

A Quantitative Study on Plastic Usage in Ernakulam District

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Abstract

In the modern era, plastic has woven itself convolutely into the fabric of our daily lives, offering exceptional convenience and versatility. Balancing plastic's benefits with its ecological footprint is crucial for a sustainable path forward, acknowledging the imperative to address its environmental impact. To tackle plastic usage, we advocate the 3R approach: reduce, reuse, and recycle. This study focuses on analyzing plastic usage in Ernakulam district. Data gathered through a 22-question Google Form distributed among St. Teresa's College students residing in the district, yielded 316 responses from diverse localities. The research delves into plastic usage, waste disposal challenges, changes in plastic consumption post the Brahmapuram plant fire, and awareness of microplastics across different localities. Employing percentage analysis, chi-square tests, and the free-hand curve method, the study explores these aspects for informed insights. According to this study, plastic consumption has decreased considerably in all 3 localities after the Brahmapuram plant fire. There is a significant association between the method of plastic waste disposal and its effectiveness. Most of the respondents are well aware of the content of microplastic in the products that we use in our daily lives.

Keywords: Plastic usage, Plastic Waste, Environmental pollution, Ernakulam District

Introduction

Plastic usage significantly impacts people worldwide, influencing various aspects of daily life, health, and the environment. The widespread use of plastic has both positive conveniences and detrimental consequences for individuals globally. The convenience of plastic products has transformed many aspects of daily life. From packaging materials to household items, plastic has become an integral part of modern living, offering lightweight, durable, and versatile solutions. The ease of use and affordability of plastic goods contribute to their widespread adoption, simplifying tasks and amplifying comfort for people across the world. However, the unfavourable effects of plastic usage on human health and the environment cannot be overlooked. Plastics often contain harmful chemicals, and when used in food packaging or containers, there is a risk of these chemicals leaching into consumables. Microplastics, resulting from the breakdown of larger plastic items, have been found in various food sources, raising concerns about potential health impacts on individuals.

Moreover, improper disposal of plastic waste contributes to environmental pollution, affecting both ecosystems and human well-being. Plastic litter contaminates water bodies, soil, and air, posing risks to wildlife and entering the food chain. The cumulative impact of plastic pollution on ecosystems can have indirect consequences for human health through compromised food sources and environmental degradation. In regions with inadequate waste management systems, plastic pollution worsen health risks for communities. Improper disposal leads to the accumulation of plastic waste in

public spaces, contributing to the spread of diseases and creating unsanitary conditions. People residing in areas with limited resources, bear the brunt of these health challenges associated with plastic pollution.

A fire broke out at the Brahmapuram plant recently. The Brahmapuram plant fire was worsen by the presence of plastic waste, which is known to be highly flammable. The accumulation of plastic waste at the site likely contributed to the intensity and spread of the fire. The Brahmapuram plant fire has implications for the well-being of the local community, impacting air quality, potential health risks, and overall safety concerns for residents in the surrounding area. Additionally, the incident underscores the importance of proper waste management practices and highlights the potential dangers associated with the improper disposal of plastic waste in industrial settings. Addressing the issue of plastic waste management becomes crucial not only for environmental conservation but also for preventing such catastrophic events in the future.

Objectives

1. To compare the plastic usage in different localities.
2. To analyse what kind of waste is more difficult to dispose and which alternatives people prefer to use instead of that.
3. To analyse the relationship between plastic usage and localities.
4. To analyse the relationship between health issues and localities.
5. To study the trend analysis of Brahmapuram plant fire.
6. To check whether, Brahmapuram plant fire had affected the plastic consumption and disposal.
7. To check whether people are aware of the micro plastics that we use in our day to day life.

Research Methodology

We developed 22 survey questions for primary data collection. We used an online questionnaire to collect the data. An online questionnaire is a series of questions specifically structured to gather information about a group of people. The primary data collected through a Google Form distributed among St. Teresa's College students covers a broad spectrum. While the survey specifically targeted students from the college, it also effectively reached respondents from diverse regions within the Ernakulam district, spanning across its different localities, including panchayats, municipalities, and corporations. As a result, the dataset reflects a comprehensive representation of various areas within the Ernakulam district. The primary data collection method involves distributing a Google Form among undergraduate (UG) and postgraduate (PG) students of St. Teresa's College. It is anticipated that there will be no accessibility issues for respondents, since the students have accessibility for technology.

Primary Data

The data collected was the primary data for the analysis on plastic usage in Ernakulam district. The questionnaire was circulated using Google form through social media platforms containing 22 questions among the students of St Teresa's college who are residing in Ernakulam district yielded 316 responses from different localities. For calculating the sample size with a 90% confidence interval and a margin of error set at 5, the required sample size was determined to be 273. However, 316 samples were

collected. Therefore, the sample size should be sufficient for the study.

Methodology

Correlation: Correlation refers to the measure of the statistical association or relationship between two variables. Correlation coefficient (ρ) ranges from -1 to +1.

The absolute value indicates strength:

Positive correlation: Variables move together

Negative correlation: Variables move opposite

Zero correlation: No relationship

Karl Pearson's formula:
$$\rho(x, y) = \frac{\text{Covariance}(x, y)}{(SD \text{ of } x) * (SD \text{ of } y)}$$

If $\rho = 0$, no correlation. If $0 < \rho < +1$, positive correlation. If $-1 < \rho < 0$, negative correlation. Here we correlate between rate of reuse of plastic and rate of plastic pollution and we observe a negative correlation of -0.1232 . Hence we conclude that carry bags may not be a significant contributor to plastic pollution.

