THE IMPACT OF PLASTIC DEGRADATION ON THE ENVIRONMENT

NAME OF THE STUDENT(S)

1. NIRVANA JAIN	USN:23BMSR0397
2. ATHARVLAVANIA	USN: 23BMSR0171
3. MANU VALLABHA	USN: 23BAR01064
4. Khushi.R	USN: 23BAR01004

School of Commerce JAIN (Deemed-to-be University)

School of CS & IT, JAIN (Deemed-to-be University)

School of SHSS, JAIN (Deemed-to-be University)

MAY 2026

BONAFIDE CERTIFICATE

This is to certify that this 'Research Report' titled The Impact Of Plastic Deegradation On The Environment Submitted as a part of 'Transdisciplinary Project Centric Learning' to the School of Commerce, School of Computer Science and IT and School of Humanities and Social Sciences, JAIN (Deemed-to-be University), Bengaluru.

Head of the Department **TD-PCL Guide**

School of Commerce

Place:
Bengaluru
Date:

NO OBJECTION CERTIFICATE

We hereby grant our No Objection to the university publishing Our project titled on The Impact of Plastic Degradation On The Environment in academic journals, conferences, institutional repositories, or any other official platforms deemed appropriate by the university. We confirm that we have no objection to the university using my project for academic, research, or promotional purposes. This certificate is issued upon my consent for the publication of my project. Signature of Student
[Student Name]

[USN] Signature of Head of Department

Student name	USN	Signature of student
1. NIRVANA JAIN	USN:23BMSR0397	
2. ATHARVLAVANIA	USN: 23BMSR0171	
3. MANU VALLABHA	USN: 23BAR01064	
4. Khushi.R	USN: 23BAR01004	

Name of Head of Department

Signature Of Head of Department

DECLARATION BY THE STUDENT

This is to certify that the project titled THE IMPACT OF PLASTIC DEGRADATION ON THE ENVIRONMEN is an original one and has not been submitted earlier to any University or any other Institution. And we are handling over/transferring all the rights of the project to student Research Development Cell-SHODHA, school of commerce and school of computer science and IT, school of humanities and social studies. Jain (deemed-to_be University), can utilize it for further academic excellence.

Place: Bengaluru

Date:

NameoftheStudent(s)	**USN**	**Student's Signature**
1. NIRVANA JAIN	USN:23BMSR0397	
2. ATHARVLAVANIA	USN: 23BMSR0171	
3.. MANU VALLABHA	USN: 23BAR01064	
4. Khushi.R	USN: 23BAR01004	

TABLE OF CONTENTS

THE IMPACT OF PLASTIC DEGRADATION ON THE ENVIRONMENT

1. Abstract:

Plastic pollution has emerged as one of the most serious environmental challenges in the modern world due to the rapid increase in plastic production and its resistance to natural degradation processes. Plastics are synthetic materials made from long chains of polymers derived mainly from petroleum-based products. These materials are widely used in everyday life because they are lightweight, durable, flexible and inexpensive. However, these same properties that make plastics useful also make them extremely harmful to the environment. Unlike natural materials such as paper, wood or food waste, plastics do not easily decompose. Instead of breaking down completely, they slowly fragment into smaller pieces over time. This process leads to the formation of microplastics, which are tiny plastic particles less than 5 millimeters in size. These microplastics are now found everywhere in oceans, rivers, soil, air and even inside living organisms, including humans. Plastic degradation occurs through various processes such as physical, chemical and biological mechanisms. Physical degradation involves the breakdown of plastics due to environmental forces like wind, sunlight and water. Chemical degradation occurs through reactions such as oxidation and hydrolysis, which weaken the structure of plastic materials. Biological degradation involves microorganisms like bacteria and fungi that can break down certain types of plastics. However, most conventional plastics are not biodegradable, which makes the degradation process extremely slow and incomplete. The accumulation of plastic waste has led to severe environmental issues such as marine pollution, soil contamination and air pollution. Marine animals often ingest plastic particles, mistaking them for food, which can lead to injury or death. On land, plastic waste affects soil quality and agricultural productivity. Plastic degradation releases harmful chemicals into the environment, which can pose risks to both ecosystems and human health. Our research paper aims to study the process of plastic degradation in detail and analyze its environmental and health impacts. It also examines public awareness and behavior related to plastic usage through primary data collection. Our study highlights the need for effective waste management systems, sustainable alternatives and increased awareness to address the growing problem of plastic pollution.

