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Research Article

Household Waste Management and Environment Protection – Residents' Contribution

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ABSTRACT

Waste management is a massive challenge across the globe. Waste is one of the results of residential, commercial and industrial activities. Household waste is the waste generated from day-to-day activities of the households. It is as an important element of Municipal Solid Waste (MSW). It plays very crucial role, but at the same time it is very much neglected element of human life which directly impacts our environment. Even after 77 years of independence in India, waste management has emerged as a huge challenge. At present in cities, not only waste has increased in quantity but the characteristics of waste have changed tremendously with changing consumption patterns and it is imposing pressure on waste management authorities. The purpose of this study was to study kitchen / biodegradable waste disposal methods adopted by residents of Panvel Municipal Corporation (PMC), to ascertain the residents' behavior towards household waste management and environment protection and to understand ideas of residents on environment friendly household waste management systems or practices to be adopted by residents to solve the issues of household waste management and to protect environment. A quantitative method was adopted for study. Data was collected through structured questionnaire from residents of PMC by convenient sampling method. The study concluded that behavior of residents from PMC do not contribute significantly to the effective household waste management and environment protection. There is urgent need of strict implementation of Municipal Solid Waste Management Act, 2016 by PMC. Also, there is a need of rigorous awareness programs about ill effects of improper HWM and promotion of sustainable consumption patterns to be adopted by residents of PMC. A disciplined, knowledge driven behavior of residents towards household waste management leads to segregation of household waste at source point; which acts as a major achievement to waste management authorities for further resourceful and smooth disposal of household waste. It automatically contributes in protecting environment, human health and biodiversity.

Keywords: Household waste, environment protection, residents' contribution, behavior of residents', household waste management, Panvel Municipal Corporation

1. INTRODUCTION:

Nature has its own way of management of waste. But in human made society there is need of waste management as human beings have contributed a lot in depleting the environment by mismanagement of waste. What has changed over a period of time? Increasing population of the India demands more production of goods and services. More population means more consumption. It leads to more generation of waste. There is wide disparity between the rate of production of waste and the rate of management of waste. Materials used for various activities to fulfil needs and wants of humans are of more complex nature. Household waste is the waste generated from day-to-day activities of the households. It is as an important element of municipal solid waste. It has major proportion in entire MSW. It consists of Wet/Biodegradable/Compostable waste (Parts of - vegetables, fruits, flowers, garden trash, eggshells, fish bones, meat bones, etc.), Dry waste (Plastic, Paper, metal, wood, glass, clothes, shoe wears, thermocol, etc.), Sanitary waste (Napkins, pads, baby or adult diapers contaminated with blood, urine and faeces, bandages, wet cotton with blood, used condoms, etc.) Hazardous waste (Batteries, paints, pesticides and other garden chemicals, expired medicines, needles and syringes, motor oils, empty containers of cleaning agents, mosquito repellents, etc.)

