as the waste is lying around (**82%**), bad odor (**12.3%**), the emergence of rats, unhygienic environment leading to many communicable diseases, etc.





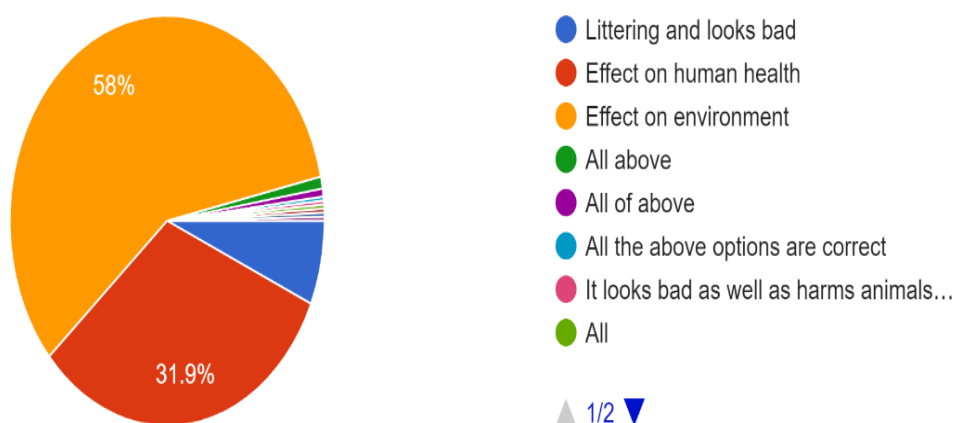
**Figure.8:** Problem with the current solid waste management system

For every household waste management, there is a dumping site for every area. For most of the respondents (**Figure.9**), the dumping site was within 100 m (**32.8%**). And the average dumping site distance was found to be 100 m (**25.2%**), 50 m (**23%**), and 25 m (**18.95%**).



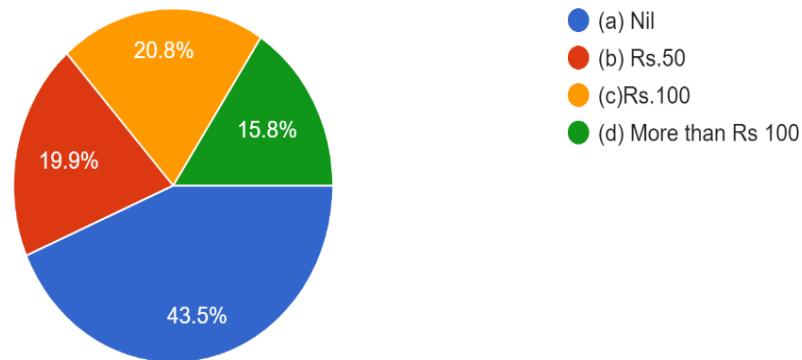
**Figure.9:** Distance between house and dumping site

The waste building up in the neighborhood still is a concern for people. People are now more aware of the effects of waste developed in the surroundings and their effect on the environment (**58%**), human health (**31.9%**), and the piling up of waste and bad odor (**Figure.10**).



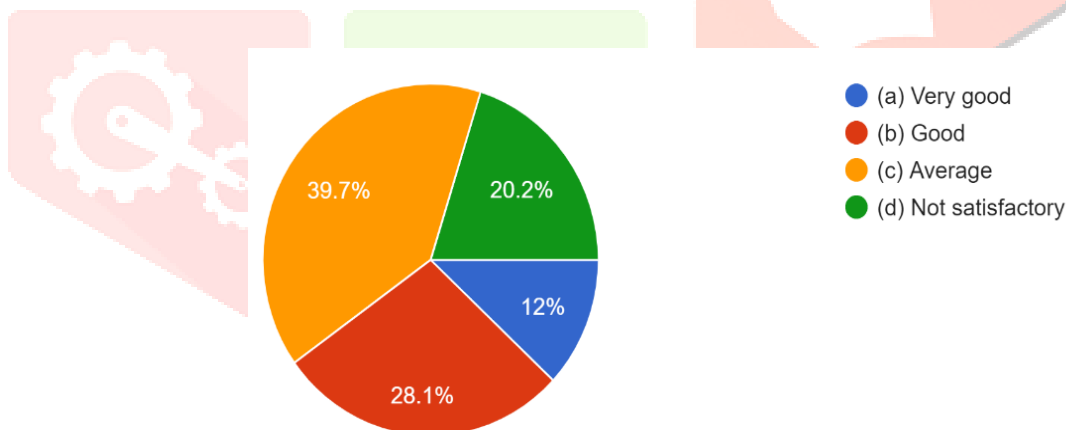
**Figure.10:** Priority concern about waste in the area

Respondents were asked about their current spending for waste disposal per month (**Figure.11**). Majority of people **43.5%** don't get involved whereas **19.9%** spend Rs. 50, **20.8%** spend Rs. 100, and **15.8%** spend more than Rs. 100 waste disposable per month.