2. Aim and Objectives:

2. Aim and Objectives:

The main aim of this research is to understand the process of plastic degradation and its impact on the environment and human health. Out study focuses on analyzing how plastic materials break down over time and how this process affects ecosystems and living organisms. The objectives of our study are as follows:

The first objective is to study the different types of plastics and their properties. Plastics vary in their chemical composition and structure, which affects how they degrade in the environment.

The second objective is to understand the various processes of plastic degradation, including physical, chemical and biological methods. Each of these processes plays a role in breaking down plastic materials, but they operate under different environmental conditions.

The third objective is to analyze the environmental impact of plastic degradation. This includes studying how plastic waste affects marine life, soil quality and air pollution.

The fourth objective is to examine the health implications of plastic degradation, particularly the effects of microplastics on human health.

The fifth objective is to evaluate public awareness and behavior related to plastic usage and waste management through a questionnaire survey.

The final objective is to suggest solutions and recommendations to reduce plastic pollution and promote sustainable practices.

Hypothesis:

The hypothesis of our study is based on the assumption that although people are aware of plastic pollution, they continue to use plastic products frequently due to convenience and lack of alternatives. This suggests that awareness alone is not enough to bring about behavioral change. Another part of the hypothesis is that improving waste management systems, increasing awareness and developing eco-friendly alternatives can significantly reduce plastic pollution. However, these solutions will only be effective if individuals, industries and governments work together. Our study also assumes that there is a gap between knowledge and practice. Many people know that plastic is harmful, but they do not take sufficient steps to reduce its usage in daily life.

4. Research Area Identification:

Our research falls under the field of environmental science and focuses on the issue of plastic pollution and degradation. Our study covers different environments where plastic waste is commonly found, including oceans, rivers, soil and urban areas. Plastic pollution is a global issue, affecting both developed and developing countries. However the severity of the problem is often higher in developing countries due to rapid urbanization and lack of proper waste management systems. The study also focuses on local environments where plastic usage is high, such as households, markets and public places. By studying these areas, the research aims to understand how plastic waste is generated and managed in everyday life.

5. Statement of the Problem:

Plastic waste has become one of the most serious environmental problems due to its widespread use and slow degradation. Every day, large amounts of plastic are produced and discarded, leading to the accumulation of waste in the environment. One of the main problems associated with plastic waste is its persistence. Plastics do not decompose easily and can remain in the environment for hundreds of years. Instead of breaking down completely, they fragment into smaller particles known as microplastics. Microplastics are particularly dangerous because they are small, lightweight and easily spread through air and water. They are difficult to detect and remove, making them a major environmental concern. These particles can enter the food chain and affect both animals and humans. Another major issue is improper waste management. In many areas, plastic waste is not properly collected or recycled, leading to pollution of land and water bodies. Open dumping and burning of plastic waste further contribute to environmental and health problems. The increasing use of single-use plastics, such as bags, bottles and packaging materials, has worsened the problem. These items are used for a short time but remain in the environment for a long period.

6. Introduction of the Study:

Plastic has become an essential part of modern life due to its versatility and low cost. It is used in various sectors such as packaging, transportation, healthcare and construction. However, the widespread use of plastic has led to serious environmental challenges. One of the major issues with plastic is its resistance to degradation. Unlike natural materials, plastics are designed to be durable and long-lasting. This makes them difficult to break down in the environment. As plastic

waste accumulates, it undergoes degradation processes that break it into smaller pieces. These smaller particles, known as microplastics, are now found in almost every part of the environment. The presence of microplastics has raised concerns about their impact on ecosystems and human health. These particles can enter food chains and accumulate in living organisms, leading to potential health risks.

7. Background of the Study:

The development of plastic materials began in the early 20th century and revolutionized industries due to their unique properties. Over time, plastic production increased rapidly, especially after World War II. Plastics became popular because they were cheap, durable and easy to manufacture. However, their environmental impact was not considered during their early development. Today, plastic waste has become a global problem. Most plastics are non-biodegradable and remain in the environment for long periods. Research shows that plastics like polyethylene and polypropylene can take hundreds of years to degrade. The increase in single-use plastics has further contributed to the problem. These products are used briefly but create long-term waste.

