

The Impact of Water Pollution Caused by Plastic Waste: A Threat to Ecosystems and Health

Abdulsamea Mohammed Elhadi Hussen¹, Faiza Tawati Abdalnaser² and Mohamed Abusa Gaza³

¹Department of Physics, Faculty of Education, Zintan University, Derj, LIBYA

²Higher Institute of Sciences and Technology, AL Garaboulli, LIBYA

³Department of Biotechnology, Faculty of Biotechnology, Aljafara University, Aljafara, LIBYA

Corresponding Author: abdulsamea.hussen@uoz.edu.ly



www.jrasb.com || Vol. 1 No. 1 (2022): April Issue

Received: 03-04-2022

Revised: 13-04-2022

Accepted: 25-04-2022

ABSTRACT

Waste made of plastic has become a major source of water contamination, endangering both human health and ecosystems. To disrupt aquatic life, damage biodiversity, and get into the food chain, this research investigates how microplastics and larger plastic trash pollute water bodies. The report emphasizes the risks that plastic pollution poses to the ecosystem and human health, including its harmful effects and long-term persistence. To address this expanding worldwide concern, strategies for minimizing this issue are presented, reducing the use of plastic, improving trash disposal methods, and promoting sustainable substitutes. This study will use a quantitative approach to assess the impact of plastic waste on water pollution and its effects on ecosystems and human health. Data will be collected through water sampling to measure the concentration of microplastics and larger plastic debris in various water bodies. Statistical analysis will be performed to identify correlations between pollution levels and changes in aquatic biodiversity, as well as health risks associated with plastic contamination. The findings will provide quantitative evidence to support strategies aimed at reducing plastic pollution and improving waste management practices.

Keywords- Water, Pollution, Ecosystems, Health.

I. INTRODUCTION

Plastic pollution is one of the most pressing environmental problems of the modern day. This widespread problem, which has a major impact on both the environment and human health, is most acutely felt in water bodies. Oceans, rivers, and lakes around the world are severely contaminated due to the pervasiveness of plastic, which includes everything from big trash to microplastics. Plastic debris in water sources harms biodiversity, disturbs aquatic ecosystems, and even makes its way into the human food chain through aquatic species. The necessity of dealing with plastic pollution immediately because of its toxicity, persistence, and rising levels in aquatic habitats. Water pollution caused by plastic waste has become an increasingly serious environmental problem worldwide. Plastic that does not decompose quickly in nature causes major damage to

aquatic ecosystems and human health. Plastic waste, especially that dumped into rivers, seas, and lakes pollutes water resources that are very important for the lives of living things, including humans. Based on data from the World Economic Forum, it is estimated that more than 8 million tons of plastic enter the ocean every year, and most of this waste comes from rivers that cannot effectively manage plastic waste. Plastic that decomposes in water produces microplastics that can damage marine habitats and enter the food chain, threatening human health¹.

Plastic garbage accumulates in water bodies and remains there for decades due to the materials' infamous durability and resistance to natural degradation. In addition to the impact on the ecosystem, water pollution by plastic waste also poses a threat to human health. Plastics that is thrown into the water can contain various hazardous chemicals such as bisphenol A (BPA) and phthalates that can disrupt the endocrine system and cause

long-term health problems, including cancer and reproductive disorders. Microplastics that dissolve in water and enter the human body through the consumption of contaminated fish also pose a risk of increasing health problems. Therefore, it is important to understand the impact of water pollution by plastic waste, especially on aquatic life and human health². Microplastics, which are tiny particles that are either discharged into the environment in minuscule amounts or are produced when bigger plastic garbage breaks down, are of special concern. Because marine species may readily consume these particles which are frequently undetectable to the human eye bioaccumulation occurs throughout the food chain. Research has demonstrated that plastic particles can change aquatic creatures' feeding, development, and reproductive patterns, putting biodiversity at risk. Plastics can disturb marine life and release dangerous chemicals into the watery environment, such as heavy metals and persistent organic pollutants (POPs), which stick to the surface of plastic particles and are toxic to humans and wildlife³.