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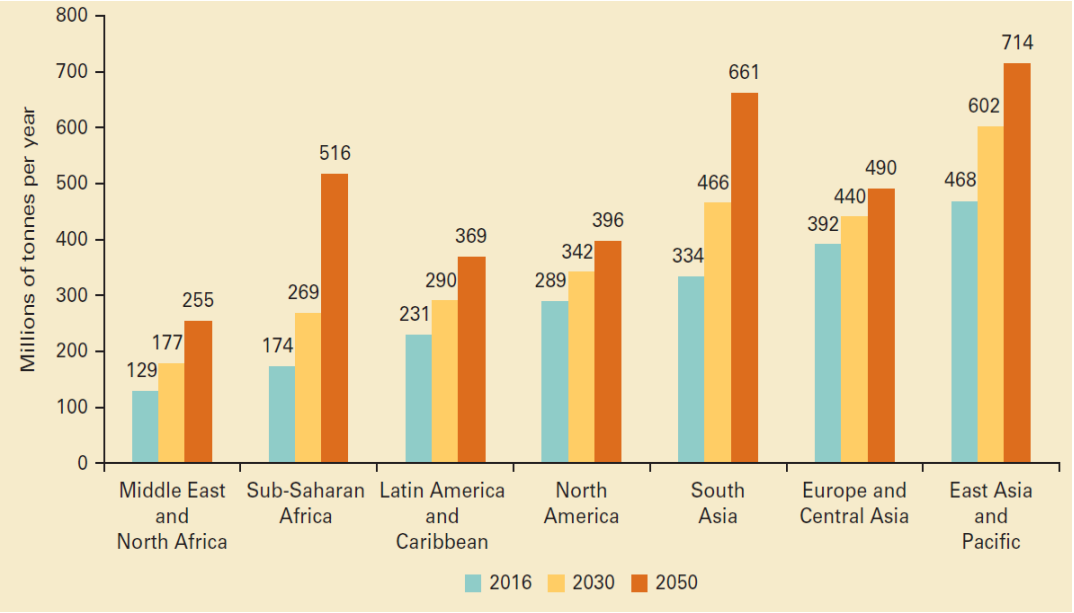
Disposal of these materials is quite challenging. In urban areas waste management is expensive. Behavior of residents play significant role in HWM and protecting the environment. Waste is collected and transported from one place and further it goes to either dumping ground or landfill for further disposal. But does it really get processed in ecofriendly way? The facts are alarming. According to the World Bank's What a Waste 2.0, 2018 report, the world generates 2.01 billion tonnes of municipal solid waste annually, with at least 33% of that not managed in an environmentally safe manner. The report projects that rapid urbanization, population growth, and economic development will push global waste to increase by 70% over the next 30 years – to a staggering 3.40 billion tonnes of waste generated annually. In 2016 alone, the world generated 242 million tonnes of plastic waste – equivalent to about 24 trillion 500-millimeter, 10-gram plastic bottles.

1.1 Projected waste generation, by region (millions of tonnes/year)



(Source - World Bank's What a Waste 2.0, 2018 report)

According to, "Times of India", newspaper dated on Sep 7, 2024, India emerges as the world's largest plastic polluter, releasing 9.3 million tonnes plastic annually. It now constitutes about one-fifth of global plastic emissions. This figure highlights an important environmental concern, with India's plastic emissions surpassing those of other countries by a considerable margin.

As per INVEST INDIA, Waste generation in urban areas of India will be 0.7 kg per person per day in 2025, approximately four to six times higher than in 1999. According to the Ministry of Environment, Forest and Climate Change, India currently generates 62 million tons of waste (both recyclable and non–recyclable) every year, with an average annual growth rate of 4%. Solid waste, plastic waste and E-waste are the principal waste materials. The generation of municipal solid waste is expected to rise to 165 million tonnes by 2030 due to changing consumption patterns and rapid economic growth.

The generation of municipal solid waste is expected to rise to 165 million tonnes by 2030 due to changing consumption patterns and rapid economic growth.

In India SWM is handled under, The Environment Protection Act (EPA) of 1986. The SWM Rules, 2016 were notified by the Ministry of Environment, Forests and Climate Change (MoEF&CC) on April 8, 2016. It has replaced earlier Municipal Solid Waste (Management and Handling) Rules, 2000.

This itself shows that there is much time gap between the formation of SWM Acts and by the time nature of waste has drastically changed over a period of time. After that there was amendment of Plastic Waste Management Amendment Rules, 2021. The Ministry of Environment, Forest and Climate Change has also notified the Guidelines

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on the Extended Producer Responsibility for plastic packaging vide Plastic Waste Management Amendment Rules, 2022, on 16th February, 2022.

Further, under Swachh Bharat Mission additional central assistance is provided to States and Union Territories for solid waste management including plastic waste management in urban and rural areas. Even after 77 years of independence in India, waste management has emerged as a huge challenge. At present in cities, not only waste has increased in quantity but the characteristics of waste have changed tremendously with changing consumption patterns and it is imposing pressure on waste management authorities.

1.2 Panvel City:

It is known for being rich in nature, history, and culture. It is a fast-growing urban area close

to Mumbai, surrounded by highways, shipping and industrial zones. It is between Pune and Mumbai. Municipal Corporation is the governing body of the city of Panvel in Raigad district.
There are 4 wards named Panvel, Kamothe, Kalamboli, Kharghar.