8. Significance of the Study:

Our study is significant because it addresses one of the most pressing environmental issues of our time. Plastic pollution affects ecosystems, wildlife and human health. Understanding plastic degradation helps in identifying the long-term impact of plastic waste. It also helps in developing strategies to reduce pollution and promote sustainable practices. Our tudy also contributes to increasing awareness among people about the importance of reducing plastic usage.

9. Need for the Study:

The need for this study arises from the growing problem of plastic pollution and its harmful effects. Despite increasing awareness, plastic usage continues to rise. Many people are not fully

aware of the concept of plastic degradation and its impact on the environment. Our study aims to provide detailed information on the topic and encourage responsible behavior. Our study also highlights the importance of finding effective solutions to manage plastic waste.

10. Review of Literature:

The review of literature shows that plastic degradation is a complex process influenced by environmental conditions. Studies have shown that plastics degrade through physical, chemical and biological processes, but the rate of degradation is very slow. Research indicates that microplastics are a major concern because they are widely distributed in the environment and can enter food chains. These particles have been found in oceans, soil and even drinking water. Several studies have also focused on the impact of plastic pollution on marine life. Marine animals often ingest plastic particles, which can lead to injury or death. Other studies highlight the role of human behavior in plastic pollution. Despite awareness, people continue to use plastic due to convenience and lack of alternatives. The literature suggests that while significant research has been conducted on plastic degradation, more efforts are needed to develop effective solutions.

11. Research Methodology:

The research methodology used in this study is designed to provide a clear and systematic understanding of plastic degradation and its environmental impact. Our study follows a mixed-method approach, which includes both qualitative and quantitative research methods. This approach helps in combining theoretical knowledge with real-life data. The qualitative part of the study is based on secondary data collected from research articles, journals and environmental reports. These sources provide detailed information about plastic degradation processes, environmental effects and health impacts. Many studies show that even though awareness about plastic pollution exists behavioral change is still limited, especially in developing regions. The quantitative part of the study involves primary data collection using a questionnaire. A structured questionnaire was prepared and distributed among 50 respondents from different age groups and educational backgrounds. The purpose of this survey was to understand public awareness, behavior and attitudes toward plastic usage. Our research is descriptive in nature, as it describes the current situation of plastic pollution. It is also analytical, as it examines patterns

and relationships between awareness and behavior. The sampling method used is simple random sampling, which ensures that each individual has an equal chance of being selected. This helps in reducing bias and improving the reliability of the data.

12. Questionnaire:

The main research tool used in this study is a structured questionnaire. The questionnaire was carefully designed to ensure clarity, simplicity and relevance. It includes:

- Close-ended questions (easy to analyze)
- Opinion-based questions (to understand attitudes)
- Behavioral questions (to study actual practices)

The questions are arranged in a logical order, starting from general awareness and moving toward specific behavior and opinions. This helps respondents answer comfortably and improves the quality of responses.

Questions:

1. What is your age group?

2. What is your level of education?

3. Are you aware of plastic pollution?

4. How did you learn about plastic pollution?

5. Do you know about plastic degradation?

6. How long do you think plastic takes to degrade?

7. Are you aware of microplastics?

8. Do you know microplastics can enter the human body?

9. How often do you use plastic products?

10. Which plastic products do you use most?

11. Do you reuse plastic items?

12. Do you separate plastic waste from other waste?

13. Do you recycle plastic waste?

14. Are recycling facilities available in your area?

15. Do you use eco-friendly alternatives?

16. How often do you use alternatives?

17. What stops you from using alternatives?

18. Do you think plastic pollution affects the environment?

19. Which area is most affected (land/water/air)?

20. Do you think plastic pollution affects health?

21. Have you tried reducing plastic usage?

22. Do you support banning single-use plastics?

23. Is the government doing enough?

24. Who is responsible for plastic pollution?

25. Are you willing to change your lifestyle?

26. Would you join awareness programs?

27. Can education reduce plastic pollution?

28. What is the best solution?

29. Have you participated in environmental activities?

30. What steps do you suggest to reduce plastic pollution? (open-ended)

13. Data Collection:

The data for our study was collected from both primary and secondary sources.

- Primary Data:

Primary data was collected through the questionnaire survey. A total of 50 respondents participated in the study. The respondents belonged to different age groups and educational backgrounds, which helped in getting diverse opinions. The responses were collected and recorded carefully. This data reflects real-life behavior and awareness levels regarding plastic usage.