As an archipelagic country with thousands of rivers and oceans as important natural resources, Indonesia faces major challenges related to plastic waste management. According to a report from Ocean Conservancy, Indonesia is one of the largest contributors of plastic waste to the ocean, which has an impact on the destruction of coastal and marine ecosystems. Ineffective plastic waste management is the main cause of water pollution in Indonesia. Even though the Indonesian government has started several programs to cut back on single-use plastics, not many people are aware of how important it is to manage plastic waste. Therefore, this study aims to examine in more depth the impact of water pollution due to plastic waste on aquatic ecosystems and human health⁴.

The direct effects of plastic waste on human health are among its most alarming features. By consuming tainted seafood, water, and other food items, humans are indirectly exposed to microplastics⁵. There is mounting proof that plastic particles in the food chain pose some health hazards, such as toxicity, inflammation, and possible long-term impacts on human organs and systems⁶. The buildup of plastic garbage in water bodies also causes physical harm to ecosystems, including the devastation of coral reefs and the entanglement of aquatic life in bigger plastic debris. The general health of aquatic habitats and their capacity to sustain biodiversity have eventually deteriorated as a result of these negative impacts⁷.

Since plastic pollution has negative consequences on public health worldwide in addition to the environment, its importance in reducing it cannot be stressed. Examining the concentrations of microplastics and bigger plastic debris, this study aims to assess the extent of plastic pollution in aquatic bodies. Various water bodies will have their samples taken, and the amount of plastics present will be measured. Potential health effects

and the relationships between plastic pollution and noted shifts in aquatic biodiversity will be evaluated using statistical analysis. The results of this study will add to the current discussion on plastic pollution by offering useful quantitative information that can guide tactics meant to cut down on plastic waste, enhance waste management systems, and promote the use of sustainable substitutes⁸.

Addressing this environmental catastrophe requires coordinated international actions due to the growing threat of plastic contamination. Reducing plastic usage, improving recycling systems, and encouraging the use of biodegradable materials are all effective ways to fight plastic pollution. This research will provide crucial insights into the actions required to minimize this expanding issue and safeguard the environment and human well-being by fully comprehending the level of plastic contamination in aquatic ecosystems and its effects on human health⁹.

Water pollution, especially from plastic trash, has become a serious problem for the environment and human health in recent years. Because they are inexpensive and durable, plastics are used extensively in many different industries. As a result, they are now one of the biggest contaminants of aquatic environments globally. Ocean, river, and lake plastic garbage have resulted in a variety of environmental issues, including serious risks to ecosystem stability, biodiversity, and public health. More than 10 million tons of plastic debris enter the oceans annually, according to recent studies, creating worrying levels of plastic pollution. The accumulation of plastics in water bodies not only endangers aquatic life but also has a major negative influence on human health since the plastics decompose into microplastics that are ingested by marine life and go up the food chain¹⁰.

Ecosystems are known to be negatively impacted by plastic garbage. Marine life, including fish, seabirds, and sea turtles, is directly threatened by plastics, particularly bigger items like bottles and bags, as they may consume or become entangled in plastic¹¹. Additionally, plastic garbage contaminates the water and exacerbates the harm to aquatic life by providing a growing medium for dangerous microbes. Microplastics are less obvious but significantly more pervasive, penetrating ecosystems in ways that are yet unclear when plastics decompose into tiny particles¹². Addressing the problem has become a top priority for governments, environmental organizations, and the scientific community because of the growing awareness of plastic pollution and its extensive effects. To lessen the effects of plastic pollution, it is essential to make efforts to decrease plastic waste, enhance waste management procedures, and create substitute materials. In this regard, creating practical plans to safeguard the environment and public health requires an awareness of the dynamics of plastic trash and how it affects aquatic ecosystems. To add to the expanding corpus of research focused on resolving this pressing environmental issue, this study intends to

investigate the extent of water pollution brought on by plastic trash, its impacts on ecosystems, and the related health hazards.

The impact of water pollution by plastic waste is also increasingly relevant considering the many international programs aimed at reducing plastic pollution. Organizations such as the United Nations Environment Program (UNEP) and various countries have made efforts to reduce plastic use at the global level, with a focus on managing plastic waste in water. However, to achieve significant change, more comprehensive research is needed on the long-term impacts of plastic pollution on ecosystems and human health.

