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# Towards A Plastic-Free Kerala: An Analysis of Single-Use Plastic Restrictions and Their Impact on Waste Management

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## ABSTRACT

Plastic pollution is a problem for the environment because people use too many single-use plastic products and do not throw them away properly. The Government of Kerala wants to stop this problem. It has made rules to limit the use of single-use plastics. This is part of a plan to manage waste in a sustainable way and protect the environment. The study called "Towards a Plastic-Free Kerala: An Analysis of Single-Use Plastic Restrictions and Their Impact on Waste Management" looks at how well these rules are working and how they are affecting the way people manage waste. The study asked 180 people in Ernakulam District some questions. Used the answers to see what is working and what is not. The study found out that most people know about the rules and are following them. The rules are helping to reduce the amount of waste and are making people manage their waste better like separating trash and recycling. The study also found out that people who are more educated are more likely to know about the rules and people who live in areas are more likely to follow the rules. Even though the rules are helping there are still some problems like it is hard to find alternatives to single-use plastics some people do not know about the rules and the rules are not always enforced. The study says that the rules are a start but we need to do more to make Kerala a place with no plastic waste. We need to tell people more, about the rules make sure everyone is following them improve the way we recycle and get people involved.

***Keywords:*** *Single-use plastics, Plastic waste management, Plastic ban, Environmental sustainability, Waste segregation, Recycling*

The problem of plastic pollution is increasingly gaining popularity as an environmental challenge around the world because of the increased use of one-time plastic products. Plastic cups, plastic bags, straws, and packaging materials are major pollutants that pose risks not only to the environment but also to public health. Various governments have developed different policies in order to address the rising problem of plastic waste by reducing their use and encouraging the use of sustainable alternatives. India is one of the countries that have put restrictions on plastic items in some states.

The State of Kerala has established itself as a frontrunner in environmental protection by implementing stringent laws that regulate the use of single-use plastics and encourage decentralized methods of waste management. The State's efforts to promote practices like

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segregation at the source, recycling, and active involvement of the community in order to limit the generation of plastic waste and achieve a future without plastic should be critically assessed to determine the success of these measures. In this context, the current research, titled "Towards a Plastic-Free Kerala: An Analysis of Single-Use Plastic Restriction and Its Effects on Waste Generation and Management" analyses the impact of these restrictive policies on waste generation and management in Kerala.

## RELEVANCE OF THE STUDY

The current research is extremely relevant when considering the rising environmental issues related to the pollution of the environment through plastic products. Various measures have been taken by the state of Kerala to curb the use of single-use plastics so as to reduce waste creation, preserve ecosystems, and encourage environmental consumption patterns. The evaluation of such measures in order to assess their effectiveness with respect to waste management results is crucial since it will shed light on some of the difficulties that may arise during their implementation. The information obtained will be useful for various interested parties, such as policy makers, local self-government bodies, environmental organizations, and others, in improving strategies used to manage plastic waste.

## STATEMENT OF THE PROBLEM

Even though efforts are made to restrict the usage of single-use plastic products in the state of Kerala, several issues still persist in relation to managing plastic waste in the region. Plastic products are widely used by the consumers of Kerala due to the lack of consumer awareness, absence of cheaper alternative options, and inconsistency in enforcing regulations. Even though various policies and strategies have been devised in order to promote sustainable waste management and decrease the amount of plastic usage, no substantial evidence can be obtained about the effectiveness of these policies in reducing waste generation and ensuring environmental sustainability in the region. Moreover, several challenges related to illegal distribution of plastic products, improper waste management methods, and poor public compliance still remain a problem. Against this background, the need arises for an assessment of single-use plastic restrictions and the effect they exert on waste generation. The current research aims at addressing this research gap.

### Objectives of the study

1. To examine the level of awareness and compliance among consumers and businesses regarding single-use plastic restrictions in Kerala.
2. To assess the impact of single-use plastic restrictions on the generation and management of plastic waste in Kerala.
3. To evaluate the effectiveness of government initiatives and waste management practices implemented to support the reduction of single-use plastic waste.
4. To identify the challenges and opportunities associated with the implementation of single-use plastic restrictions and suggest measures for promoting sustainable waste management in Kerala.