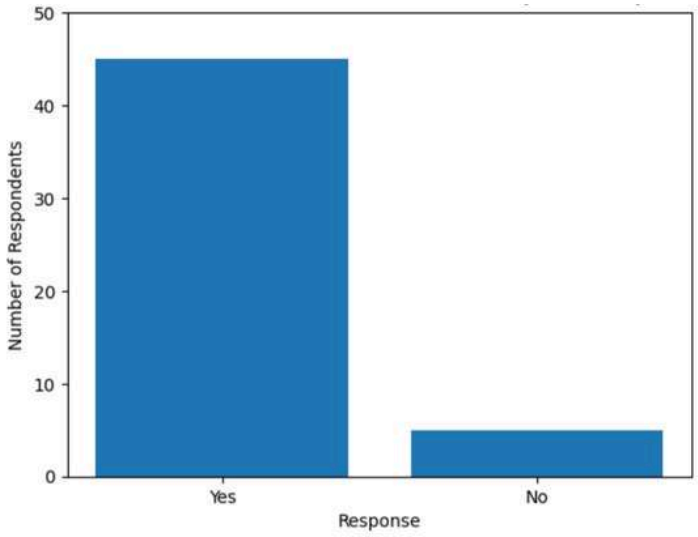
- Secondary Data:

Secondary data was collected from research papers, environmental reports and journals. Studies show that even though awareness about plastic pollution is high, actual reduction in plastic usage is limited due to convenience and lifestyle habits

14. Data Analysis and Interpretation:

The collected data was organized into charts for better understanding. Each table represents a specific aspect of the study.

- Table 1: Awareness of Plastic Pollution



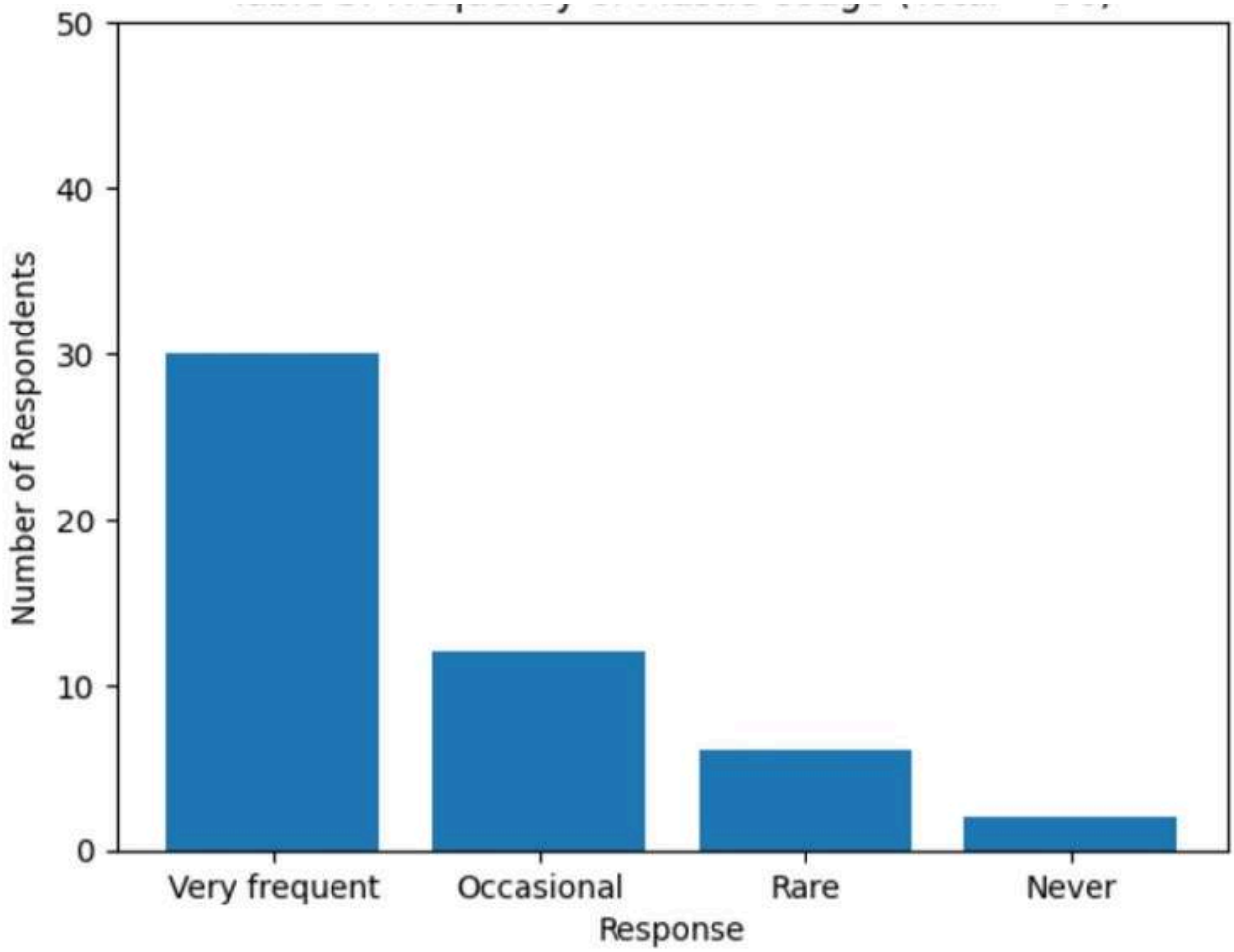
This shows that most respondents are aware of plastic pollution. This indicates that awareness campaigns and education have been effective. However, awareness alone does not guarantee behavioral change.