II. LITERATURE REVIEW

Plastic Pollution

One of the biggest environmental risks in recent decades has been plastic trash in aquatic environments. Microplastics and large plastic trash are now commonplace in rivers, freshwater bodies, and seas, harming marine life both directly and indirectly. Marine species are physically threatened by larger plastic items like bottles and bags. Animals frequently swallow or become entangled in plastic, which can cause harm or even death. Marine life suffers internal harm by ingesting plastics, which can include stunted growth, damage to organs, and even death in some species. Plastic pollution is one of the most pressing environmental issues worldwide. Non-biodegradable plastic waste easily contaminates various ecosystems, both terrestrial and aquatic. Plastic, which is a very durable material, can persist for hundreds of years in the environment, resulting in significant accumulation in oceans and rivers. Plastic that is dumped into the ocean then breaks down into small pieces called microplastics, which can spread widely and threaten marine life. Research shows that microplastics can enter the bodies of marine organisms such as fish and mollusks, which can eventually enter the human food chain¹³.

The breakdown of plastic into tiny particles, called microplastics, which have been discovered in all marine habitats, from surface waters to the deep ocean, worsens the environmental damage. Fish, zooplankton, and filter feeders are among the many marine creatures that consume microplastics, which are plastic particles smaller than 5 mm. All trophic levels of marine organisms absorb microplastics, which can cause plastics to bioaccumulate and biomagnify in the food chain. Additionally, these particles serve as carriers of dangerous substances like persistent organic pollutants (POPs), which stick to plastic surfaces and endanger marine life. The impacts of plastic pollution are extensive, including habitat destruction, disruption to marine species, and threats to human health. Microplastics ingested by fish and marine animals can cause digestive and reproductive disorders and can even lead to death. In

addition, plastic that is decomposed in the environment can release hazardous chemicals that threaten human health. This problem is further complicated by the increasing use of single-use plastics, such as bottles, plastic bags, and food packaging, which are among the largest contributors to plastic pollution¹⁴.

Aquatic habitats' normal behavior and ecological processes are also disturbed by plastic pollution. How bacteria and other illnesses spread in coastal habitats as a result of plastics acting as a substrate for dangerous microbes. Human health and aquatic creatures may be further harmed by this microbial pollution. Plastic waste worsens the deterioration of aquatic ecosystems, upsetting food webs, decreasing biodiversity, and endangering the survival of species as it keeps piling up in freshwater and ocean systems. Efforts to reduce plastic pollution are increasingly being carried out in various countries, with a focus on reducing the use of single-use plastics and increasing public awareness of the importance of recycling and more effective management of plastic waste.¹⁵

Bioaccumulation and Chemical Contamination

The environmental impact of plastic trash, especially microplastics, is complicated by the fact that it is a vector for chemical pollutants in addition to being a physical pollutant. Pesticides, heavy metals, and persistent organic pollutants (POPs) are among the harmful substances that microplastics can absorb and concentrate from the surrounding water. When marine species consume plastics, these chemicals are then passed up the food chain, causing harmful substances to bioaccumulate. demonstrated how a variety of chemical pollutants, including dangerous materials like pesticides, industrial chemicals, and medications, can be carried by microplastics. Marine life absorbs these substances, which may have long-term health consequences. Bioaccumulation and chemical contamination from plastics are serious problems affecting ecosystems and human health. Plastics, especially microplastics, can contain a variety of hazardous chemicals such as bisphenol A (BPA), phthalates, and heavy metals, which are released into the environment as they decompose. When plastics enter the bodies of marine organisms, these chemicals can accumulate in their tissues through a process of bioaccumulation, potentially causing metabolic and hormonal system disorders. Fish that consume plastics can be exposed to hazardous chemicals derived from plastics, which can then enter the food chain and threaten human health¹⁶.

These pollutants have detrimental effects on human health and marine life when they move up the food chain. When marine species consume plastic particles, toxic compounds may build up and be passed on to humans who eat seafood. Numerous health concerns, including hormone imbalances, reproductive problems, and developmental disorders, have been linked to BPA (bisphenol A), phthalates, and other endocrine-disrupting chemicals present in plastics. Human health is seriously

endangered by these harmful compounds, especially when eating seafood, which is a common food source for these toxins. The bioaccumulation process occurs when organisms continue to consume plastic contaminated with hazardous chemicals for a long time so that the concentration of these chemicals increases in the organism's body. Chemicals such as BPA and phthalates, which are used in plastic production, are known as endocrine disruptors that can interfere with the hormonal systems of living things, both animals and humans. This chemical contamination not only endangers marine species but can also affect human health through the consumption of contaminated seafood. In addition, microplastics dissolved in water can also spread pathogens and other hazardous substances into the aquatic ecosystem¹⁷.