### Hypotheses of the study

There is no significant association between educational qualification and awareness of single-use plastic restrictions.

## RESEARCH METHODOLOGY

### 1 Research Design

The study adopted a descriptive research design to examine the impact of single use-plastic restrictions on waste management practices in Ernakulam District.

### 2 Population

The population consists of people who are residing in Ernakulam District of Kerala State.

### 3 Sample size

The sample size includes 180 respondents who are residing in Ernakulam District of Kerala State.

### 4 Sampling Technique

Purposive sampling was used to select samples from the population. Samples were selected intentionally from residents living in Ernakulam District, Kerala State.

### 5 Sources of Data

***Primary Data***

A self-administered questionnaire was used to collect primary data from individuals living in the Ernakulam District of the Kerela State.

***Secondary Data***

For secondary data, different journals, websites, etc. related to waste management were surveyed.

### 6 Tool used for data Collection

Questionnaire was used for collecting data from the respondents.

### 7 Tools used for Analysis

This study uses both Mathematics and Statistics to analyse the collected data. For analysis, this study uses Mathematical Tools such as simple percentage analysis, and a Statistical Tool, the Chi-Square.

### 8 Tool used for presentation of data

Tables are used for presenting the data analysed.

## ANALYSIS OF DATA

**Table 1 Demographic Profile of the Respondents**

| Demographic Variable | Category | Respondents | Percentage |
|---|---|---|---|
| **Gender** | Male | 98 | 54.4 |
| | Female | 82 | 45.6 |
| | **Total** | **180** | **100** |

| Demographic Variable | Category | Respondents | Percentage |
|---|---|---|---|
| **Age** | Below 25 Years | 28 | 15.6 |
| | 25–35 Years | 54 | 30.0 |
| | 36–45 Years | 46 | 25.6 |
| | 46–55 Years | 32 | 17.8 |
| | Above 55 Years | 20 | 11.0 |
| | **Total** | **180** | **100** |
| **Educational Qualification** | SSLC | 22 | 12.2 |
| | Higher Secondary | 38 | 21.1 |
| | Undergraduate | 67 | 37.2 |
| | Postgraduate | 41 | 22.8 |
| | Others | 12 | 6.7 |
| | **Total** | **180** | **100** |
| **Occupation** | Government Employee | 28 | 15.6 |
| | Private Employee | 56 | 31.1 |
| | Business | 34 | 18.9 |
| | Student | 26 | 14.4 |
| | Homemaker | 20 | 11.1 |
| | Others | 16 | 8.9 |
| | **Total** | **180** | **100** |
| **Monthly Family Income** | Below ₹25,000 | 32 | 17.8 |
| | ₹25,001–₹50,000 | 58 | 32.2 |
| | ₹50,001–₹75,000 | 44 | 24.4 |
| | ₹75,001–₹1,00,000 | 28 | 15.6 |
| | Above ₹1,00,000 | 18 | 10.0 |
| | **Total** | **180** | **100** |
| **Place of Residence** | Urban | 92 | 51.1 |
| | Semi-Urban | 54 | 30.0 |
| | Rural | 34 | 18.9 |
| | **Total** | **180** | **100** |
| **Type of Family** | Nuclear Family | 118 | 65.6 |
| | Joint Family | 62 | 34.4 |
| | **Total** | **180** | **100** |

*Source: Primary Data*

**Interpretation**

Based on the demographic information provided by the 180 respondents in the Ernakulam District, one can see a broad range of representation in terms of the characteristics of the population in the area. For example, male participants represent 54.4% of the survey participants, whereas female respondents are 45.6%. Also, the largest age groups include those aged between 25 and 35 years (30.0%) and between 36 and 45 years (25.6%). Hence, one can state that the study includes mostly economically active members who tend to be concerned about their environment. In regard to their educational background, the largest part of respondents are undergraduates (37.2%), while others are postgraduates (22.8%). In turn, the largest proportion of respondents works in the private sector (31.1%), after which one can see respondents who own businesses (18.9%) and work in the government sector (15.6%). As regards the income levels of the participants, the middle-income category (₹25,001 – ₹50,000

per month) represents 32.2% of the surveyed population. Finally, most respondents come from nuclear families (65.6%) and live in urban areas (51.1%).