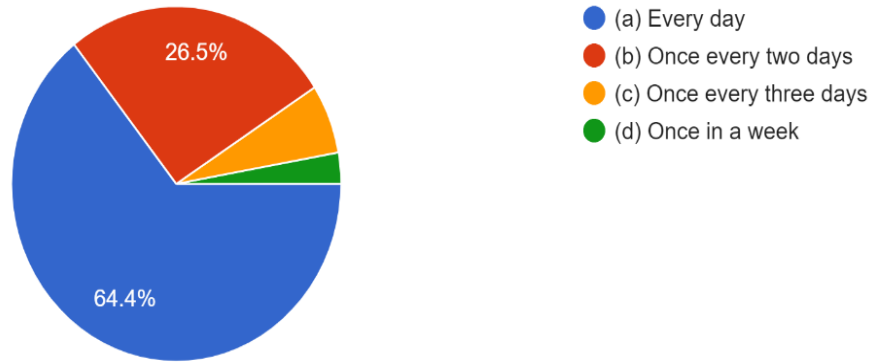
**Figure.11:** Expenditure on waste disposal per month by people

The municipal system is responsible for removing the waste from the city. However, each waste management system is not able to fulfill every task. On asking about the satisfaction level of the concerned municipal system (**Figure.12**), **39.7%** were commonly satisfied whereas, **28.1%** rated the system to be good enough and **12%** of respondents were very satisfied and happy with the municipal system service. **20.2%** were not satisfied with the municipal system service.



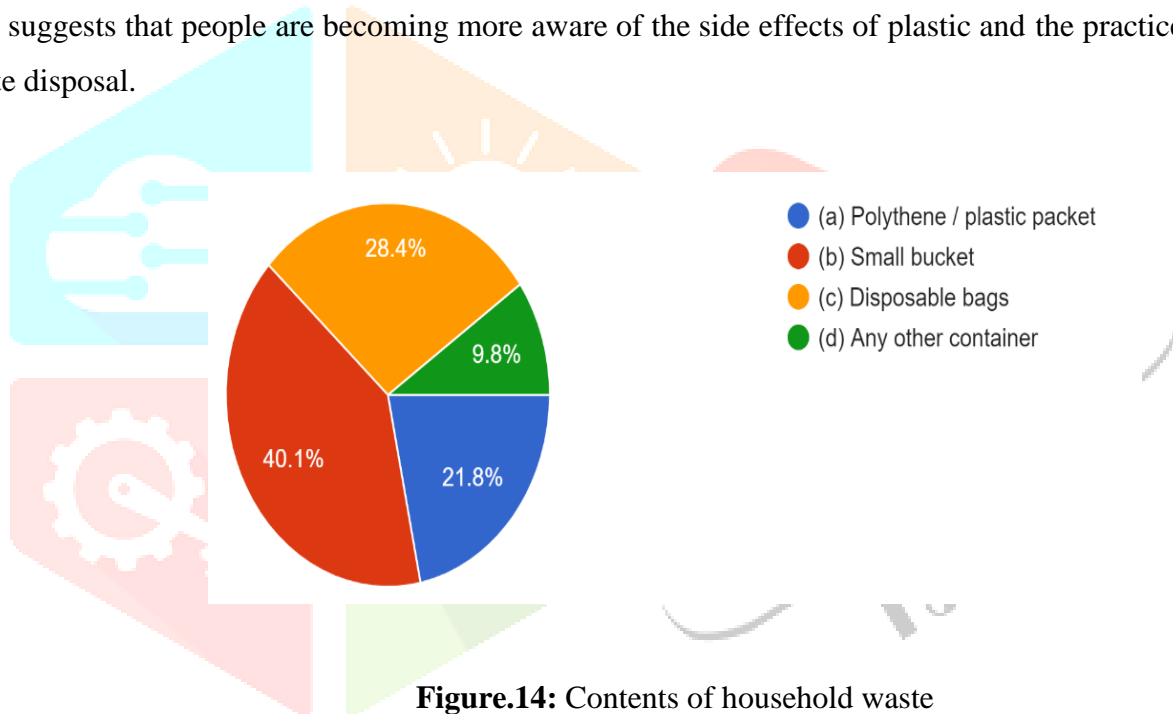
**Figure.12:** Review of the current municipal waste removal system

Every household disposes of its waste on a regular periodic basis. The majority of the people dispose of waste every day (**64.4%**) whereas **26.5%** of people dispose the waste on a period of every two days (**Figure.13**). This can be considered a positive outcome of initiatives like Swachh Bharat Mission and also because of media highlighting environmental issues like plastic pollution and proper waste management.