There may be serious ecological repercussions if these pollutants build up in marine organisms. The bioaccumulation of dangerous chemicals in marine organisms can change the general health of marine species, interfere with reproductive cycles, and decrease population levels. These chemical pollutants can harm marine creatures' ability to reproduce and flourish, which can have a domino impact on the food chain. The bioaccumulation of toxic substances is expected to increase as microplastics continue to spread throughout aquatic environments, posing an increasing threat to human health and marine life. With increasing levels of plastic pollution in the ocean, research into the bioaccumulation and chemical contamination impacts of plastics is becoming increasingly important to identify risks to organisms and humans. Therefore, the need for better plastic waste management policies and technologies to detect and reduce plastics in the water is urgent¹⁴.

Human Health Risks Associated with Microplastic Contamination

Concerns over the possible hazards to human health posed by plastic waste, especially microplastics, have grown. Recent studies have demonstrated that microplastics not only endanger marine life but also present serious health concerns to people, mainly through the ingestion of tainted seafood. The existence of microplastics in seafood and discovered that fish, shellfish, and other marine animals that are frequently eaten by people include microplastic particles. These particles have the potential to create health problems since they are small enough to reach the human digestive system. Microplastic consumption may cause physical harm, such as inflammation, oxidative stress, and tissue damage. The human health risks associated with microplastic contamination are of increasing global concern. Microplastics are plastic particles smaller than 5 mm in size, which can enter the human body through the consumption of contaminated seafood or drinking water contaminated with microplastics. Microplastics can be found in a variety of seafood, such as fish, shellfish, and shrimp, which are the main sources of human exposure.

Hazardous chemicals found in microplastics, such as bisphenol A (BPA), phthalates, and heavy metals, can pass into the human body and potentially cause health problems¹⁷.

Microplastics have the potential to transport dangerous substances like insecticides, heavy metals, and substances that affect hormones. When consumed, these compounds can seep into the human body via microplastics, creating serious health hazards. Chemicals such as bisphenol A (BPA), which is frequently used in the manufacture of plastic, can interfere with hormones and cause problems with reproduction. Another class of chemicals included in plastics, phthalates, have been connected to developmental abnormalities, especially in young infants. Consuming tainted seafood exposes people to these harmful compounds, which is a direct route to health hazards associated with plastic. Long-term exposure to chemicals contained in microplastics can risk disrupting the body's hormonal system. BPA, a chemical used in the manufacture of plastics, is known to have an endocrine disruptor effect that can affect the reproductive system, growth, and development. In addition, microplastics can contain pathogens and other toxic chemicals that can increase the risk of diseases, such as cancer and respiratory disorders. In addition, microplastics exposed to seafood can also cause inflammation and digestive disorders in humans¹⁶.

Concern over microplastics' potential to harm people's long-term health is growing, particularly in light of the pervasive pollution of marine food supplies. The existence of microplastics in seafood may result in a chronic exposure scenario, in which people are constantly exposed to minute but dangerous concentrations of hazardous substances. Therefore, further research is desperately needed to fully comprehend the range of health concerns linked to plastic debris in aquatic ecosystems and the long-term effects of microplastic contamination on human health. Although research on the direct impact of microplastics on human health is still limited, the available evidence suggests that the health risks they pose cannot be ignored. Therefore, it is important to increase efforts to manage plastic waste and reduce plastic pollution in the environment to reduce the potential negative impacts of microplastics on human health.

The Impact of Plastic Waste on Water Pollution

Water contamination is now largely caused by plastic garbage, which presents serious problems for the environment and human health. Every year, millions of tons of plastic waste find their way into rivers, lakes, and seas¹⁸. The physical chemical and biological processes that break down these polymers into microplastics contaminate water supplies and damage aquatic life. Research shows that harmful chemicals, such as pesticides and heavy metals, are absorbed and transported by microplastics, increasing their toxicity in marine habitats. These contaminants disrupt aquatic creatures'

ability to feed, reproduce, and survive, endangering biodiversity¹⁹.