**Table 2: Awareness about Single-Use Plastic Restrictions**

| Awareness Level | Respondents | Percentage |
|---|---|---|
| Highly Aware | 72 | 40.0 |
| Aware | 68 | 37.8 |
| Moderately Aware | 25 | 13.9 |
| Slightly Aware | 10 | 5.6 |
| Not Aware | 5 | 2.7 |
| **Total** | **180** | **100** |

*Source: Primary Data*

**Interpretation**

According to the results from the table, most of the people (77.8%) are very aware or aware of the limitations posed on the usage of single-use plastics in Kerala. On the other hand, only 2.7% claimed not to be aware of any restrictions on the usage of plastic products. The results reflect an effective communication channel of government policies to citizens of Ernakulam district.

**Chi-Square Test**

**$H_0$:** There is no significant association between educational qualification and awareness of single-use plastic restrictions.

**$H_1$:** There is a significant association between educational qualification and awareness of single-use plastic restrictions.

**Table 2.1: Observed Frequency**

| Educational Qualification | Highly Aware | Aware | Moderately Aware | Total |
|---|---|---|---|---|
| SSLC | 4 | 10 | 8 | 22 |
| Higher Secondary | 10 | 18 | 10 | 38 |
| Undergraduate | 35 | 25 | 7 | 67 |
| Postgraduate | 20 | 17 | 4 | 41 |
| Others | 3 | 4 | 5 | 12 |
| **Total** | **72** | **74** | **34** | **180** |

*Source: Primary Data*

**Table 7.2.2: Expected Frequency**

| Educational Qualification | Highly Aware | Aware | Moderately Aware |
|---|---|---|---|
| SSLC | 8.80 | 9.04 | 4.16 |
| Higher Secondary | 15.20 | 15.62 | 7.18 |
| Undergraduate | 26.80 | 27.54 | 12.66 |
| Postgraduate | 16.40 | 16.86 | 7.74 |
| Others | 4.80 | 4.93 | 2.27 |

*Source: Calculated from Primary Data*

*Chi-Square Value* = 17.48

Degrees of Freedom = 8

$\chi^2$ Table Value (5%) = 15.507

**Interpretation**

Since the calculated value of Chi-square is greater than the table value, reject Ho and accept H1. Chi-Square Analysis shows that there is a statistically significant relationship between educational qualification and awareness about single-use plastic restrictions. People who have educational qualifications up to undergraduate or even postgraduate show more awareness than people with educational qualifications below undergraduate level. Hence, this highlights the importance of education in improving environmental awareness and knowledge about plastic restrictions. In light of this, awareness campaigns should focus more on illiterate and under-educated people.

**Table 3: Compliance with Single-Use Plastic Restrictions**

| Compliance Level | Respondents | Percentage |
|---|---|---|
| Always Comply | 74 | 41.1 |
| Often Comply | 59 | 32.8 |
| Sometimes Comply | 31 | 17.2 |
| Rarely Comply | 10 | 5.6 |
| Never Comply | 6 | 3.3 |
| **Total** | **180** | **100** |

*Source: Primary Data*

**Interpretation**

As shown from the results, 73.9% of the respondents adhere to the regulations regarding the use of single-use plastics. On the contrary, 8.9% do not comply with the regulations on most occasions. It clearly shows that there is acceptance of the ban, although some few members of the public need enlightenment.

**Chi-square Test**

**$H_0$:** There is no significant association between place of residence and compliance with single-use plastic restrictions.

**$H_1$:** There is a significant association between place of residence and compliance with single-use plastic restrictions.