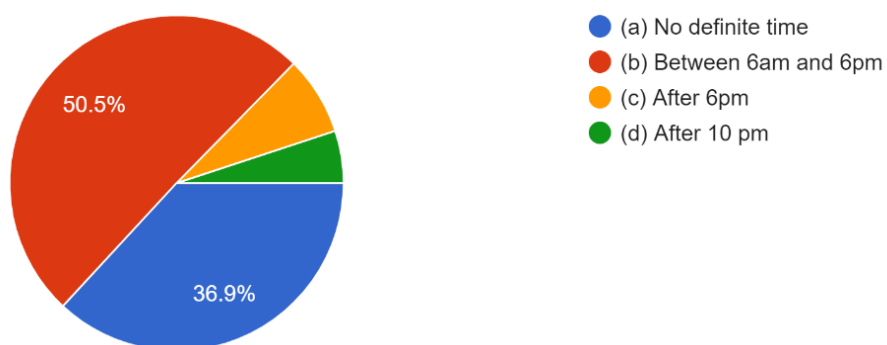
**Figure.13:** Routine of disposing of household waste

The method of disposing of the waste is different for each household (**Figure.14**). Some people practice waste disposal in polythene or plastic bag (**21.8%**), some utilize disposable bags (**28.4%**) and some uses any type of container (**9.8%**). The majority of people practice waste disposal in a small buckets (**40.1%**). This suggests that people are becoming more aware of the side effects of plastic and the practice of proper waste disposal.



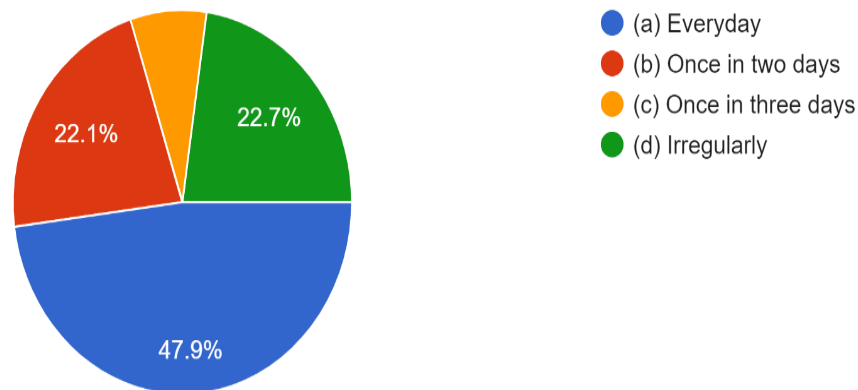
**Figure.14:** Contents of household waste

For disposing of the waste **50.5%** of respondents prefer the time between 6 am to 6 pm whereas for **36.9%** there is no definite time for the waste disposal (**Figure.15**).



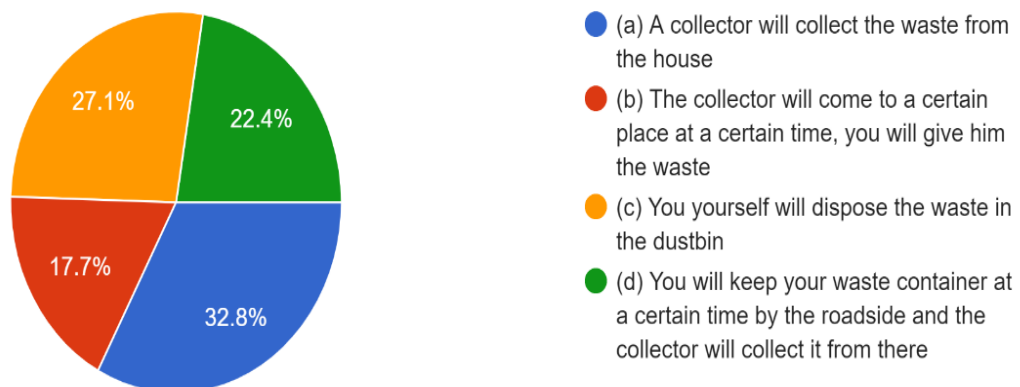
**Figure.15:** Timing for the waste disposal

The municipal waste management system works on a daily basis for the collection of waste and disposal of them. **47.9%** of people every day dispose of waste in the municipal system. **22.1%** of people dispose of waste in a period of two days whereas, **22.7%** of municipal system collects waste irregularly (**Figure.16**).