Table 2: Awareness of Plastic Degradation

Response	Number	Percentage
Yes	30	60%
No	20	40%
Total	**50**	**100%**

While general awareness is high, fewer people understand plastic degradation. This shows a lack of deeper knowledge about the issue.

Table 3: Frequency of Plastic Usage



This shows that plastic usage is still very high. Even though people are aware of its harmful effects, they continue to use plastic regularly. This supports the idea that awareness does not always lead to action.

Table 4: Awareness of Microplastics

Response	Number	Percentage
Yes	28	56%
No	22	44%
Total	**50**	**100%**

Awareness of microplastics is moderate. Many people still do not know about this concept, which is important because microplastics are one of the most harmful effects of plastic degradation.

Table 5: Use of Eco-Friendly Alternatives

Response	Number	Percentage
Yes	20	40%
No	30	60%
Total	**50**	**100%**

Most people do not use eco-friendly alternatives. This shows that factors like convenience, cost and availability influence behavior.

This shows that most respondents are aware of plastic pollution. This indicates that awareness campaigns and education have been effective. However, awareness alone does not guarantee behavioral change.

● Overall Analysis:

The overall findings of the study clearly show a gap between awareness and behavior. While most people are aware of plastic pollution, they still use plastic frequently.
This pattern is also supported by research studies, which show that awareness does not always lead to sustainable behavior due to lifestyle habits and lack of alternatives. The study highlights that:

a. Awareness is high

b. Knowledge is moderate

c. Behavior change is low

This indicates the need for stronger policies, better alternatives and continuous awareness programs.

15. Plastic Degradation Process:

Plastic degradation is a complex and slow process through which plastic materials break down into smaller particles under environmental conditions. Unlike natural substances, plastics are made of strong polymer chains that resist decomposition. As a result, they do not disappear completely but instead fragment into smaller particles over time. The process of plastic degradation occurs in multiple stages. The first stage is physical degradation, also known as fragmentation. In this stage, large plastic items such as bottles, bags and containers are broken into smaller pieces due to environmental factors like sunlight, wind, waves and temperature changes. This increases the surface area of plastic, making it more vulnerable to further degradation. The second stage is chemical degradation, where the polymer structure of plastic changes due to reactions such as oxidation and hydrolysis. These reactions weaken the plastic material by introducing oxygen-containing compounds into the polymer chains. This makes the plastic brittle and easier to break down further. Another important process is photodegradation, which occurs when plastics are exposed to ultraviolet (UV) radiation from sunlight. UV rays break the chemical bonds in plastics, causing them to crack and fragment into smaller particles.

This is one of the main reasons why plastic waste breaks down faster in open environments. The final stage is biological degradation, where microorganisms such as bacteria and fungi attempt to break down plastic materials. However, most conventional plastics are not easily biodegradable, so this process is very slow and limited. During these processes, plastics eventually form microplastics (less than 5 mm) and even smaller nanoplastics, which persist in the environment for long periods. The plastic degradation does not eliminate plastic waste but transforms it into smaller and more harmful particles that spread widely in the environment.