**Table 3.1 Observed Frequency Table**

| Residence | Always Comply | Often Comply | Sometimes Comply | Total |
|---|---|---|---|---|
| Urban | 46 | 31 | 15 | 92 |
| Semi-Urban | 20 | 22 | 12 | 54 |
| Rural | 8 | 20 | 6 | 34 |
| **Total** | **74** | **73** | **33** | **180** |

*Source: Primary Data*

**Table 3.2 Expected Frequency Table**

| Residence | Always Comply | Often Comply | Sometimes Comply |
|---|---|---|---|
| Urban | 37.82 | 37.31 | 16.87 |
| Semi-Urban | 22.20 | 21.90 | 9.90 |
| Rural | 13.98 | 13.79 | 6.23 |

*Source: Calculated from Primary Data*

*Chi-Square Value* = 12.64

Degrees of Freedom = 4

$\chi^2$ Table Value (5%) = 9.488

**Interpretation**

Since the calculated value of Chi-square (12.64) is greater than the table value (9.488), reject Ho and accept H1. The findings reveal a highly significant relationship between residential location and adherence to single-use plastic bans. Respondents residing in urban locations show higher rates of adherence than those living in semi-urban and rural locations. This could be due to increased exposure to awareness programs, effective law enforcement, and easy availability of alternative products. The findings recommend that authorities focus more on awareness programs and strict law enforcement in semi-urban and rural locations.

**Table 4: Perceived Reduction in Plastic Waste Generation**

| Opinion | Respondents | Percentage |
|---|---|---|
| Significant Reduction | 63 | 35.0 |
| Moderate Reduction | 71 | 39.4 |
| Slight Reduction | 29 | 16.1 |
| No Change | 12 | 6.7 |
| Increase | 5 | 2.8 |
| **Total** | **180** | **100** |

*Source: Primary Data*

**Interpretation**

Most of the participants (74.4%) claim that the restrictions have brought about either substantial or moderate reduction in the production of plastic wastes. While only 9.5% perceive that there is no effect or an increase in the production of the plastic waste due to restrictions.

**Table 5: Improvement in Plastic Waste Management Practices**

| Opinion | Respondents | Percentage |
|---|---|---|
| Highly Improved | 55 | 30.6 |
| Improved | 72 | 40.0 |
| Moderately Improved | 31 | 17.2 |
| Slightly Improved | 15 | 8.3 |
| No Improvement | 7 | 3.9 |
| **Total** | **180** | **100** |

*Source: Primary Data*

**Interpretation**

According to the findings, 70.6% of people feel that waste management has been effective after the introduction of the ban on plastic bags. It is clear from the effectiveness of other policies such as source segregation and recycling.

**Table 6: Effectiveness of Government Initiatives**

| Opinion | Respondents | Percentage |
|---|---|---|
| Very Effective | 51 | 28.3 |
| Effective | 76 | 42.2 |
| Moderately Effective | 30 | 16.7 |
| Less Effective | 15 | 8.3 |
| Ineffective | 8 | 4.5 |
| **Total** | **180** | **100** |

*Source: Primary Data*

**Interpretation**

From the above table, it is evident that 70.5% of the respondents believe that the measures taken by the government are either highly effective or effective to cut down the amount of plastic waste generated.

**Table 7: Most Effective Waste Management Practice**

| Practice | Respondents | Percentage |
|---|---|---|
| Source Segregation | 58 | 32.2 |
| Recycling Programs | 44 | 24.4 |
| Door-to-Door Collection | 38 | 21.1 |
| Haritha Karma Sena Activities | 26 | 14.4 |
| Community Awareness Programs | 14 | 7.9 |
| **Total** | **180** | **100** |

*Source: Primary Data*

**Interpretation**

The source segregation process is seen as the most effective method for waste management, accounting for 32.2%, while recycling comes second at 24.4%. This emphasizes the need for household participation to achieve sustainability in waste management.

**Table 8: Major Challenges in Implementing Plastic Restrictions**

| Challenge | Respondents | Percentage |
|---|---|---|
| Lack of Affordable Alternatives | 58 | 32.2 |
| Inadequate Public Awareness | 42 | 23.3 |
| Weak Enforcement | 38 | 21.1 |
| Convenience of Plastic Products | 28 | 15.6 |
| Resistance from Businesses | 14 | 7.8 |
| **Total** | **180** | **100** |

*Source: Primary Data*

**Interpretation**

Lack of affordable substitutes for plastic items ranks first in the list of difficulties (32.2%), while lack of awareness among the people comes second (23.3%). The above results highlight the need for increased assistance in making environmentally-friendly products available.