1.3 Panvel Municipal Corporation (PMC) and Municipal Solid Waste Management (MSWM)

PMC was established in the year 2016. The City and Industrial Development Corporation (CIDCO) used to collect, transport and process MSW. From 2018 PMC started collection and transportation of MSW. At present CIDCO takes care of processing of MSW at Ghot Chal landfill near Taloja area.

The daily average solid waste generated and collected by PMC in 2023 was about 470.8 tons per day (TPD). The main source of solid waste is primarily from the residential areas and commercial areas, falling within the PMC area.

Waste Generating Source	Waste (in TPD	(%) share of waste Generated
Residential area- colonies, apartment complexes	350	74.34
Commercial establishments, malls	62	13.17
Hotels and Restaurant	20	4.25
Markets (Vegetable Markets, Mandi, etc.)	30	6.37
Institutional areas, office, schools, universities	5.8	1.23
Hospital and nursing homes (excluding biomedical waste)	3	0.64
Total Waste Generated	**470.8**	**100**

Source: SWM Department, Panvel 2023

This study has considered only residential/household waste only as it has the highest proportion in Municipal Solid Waste of Panvel Municipal Corporation.

2. REVIEW OF LITERATURE:

(Agarwal R., Sinha S. Aug. 13, 2024) according to this study all Indian salt and sugar brands, whether big or small, packaged or unpackaged, contain microplastics. 10 types of salt, 5 types of sugar were tested. Iodised salt had the highest concentration of microplastics (89.15 pieces per kilogramme) while organic rock salt had the lowest (6.70 pieces per kilogramme) Microplastics are of global concern. Particles can enter body via food, water and air. The objective of study was to contribute to the existing scientific database on microplastics so that the global plastic treaty can address this issue in a concrete and focused manner. Also, to trigger policy action and attract researchers' attention to potential technological interventions that could reduce exposure risks to microplastics."

(Singh, 2020) has discussed the state of solid waste management in India and put forth recommendations to solve the many challenges of it. The researcher has presented data from Swachh Bharat Mission (Urban) SBM, January

2020 about waste generation, 100% source segregation, total waste processing and 100% door-to-door collection, by wards of different states and union territories of India. It has covered study of Solid Waste Management Rules, 2016, Plastic Waste Management Rules, 2016 and Municipal Solid Waste Management Manual, 2016. The study also focused on Integrated Solid Waste Management System Hierarchy, (MoUHA, 2016), Swachh Bharat Mission (Urban) and the impact of COVID-19 on solid waste management. The study concluded that SWM problem is very serious in urban areas and ULBs are unable to manage it effectively. It showed that existing waste management systems are caught up in disorder. It suggests that community participation and behavioural change in its stakeholders is essential to face the problem of SWM in urban areas.

(Silpa, Lisa,Tata, Perinaz, Frank 2018) the referred report by World Bank Group, has elaborated in depth on global solid waste management. The entire world is going to generate more and more waste exponentially. What will be scenario of solid waste management by year 2030 and 2050 is estimated and projected. This study was conducted between the year 2011 and year 2017. Urban data of SWM from 217 countries and economies367 cities of various countries was collected. Findings of the study on global waste disposal showed that around the world, almost 40%of waste is disposed of in landfills, 19 %undergoes materials recovery through recycling and composting, 4 and 11% is treated through modern incineration. Still, globally 33% of waste is still openly dumped. It shows the intensity of SWM problem and efforts required to tackle it by its all stakeholders.

(Jabeen, Rafiq Zia, Akhunzada, 2017) This study suggested there must be awareness programs on SWM for promotion of clean environment through solid waste management. It is necessary for every individual. Community members do not discuss this issue with each other. It demonstrates that they have no ecological discussions (green speak) in their everyday life. They do not know about ecological issues particularly females do not know about it. It was concluded by this study that females especially housewives have less interaction outside their homes. So, they are not aware of situation of solid waste in their area. Also, they have very less chance to take part in any activity for promotion of clean environment through solid waste management. So above study further revealed scope to design HWM promotional campaigns focusing females and children and to ascertain their behavior towards household waste and environment.