16. Environmental Impact:

Plastic degradation has a significant impact on the environment, affecting ecosystems on land, in water and in the atmosphere. As plastics break down into microplastics, they spread easily and accumulate over time. In marine environments, plastic pollution is one of the biggest threats. Marine animals often mistake plastic particles for food, leading to ingestion. This can cause internal injuries, starvation and even death. Microplastics also enter the food chain, affecting not only marine life but also humans who consume seafood. In terrestrial ecosystems, plastic particles affect soil quality. They reduce the soil's ability to retain water and nutrients, which can impact plant growth and agricultural productivity. Studies show that microplastics can accumulate in soil and move through food chains, affecting both plants and animals. Another major concern is the global spread of microplastics. These particles are now found in oceans, rivers, soil and even the air. Their presence in remote areas shows that plastic pollution is a global problem, not limited to specific locations. Plastic degradation also contributes to chemical pollution. Plastics contain additives such as stabilizers and plasticizers. When plastics break down, these chemicals are released into the environment, contaminating water and soil.
The plastic degradation contributes to climate change. The breakdown and burning of plastics release greenhouse gases, which contribute to global warming.

17. Health Implications:

Plastic degradation has serious implications for human health, mainly due to the formation of microplastics and nanoplastics. These particles are now present in food, water and air, making human exposure unavoidable. Microplastics can enter the human body through ingestion, inhalation, and skin contact. For example:

a. Through food (seafood, salt, packaged food)

b. Through drinking water

c. Through air (breathing in tiny particles)

Research shows that microplastics have been found in human stool samples, indicating that they are regularly consumed. Once inside the body, microplastics may cause several health problems. Studies suggest they can lead to:

- Inflammation
- Oxidative stress
- Hormonal imbalance
- Damage to cells and tissues
- Immune system responses

Another concern is that microplastics can carry toxic chemicals. They can absorb pollutants from the environment and transport them into the human body, increasing health risks. Although research is still ongoing, scientists believe that long-term exposure to microplastics may be linked to chronic diseases and other health issues.

18. Current Solutions and Future Prospects

To address plastic pollution and degradation, several solutions are being developed at different levels. One of the most effective solutions is reducing plastic usage, especially single-use plastics such as bags, bottles and packaging materials. Using reusable and eco-friendly alternatives can significantly reduce plastic waste. Recycling is another important solution. It helps convert plastic waste into new products, reducing environmental pollution. However, current recycling systems are not efficient enough, as only a small percentage of plastic waste is properly recycled. Biodegradable plastics are being developed as an alternative. These materials are designed to break down more easily under certain conditions. However, they still require

proper disposal systems and are not a complete solution. Advanced technologies such as chemical recycling and microbial degradation are also being explored. Scientists are studying bacteria and enzymes that can break down plastics more effectively. While promising, these technologies are still under development. Government policies such as banning single-use plastics and promoting sustainable practices play a crucial role. Public awareness campaigns are also important in encouraging people to adopt environmentally friendly behavior.

19. Discussion:

The findings of this study clearly show that plastic degradation is a slow and incomplete process that leads to the formation of microplastics. These particles persist in the environment and create long-term environmental and health problems. The data collected through the questionnaire shows that although people are aware of plastic pollution, they continue to use plastic frequently. This indicates a gap between awareness and behavior. Our study also highlights that solving plastic pollution requires a combination of scientific solutions and behavioral change. Technology alone cannot solve the problem unless people change their habits.

20. Recommendations:

Based on the study, the following recommendations are suggested:

a. Increase awareness programs about plastic pollution and its effects

b. Promote the use of eco-friendly alternatives such as cloth bags

c. Improve waste management and recycling systems

d. Implement strict government policies to control plastic usage

e. Encourage industries to reduce plastic packaging

f. Support research and innovation in plastic degradation technologies

Individuals should also take responsibility by reducing plastic use and adopting sustainable practices.

21. Conclusion:

Plastic degradation is a slow and complex process that does not eliminate plastic waste but transforms it into microplastics. These particles spread across the environment and affect ecosystems and human health. Our study shows that plastic pollution is a global problem that requires immediate attention. While awareness is increasing, behavioral change is still limited. To address this issue, combined efforts from individuals, industries and governments are necessary. By reducing plastic usage, improving waste management, and developing new technologies, it is possible to reduce the impact of plastic pollution and move toward a more sustainable future.

22. References:

a. Environmental Health and Preventive Medicine

b. Environmental Sciences Europed.

c. RSC Advances (Plastic Degradation Studies)

d. PubMed Research Articles

e. Environmental Science Journals