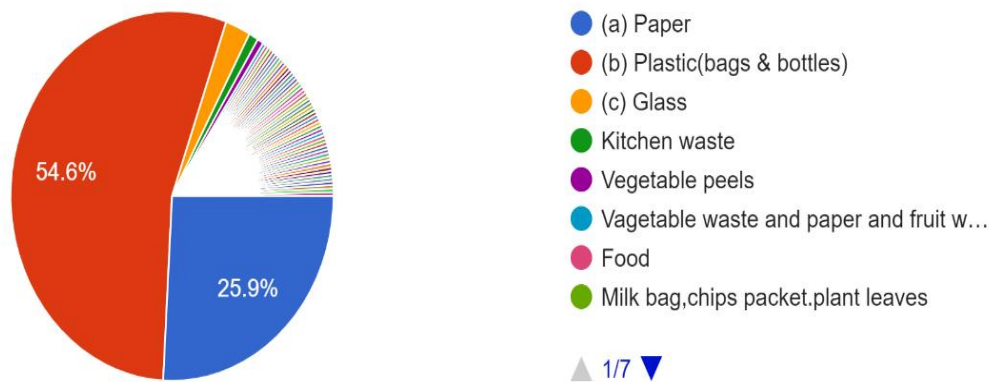
**Figure.16:** Routine of municipality waste collection

Many people prefer different methods for the removal of household waste (**Figure.17**). **32.8%** of respondents prefer to hand over waste to municipal collectors from the house door while **27.1%** prefer to dispose of waste in the dustbin by themselves. **22.4%** prefer to keep the waste container at a certain time by the roadside and the collectors will collect it from there while **17.7%** prefer that the collector will come to a certain place at a certain time and they will hand over the waste.



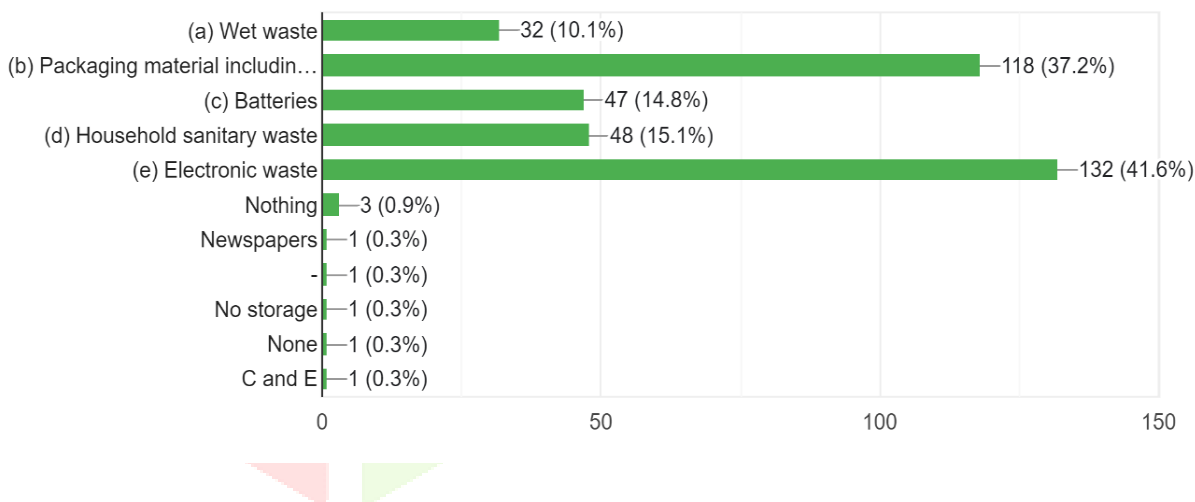
**Figure.17:** Preferred system for household waste removal

The respondents were asked about the most common type of waste generated at home (**Figure.18**). **54.6%** of people responded it was plastic waste like polythene, bags, and bottles while **25.9%** was paper waste to be generated in households.