Chi-square

Chi-square test evaluates the association between two categorical variables. Formulating null (H_0) and alternative (H_1) hypotheses, data is organized into a contingency table. Expected frequencies are computed assuming independence. The chi-square statistic (χ^2) is calculated using observed and expected frequencies. Degrees of freedom (df) are determined. A significance level is chosen, typically 0.05. Comparing the statistic to critical value or obtaining p-value guides decision-making. If $\chi^2 > \text{critical value}$ or $p \text{ value} < \text{chosen level}$, H_0 is rejected, suggesting a significant association between variables.

Here we analyse the relation between health issues due to plastic pollution and localities. Our p value is found to be 0.112 which is greater than 0.05 which implies that there is no significant relation between locality and health issues due to plastic pollution. We also analyse the relation between reduction in the usage of plastic items and locality. Since the p value is found to be 0.456 it is found that there is no significant relation between locality and reduction in the usage of plastic products.

Paired t-Test

The paired t-test, chosen for comparing means of two related groups, involved applying the t-test formula to calculate the t-statistic. Degrees of freedom adjusted based on sample size, and a significance level ($\alpha = 0.05$) guided hypothesis acceptance or rejection. Specifically designed for related data points, the paired t-test assesses mean differences in conditions or times for the same subjects. The null hypothesis suggests no significant difference, while the alternative hypothesis suggests a significant difference between the paired group means.

Here we have done 3 t tests between plastic consumption, plastic waste disposal and authorities behaviour in waste collection before and after Brahmapuram plant fire giving the conclusion that there is a significant difference between plastic consumption, plastic waste disposal and authorities behaviour in waste collection before and after Brahmapuram plant fire.

Findings

The current study aimed to analyze plastic usage in different areas before and after Brahmapuram plant fire. The study post-Brahmapuram plant fire indicates a considerable decrease in plastic consumption across Gram Panchayat, Municipality, and Corporation. Plastic packaging covers were identified as the main source of plastic waste in all areas with a percentage of 45.3%, 47% and 61.2% in corporation, municipality and grama panchayat respectively. Reuse of plastic carry bags is reported by 46.2%, 61.7%, and 54.4% in Corporation, Municipality, Gram Panchayat. The preference for plastic products is due to their widespread availability, while cloth bags are favoured as alternatives. People prefer plastic due to availability (42.76%), lack of alternatives (39.6%), and cost (17.7%). Correlation analysis reveals a negative correlation between plastic pollution and plastic carry bag reuse, challenging the assumption that carry bags significantly contribute to pollution. Chi-square tests show no significant relation between locality and plastic reduction or health issues. Freehand curve analysis indicates reduced plastic usage post-fire. After Brahmapuram plant fire people became concerned about the environmental and health impacts due to plastic pollution which created an awareness in them and prompted people to decrease its usage. People have also opted to reassess their waste disposal strategies by entrusting them to the Harithakarma Sena. Paired t-tests confirm significant differences in plastic consumption, waste disposal, and authority collection pre and post Brahmapuram plant fire. The reduction in plastic usage after the fire was evident, along with a notable change in plastic waste disposal practices. The incident prompted individuals to rethink their approach to plastic waste disposal and consumption. Our analysis also revealed a general awareness of microplastics among students from various areas, indicating a shared consciousness of microplastic-related issues. Contrary to popular belief, our findings suggest that plastic carry bags may not be the primary contributor to pollution in all three localities.

Conclusion

There is a significant decrease in plastic consumption across all three localities post Brahmapuram plant fire. Plastic waste is found to be the most difficult type of waste to dispose of. It was observed that plastic carry bags are not a primary contributor of plastic pollution. The study shows that there is no relation between locality and plastic reduction or health issues due to plastic pollution. Also there is a significant difference in plastic consumption, disposal method and collection of waste by authorities before and after Brahmapuram plant fire. People are found to be well aware of microplastics and its presence in our daily use items.

While exploring the article "Microplastics distribution and contamination from the Cochin coastal zone, India," the study shows that the water and sediment samples from the Cochin estuary are seriously polluted with microplastics. The nylon and cellophane are the prominent materials that are obtained from the gastro intestine of aquatic animals this is likely to lead to serious health impacts in humans as we consume these aquatic animals.

From the study the researchers have discovered that packaging covers are the primary household source of plastic, adopting reusable carry bags and containers for grocery shopping can be beneficial. Moreover, industry participation is crucial in reducing plastic usage; substituting plastic packaging covers with cloth or other alternatives could have a significant impact. In addition to that,

Enforce strict regulations on the production, sale, and use of single-use plastics in the district. This can include banning plastic bags, straws, and packaging materials that

are not easily recyclable or biodegradable. Other suggestions are as follows;

- ❖ Encourage the use of eco-friendly alternatives such as reusable bags, containers, and utensils.
- ❖ Establish recycling centers, composting facilities, and promoting the use of advanced technologies for plastic recycling.
- ❖ Launch awareness campaigns to educate residents about the environmental impacts of plastic waste and the importance of proper waste disposal.

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