(Joshi, 2016) The above referred study was exploratory in nature. It has stated in detail role of The City and Industrial Develipment Corporation (CIDCO) in development of Navi Mumbai since 1980. The study has not highlighted SWM aspect significantly. It has not covered importance of household waste and its management.

(CPHEEO manual part II, 2016) Swachh Bharat Mission, 2016 its objectives are elaborated. The above manual has focused on municipal solid waste management. Importance of segregation of waste also highlighted. Action points for awareness generation through information, education, and communication activities for special waste including domestic hazardous waste were stated.

(Gupta, Yadav, Kumar, 2015) This paper has presented an overview of current status of solid waste management in India which can help the competent authorities responsible for municipal solid waste management and researchers to prepare more efficient plans. The changing pattern of waste composition emphasizes the importance of segregation for successful operation of waste management facilities. Municipal authorities should maintain the storage facilities in such a manner that they do not create unhygienic and unsanitary conditions. The study suggested that a new survey should be carried out on the generation and characterization of MSW in India. Since the MSW is heterogeneous in nature, a large number of samples have to be collected and analyzed to obtain statistically reliable results.

(Prabhu, 2014) The study suggested Public Private Partnership (PPP) which is an interesting option to boost the performance of public services like Solid Waste Management. While the municipal authority focuses its activity on planning and management, a private company takes over the day-to-day operation of a service in a defined area. As every person is a waste generator, hence the Community based PPP is the best model for Municipal Solid Waste Management. The cities selected for the research were Delhi, Chandigarh, Bhopal, Kolkata, Surat, Mumbai, Pune, Panaji, Hyderabad and Chennai. It has found that maximum Compostable Waste is generated in Mumbai and Pune, followed by Panaji. So, creates scope to study further household waste management in depth for Mumbai city. How this PPP model will help in HWM is missing as household waste has the highest proportion in solid waste. Relation between solid waste management and sustainable development is not studied.

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(Srivastava, Vaish, Singh, Pooja Singh,2020) This study suggested that public apathy towards handling their waste and sanitation is one of the major reasons for poor waste management in the city. Based on composition and characteristics of waste in Varanasi composting, vermi composting and bio methanation could be used as suitable options for effective waste management. The different methods of municipal solid waste management are not considered. Promotion aspect of household waste is also not covered.

(Rejuna C. A, 2019) This study examined solid waste generation, heterogeneous management practices and willingness to pay (WTP) for improved waste management by the households in Kozhikode Corporation as a representation of urban households in Kerala. The burden of solid waste necessitated huge expenditure for its management. The community willingness and participation were the operational challenges generally faced by the authorities in collecting user charges. The study had not highlighted HWM significantly. The study found out that there should be an intensive public campaign to educate people about the danger of waste in our localities and benefits associated with the clean environment to reduce waste generation and increase the WTP for improved environmental quality in general and improved solid waste management in particular. But how to explore promotion of household waste for several benefits to people was not significantly studied.

(Gore, 2017) This study has focused on the various problems faced by the citizens of Pune due to solid waste. The Sample selected for study was 567 residents of Pune city from 41 wards and 35 employees from SWM department of PMC. The study found that Pune Municipal Corporation is doing its best but still it is somehow lagging behind to manage 1600MT garbage daily. It does not have that capacity or equipments to handle that much amount of daily garbage. NGOs are helping it to collect the waste as well as to reduce the waste. The transportation system of SWM of the Pune Municipal Corporation is not effective. The officers can't track the vehicle, due to non-implementation of GPS system. The awareness programmes run by PMC are insufficient to address issues of SWM. The study concluded that if citizens of PMC and PMC's SWM authorities follow rules and regulations of SWM then Pune will not only be smart city, but also clean and green city.

(Mujumale,2017) This research study was carried to find out possible solutions of the problems of solid waste generated in Pune city. It was conducted with reference to villages situated nearby waste depot of Pune Municipal Corporation. It has studied various problems faced by the villagers of Urali Devachi and Phursungi where PMC Waste depots are installed and tried to know about their expectations. It was conducted to know about the various acts governing solid waste management system in Pune city and to suggest expected amendments in it. This study was conducted to know about future policy and programs for solid waste management system of Pune Municipal Corporation. Study highlighted that while addressing problems of SWM over a period of time, total solid waste should not be considered as a problem. But it should be taken in a positive way and to be considered as a national wealth. SWM will help to generate revenue and to create employment opportunities. In this study, SWM was studied from social point of view.