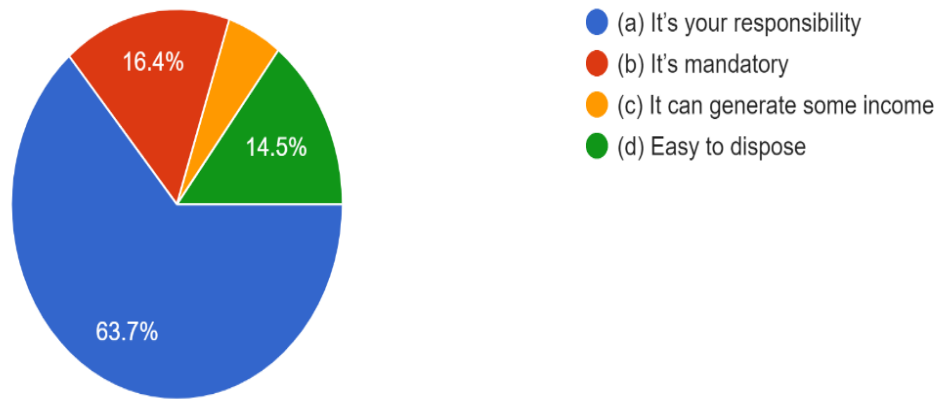
**Figure.18:** Most common waste generated at the household

However, recycling at the societal level needs to be promoted. On asking about the type of waste suitable to be stored for a few days (**Figure.19**), **41.6%** of respondents reported it to be an electronic waste, **37.2%** reported it to be packaging material including milk covers and other food packaging, **15.1%** mentioned it to be the household sanitary waste and **14.8%** reported it to be the batteries.



**Figure.19:** Type of waste to be stored for a few days

The respondents were asked if they practice segregating their household waste (**Figure.20**) in which **63.7%** of respondents agreed that it's their responsibility to segregate the biodegradable and non-biodegradable waste at the household level, **16.4%** are aware of segregation and practice it to be mandatory to do it, while **14.5%** thinks that it is an easy way to dispose of waste accordingly.



**Figure.20:** Segregation of household waste

The respondents were asked about how they can reuse household waste at home to which the majority of people believed that plastic waste can be recycled and suggested recycling plastic bags, and containers for storage and packaging while others responded to using the kitchen biodegradable waste for making bio compost from them. However, recycling needs to be encouraged at a societal level. Most of the respondents reported that the people in their society tie up with waste recyclers to recycle waste like plastic, paper, books and newspaper, glass items like bottles, iron, and tin waste, electronic waste, etc. By selling the recyclable waste to recyclers, many of the products are being made in reuse and the respondents are also benefited from it as they get money in return which is a good way of promoting the selling of recyclable products and saving the environment from the solid waste pollution.

## CONCLUSION AND RECOMMENDATIONS

This study explores a behavioural perspective in which the way people dispose of waste is related to their attitudes and perceptions. An individual's perception is governed by one's history and current situation, shaped by the individual's values, moods, social circumstances, and expectations. The results of this study are discussed under three aspects: (1) characteristics of household solid waste management practices and respondents' perceptions (2) correlation between socioeconomic background and respondents' background with waste segregation practices and (3) correlation between socioeconomic background and respondents' Knowledge of waste management awareness. One of the main purposes of collecting respondents' characteristics is to understand the correlation between the household's level of participation in SWM activities and the characteristics of the respondents.

The study found that respondents' practice of garbage sorting can be considered low, with respondents sorting their garbage comparable to those who don't, implying that there is still room for 'improvement'. The main components of solid waste generated at home are largely compostable leftovers and recyclable plastics, most of which are disposed of without segregation. The local solid waste management agency should focus on using this organic waste on a larger scale and involve more people in the composting program. The development of small-scale community composting could be a potential starting point to



accelerate this program without significant investment from local governments. The authorities of the study area provided suitable waste disposal sites, but some were disposed of at inappropriate sites. The majority of respondents are also aware that poor waste management can lead to disease. Age, marital status, and home type were found to be the most discriminatory of their births, suggesting that respondents belonging to this group may be targeted for further interventions. This study suggests that local authorities should design garbage separation programs tailored to the needs of the target population, to ensure high participation rates in the community. Marketing and campaigns should focus on positive perceptions and attitudes towards home waste sorting as well as negative perceptions among non-participants. This study could provide the Jaipur government with background information to determine the future implementation of household waste segregation activities. This study also proposes to focus on community involvement in segregation at source, waste minimization, and recycling as a habit and way of life. Local governments can facilitate this by providing bins for sorting waste and by setting up waste banks and recycling facilities on a larger scale than those currently available. Have. Top-down and bottom-up approaches should go hand in hand for successful sustainable solid waste management.

However, recognizing the limitations of the current study, a more detailed and in-depth study should incorporate a broader area and profound linkages between waste segregation programs and health implications. The combination of survey questionnaires with statistical analysis serves as a springboard to expand the research by involving the community in actual garbage sorting activities. This can be done by initiating a partnership between local authorities, community leaders, and the people themselves within the framework of a pilot study. In addition, the findings of this study will serve as baseline data and pave the way for other researchers and policymakers to conduct more rigorous studies in this area.

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