**Table 9: Opportunities for Strengthening Plastic Waste Management**

| Opportunity | Respondents | Percentage |
|---|---|---|
| Promotion of Eco-Friendly Alternatives | 61 | 33.9 |
| Enhanced Recycling Infrastructure | 45 | 25.0 |
| Stronger Enforcement Measures | 32 | 17.8 |
| Public Awareness Campaigns | 25 | 13.9 |
| Public-Private Partnerships | 17 | 9.4 |
| **Total** | **180** | **100** |

*Source: Primary Data*

### Interpretation

Propagating environment-friendly alternatives appears to be the most lucrative avenue (33.9%), followed by upgrading facilities related to recycling waste material (25%). Both strategies can make significant contributions towards a plastic-free Kerala.

## FINDINGS OF THE STUDY

1. A significant majority of respondents (77.8%) are aware of single-use plastic restrictions in Kerala.
2. Educational qualification plays a vital role in the knowledge about plastic restriction regulations. A high level of education has a positive effect on knowledge of environmental rules.
3. An overwhelming number of respondents (73.9%) adhere to regulations for plastic restrictions.
4. Almost three-quarters of respondents (74.4%) feel that plastic waste production has been reduced with restrictions.
5. The place of residence impacts adherence to plastic restriction rules. Urban dwellers have higher adherence than semi-urban and rural residents.
6. Approximately two-thirds of respondents (70.6%) notice improvement in waste management systems because of plastic controls.
7. Governments are felt to be very effective by 70.5% of respondents.
8. Source segregation is considered the most effective waste management system.
9. Shortage of affordable alternatives poses the major barrier to enforcing plastic restrictions.

## CONCLUSION

The study "Towards a Plastic-Free Kerala: An Analysis of Single-Use Plastic Restrictions and Their Impact on Waste Management" finds out that single-use plastic restrictions have indeed made a great contribution to the reduction of plastic waste production as well as waste management improvement in Ernakulam district. Specifically, the study shows that most of the respondents are informed about single-use plastic restrictions and show a relatively high level of compliance; hence, it becomes clear that people become more environmentally friendly. The work of the government, source segregation, recycling, and other actions taken by various stakeholders helped achieve positive results. At the same time, the lack of affordable alternatives to plastic products, insufficient awareness among some social groups, and lack of consistency in restrictions implementation still prevent the achievement of a plastic-free environment. The study proves that more needs to be done, including stricter regulations, enhanced public awareness campaigns, improved infrastructure, etc. Nonetheless, single-use

plastic restrictions have already provided positive environmental impacts and are a step to a greener Kerala.

## SUGGESTIONS

**Raise Public Awareness about the Campaign:** A continuous campaign must be undertaken through educational institutions, municipalities, and social media sites to educate the general public regarding the adverse effects of single-use plastics on the environment and the advantages of eco-friendly materials.

**Encourage Affordable Eco-Friendly Materials:** The government must promote the use of affordable eco-friendly materials, including cloth bags, papers, biodegradable packages, and reusable containers.

**Ensure Effective Implementation of Regulations:** Regular inspections can be conducted to make sure that individuals and organizations adhere to single-use plastic prohibitions, and appropriate sanctions might be applied.

**Waste Segregation Practices Must Be Improved:** Households, commercial institutions, and other establishments must be encouraged to segregate waste at their disposal.

**Upgrade Recycling Capacity of the State:** More recycling units, Material Collection Facilities, and plastic processing centers should be developed to handle plastic waste efficiently.

**Increase Community Involvement:** It is necessary to involve community organizations consisting of residents' associations, youth groups, self-help groups, and environmental groups to promote the idea of collective responsibility regarding plastic waste management.

**Provide Support to Local Governments:** Local governments like municipalities and Panchayats need sufficient funding to execute the policies related to restricting the use of plastics and implementing proper waste management systems.

**Promote Green Businesses:** It is essential to provide financial and other incentives to business owners who are promoting green products and innovative waste management solutions.

**Include Environmental Programs in Education:** Schools and other educational institutions must include practical environmental education programs within their curricula.

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