(Somdutta, 2016) The study has considered three aspects of MSWM - Contribution of Public Private Partnership (PPP), the relationship between the extent of private involvement and the technical efficiency of managing solid waste and Willingness-to-pay (WTP) for improved management of Municipal Solid Waste (MSW) The study has focused on household choice by ascertaining willingness-to-pay (WTP) for improved management of Municipal Solid Waste (MSW) but not highlighted household waste, its type, its eco-friendly disposal methods and its promotion.

(Deshmukh, 2015) This research study has given an insight to the study of Solid Waste Management practices adopted by the selected municipalities. It focused how solid waste management practices have been implemented by these municipalities and revealed how solid waste management practices in the selected municipalities perform and what are the major problems faced by these municipalities as well as the stakeholders. The unique suggestions such as Economists have developed an effective model for recycling of solid waste because of the awareness of public towards the effective solid waste management has been increased in United States and Europe. Therefore, it is suggested that economists should develop the effective model for recycling of solid waste for India. It also suggested that the research institutions, NGO's and international agencies can play an important role for managing household waste. Government should establish tie-ups with these NGO's and International agencies and makes a concrete plan for municipal solid waste management.

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(Dutta, Jinsart, 2014) The study stated precise estimate of MSW generation per capita for the top MSW generating cities of India and their trend, indicated in this study, would be very handy to the policymakers to compare the future progress once 'generators as segregators' and pay-as-you-throw (PAYT) systems are introduced in the concerned cities. Rewards and penalties to residential societies are also considered. The study has not focused on household waste and its promotion significantly.

(Samal, 2019) The referred study discussed in detail about domestic hazardous waste and its impact on environment. It stated that when domestic hazardous waste is mixed with other municipal solid wastes then how dangerous it is to the environment. It focuses on segregation of household waste. This study has not considered all types of household waste and its segregation at micro level. Promotion aspect of household waste is also not covered.

(Chouhan, 2016) The study has focused on the awareness level for household waste disposal in the selected states for the study, the community awareness about the Govt. policies and rules in waste handling and managing. The study has covered impact of waste segregation at household level for waste disposal and their recycling process. It has highlighted the IEC model (Information- Education and Communication). It is strongly recommended to educate people by launching campaigns and also cover Solid waste management, as well as liquid waste management to protect the environment. Communication aspect of IEC model is not explored significantly. The study had not considered relation between household waste management and sustainable development. It is more exploratory research.

(Gupta, 2014) This study has shown that human hair has a large number of uses in areas ranging from agriculture to medicine to engineering industries. This trade has provided livelihoods in many parts of the world. The public must be made aware of its beneficial properties and safe practices of collection and use. With assistance of various stakeholders, it is possible to develop complete utilization systems for human hair, which will reduce solid waste and environmental problems, generate significant socioeconomic benefits for people, and reduce pressure on other non-renewable materials and fossil fuels and thus it will contribute in sustainable development. The study has covered export aspect of hair waste. Uses of hair waste are stated. But how to create awareness about it through proper promotion is not covered. One can explore it as business opportunity and start own "Hair Bank."

(Khan, 2014) Satyamev Jayate season2- Full Episode # 3 | Don't waste your garbage, Video focuses on "Waste is wealth if treated carefully. People are conscious about home cleanliness and not bothered of society and environment at large.

(Murthy) DIY With TBI: Composting Made Easy – EP Vani Murthy is an eco-warrior who actively campaigns for waste management in the Bangalore city. Video focuses on- how to make composting at residential/individual level by using kitchen waste, garden waste (dry leaves) little amount of water, curd or compost pit.

3. OBJECTIVES OF THE STUDY:

To study biodegradable/ kitchen waste disposal methods adopted by residents of PMC.

To ascertain residents' behavior towards household waste management and environment protection.

To understand ideas of residents on environment friendly household waste management systems or practices to be adopted by residents to solve the issues of household waste management and to protect environment

4. HYPOTHESIS OF THE STUDY:

Null Hypothesis H_{01}: There is no significant difference in proportion of opinion related to household waste management.

Alternate Hypothesis H_{11}: There is a significant difference in proportion of opinion related to household waste management.

Null Hypothesis H_{02}: There is no significant difference in proportion of opinion related to practices adopted for household waste management.

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Alternate Hypothesis H_{12}: There is a significant difference in proportion of opinion related to practices adopted for household waste management.

5. RESEARCH METHODOLOGY:

The present study adopted a quantitative research methodology to analyze the behaviour and practices of residents regarding household waste management and its impact on environmental protection within the jurisdiction of Panvel Municipal Corporation (PMC). Primary data was collected using a structured questionnaire administered to 164 respondents, selected through convenience sampling. The questionnaire comprised both attitudinal and behavioral statements related to household waste management, focusing on awareness, responsibility, and adopted practices. This approach enabled the collection of standardized responses that could be statistically analyzed for patterns and significant differences in opinion.

To examine the hypotheses, non-parametric tests, specifically the Chi-square test for independence, were applied to evaluate whether the proportions of responses differed significantly from expected frequencies. The analysis involved cross-tabulations of responses to various household waste-related statements to test the null hypotheses. The significance level was set at 5%, and p-values less than 0.05 led to the rejection of null hypotheses, thereby indicating statistically significant variations in respondents' opinions and behaviors. The findings derived from this methodology provided meaningful insights into public awareness, participation, and the effectiveness of local waste management initiatives.

6.HYPOTHESIS TESTING:

Null Hypothesis H_{01}: There is no significant difference in proportion of opinion related to household waste management.

Alternate Hypothesis H_{11}: There is a significant difference in proportion of opinion related to household waste management.

To study the above null hypothesis, non-parametric test is applied and chi-square test results are as follows:

Test Statistics

	13. Household waste consists of hazardous waste.	14. Cooperative Housing Societies must be willing to pay fines if not following rules of segregation of household waste.	15. Household waste management is the responsibility of municipal corporations.	16. Implementation of laws about segregation of household waste by municipal corporations is missing to greater extent.
Chi-Square	94.415[a]	154.232[a]	74.720[a]	64.659[a]
df	4	4	4	4
P-value	.000	.000	.000	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 32.8.

Interpretation: The above results indicate that calculated p-value is 0.000. It is less than 0.05. Therefore, Chi-square Test is rejected. Hence Null hypothesis is rejected and Alternate hypothesis is accepted.

Conclusion: There is a significant difference in proportion of opinion related to household waste management.

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Findings: To understand the findings, values of opinion to the statement related to household waste management are obtained and presented as follows:

	Observed value for question No.13	Observed value for question No.14	Observed value for question No.15	Observed value for question No.16	Expected N
Strongly Disagree	1	2	2	11	32.8
Disagree	13	6	22	9	32.8
Neither agree nor disagree	29	13	30	41	32.8
Agree	52	70	69	64	32.8
Strongly Agree	69	73	41	39	32.8

The responses to Questions 13 through 16 reflect a strong leaning toward agreement with statements related to household waste management, though with slightly more variation than in the previous set. In Question 13, which addresses whether household waste consists of hazardous materials, 52 agreed and 69 strongly agreed, far exceeding the expected 32.8 in each category. A similar pattern appears in Question 14, where 70 agreed and 73 strongly agreed that cooperative housing societies should be fined for non-compliance with segregation rules. These high agreement levels suggest that respondents acknowledge both the dangers of improper waste disposal and the need for accountability mechanisms.

However, Questions 15 and 16 show a slightly more mixed response. While agreement levels are still high in Question 15 (69 agreed, 41 strongly agreed), the disagreement and neutral responses are somewhat more pronounced, indicating some uncertainty or reluctance about the practical aspects of enforcement or implementation. Question 16, regarding the lack of municipal enforcement, had the highest number of neutral responses (41) and a lower number of strong agreements (39), possibly suggesting public recognition of the problem but with varied perceptions about its severity or causes. Overall, while agreement remains dominant, the data shows nuanced opinions on policy enforcement and institutional responsibility.

Null Hypothesis H_{02}: There is no significant difference in proportion of opinion related to practices adopted for household waste management.

Alternate Hypothesis H_{12}: There is a significant difference in proportion of opinion related to practices adopted for household waste management.

To study the above null hypothesis, non-parametric test is applied and chi-square test results are as follows:

Test Statistics					
	18.	19.	20.	21.	22.
Chi-Square	156.549[a]	101.024[b]	191.061[a]	134.976[b]	209.841[a]
df	4	3	4	3	4
P-value	.000	.000	.000	.000	.000
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 32.8.					
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 41.0.					

Interpretation: The above results indicate that calculated p-value is 0.000. It is less than 0.05. Therefore, Chi-square Test is rejected. Hence Null hypothesis is rejected and Alternate hypothesis is accepted.

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Conclusion: There is a significant difference in proportion of opinion related to practices adopted for household waste management.

Findings: To understand the findings, values of opinion to the statement related to practices adopted for household waste management are obtained and presented as follows:

	Observed value for question No.18	Observed value for question No.19	Observed value for question No.20	Observed value for question No.21	Observed value for question No.22	Expected N
Strongly Disagree	1	0	1	1	1	32.8
Disagree	8	2	2	0	1	32.8
Neither agree nor disagree	14	17	9	8	8	32.8
Agree	83	78	74	68	64	32.8
Strongly Agree	58	67	78	87	90	32.8

The observed responses to Questions 18 through 22 consistently show a strong agreement among respondents regarding the importance of proper household waste management practices. For each of these questions, the number of respondents who agreed or strongly agreed far exceeds the expected value of 32.8. For instance, in Question 18 (on the use of composters or large bins), 83 agreed and 58 strongly agreed. Similarly, Question 19 (on daily collection and segregation by municipal corporations) had 78 agreeing and 67 strongly agreeing. This trend continues across all five questions, indicating a clear and repeated public consensus on the need for active involvement, awareness, and accountability in managing household waste for environmental benefit.

Conversely, the number of respondents who disagreed, strongly disagreed, or remained neutral is significantly lower than the expected count. For example, in most questions, only 1 respondent strongly disagreed, and disagreement responses rarely exceeded single digits. Neutral responses also remained well below the expected value, such as just 8–17 respondents selecting "Neither agree nor disagree" across these questions. These consistently low figures reflect that passive or opposing attitudes toward waste management practices are minimal. Overall, the data highlights a strong, positive shift in public mindset toward proactive environmental responsibility in the context of household waste.

7. FINDINGS:

The findings of the study reveal a strong public consensus among the 164 respondents in favor of responsible household waste management practices. A significant majority expressed agreement or strong agreement with statements emphasizing the hazardous nature of household waste, the accountability of cooperative housing societies, and the responsibility of municipal corporations in enforcing segregation rules. While most respondents acknowledged the importance of municipal enforcement, a relatively higher number of neutral responses in that area indicated some uncertainty or skepticism about its effectiveness. Additionally, there was overwhelming support for practical waste management practices such as the use of composters, daily collection and segregation by authorities, and community involvement. Overall, the data highlights a high level of awareness and a proactive mindset among residents, though with some reservations about the implementation aspects of municipal waste management.

8. CONCLUSION:

The chi-square test results for both sets of statements—those related to household waste management awareness (Questions 13 to 16) and practices adopted for waste management (Questions 18 to 22)—show statistically significant differences in respondents' opinions. The consistently low p-values (all < 0.05) lead to the rejection of both null

hypotheses (H01 and H02), confirming that there is a significant variation in the distribution of responses. This implies that the respondents do not share a uniform opinion, but rather show a marked tendency toward agreement with the importance of both recognizing waste-related issues and supporting proactive waste management practices.

In particular, the findings reveal a strong public consensus favoring responsible household waste management. High levels of agreement and strong agreement across statements suggest that respondents are not only aware of the hazards associated with waste mismanagement but also supportive of stricter rules, municipal responsibility, and community action (e.g., fines for non-compliance and the use of composters). While some variation appears in questions regarding municipal enforcement, overall, public opinion leans heavily toward the need for improved infrastructure, daily collection, segregation, and community participation. These insights point toward a growing environmental consciousness and a readiness among the population to embrace and enforce better waste management practices.

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