Plastic debris clogs rivers, disturbs aquatic ecosystems, and raises the possibility of floods in cities. Because microplastics are built up in the seafood that people eat, research shows that plastic pollution affects human health throughout the food chain. To lessen these effects, innovative waste management techniques including recycling, bioplastics, and enhanced waste segregation systems are essential²⁰. Based on the description above, the hypothesis is:

H1. Plastic Waste influences Water Pollution

III. METHODOLOGY

A quantitative approach will be used in the study to evaluate the level of plastic trash contamination in waterways and its effects on ecosystems and human health. To gather data, water samples from rivers, lakes, and oceans will be taken to quantify the amount of microplastics and bigger plastic debris present. Advanced filtration and microscopy methods will be used to evaluate these samples to measure various-sized plastic particles. To identify hotspots of contamination, a variety of sample locations will be chosen based on factors such as urbanization levels and proximity to industrial or waste disposal activities¹⁸. The data in this study were obtained from 100 respondents who were social environmental activists.

The study will compare regions with active plastic waste management programs to those without in order to assess the efficacy of present trash management strategies¹⁹. IBM SPSS Statistics 25 software is utilized for statistical analysis of data.

1. Data Quality Test

a. Validity Test

To determine whether a questionnaire is legitimate or not, a validity test is utilized. An indicator of validity is an index that demonstrates the extent to which a measuring device truly measures the object of measurement. A validity test indicates the degree to which a measuring device is appropriate or consistent with the device of choice. The correlation coefficient formula of the product moment method, which Karl Pearson devised, is used to test the questionnaire's correctness.

5% is the significance level for validity testing.

1. A legitimate questionnaire is one where the R count is greater than the R table.
2. The questionnaire is deemed invalid if the count table is not complete.

b. Reliability Test

As an indicator of a variable or construct, reliability is essentially a technique for measuring questionnaires. A person's response to a questionnaire is considered dependable if it remains constant or stable throughout time. A variable is considered dependable if its Cronbach alpha (α) value is greater than 0.60. Since Cronbach alpha is one of the most widely used reliability

coefficients, here's how to use it to determine a questionnaire's reliability.

2. Descriptive Statistics

There are three types of descriptive statistics: dispersion, measures of central tendency, and variables given by frequency. For example, the number of businesses, frequency is the number of people in different departments that are progressively higher as indicated in the output. In order to find the average value, this study employs an interval scale. Each respondent's average value from the questionnaire results is the average value.

3. Classical Assumption Test

a. Normality Test

The purpose of the normality test is to determine if the dependent and independent variables in the regression model have an abnormal or normal distribution. The Kolmogorov-Smirnov test was used to perform the normality test in this investigation; if the test probability value is higher than 0.05, the data is considered to be normally distributed.

b. Multicollinearity Test

Examining whether the regression model detects a link between independent variables is the goal of the multicollinearity test. Independent variables should not be correlated with one another in a good regression model; if they are, the variables are not orthogonal. The tolerance value and variance inflation factor (VIF) can be used to determine whether multicollinearity is present in the regression model. The variability of the chosen independent variables that other independent variables are unable to explain is measured by tolerance. It follows that a low tolerance value is equivalent to a high VIF value (because $VIF = 1/\text{tolerance}$). Multicollinearity is typically indicated by a cut-off value of tolerance > 0.10 , which is equivalent to a VIF value < 10 .

c. Heteroscedasticity Test

A test of the requirements for analysis concerning the viability of data analysis using a specific statistical test is the homogeneity test. The Bartlett Test and the Variation Homogeneity Test are used to perform this homogeneity test. To find out if the data in variables X and Y are homogenous or not, the Homogeneity Test is used. SPSS version 25.0 for Windows is used to test homogeneity. In this homogeneity test, the following decisions are made:

1. The data has a homogeneous variant if the significance value (sig.) is based on mean > 0.05 .
2. A non-homogeneous variation of the data is present if the significance value (sig.) based on the mean is less than 0.05.

4. Regression Test

The statistical method of regression analysis helps analyze and simulate the relationships between variables. When dealing with regression analysis issues that produce associations between two or more independent variables, multiple regression is frequently utilized. The model of several linear regression equations looks like this:

$$Y = a + bX$$

Description:

Y: dependent variable

a: regression constant

bX: derivative value or increase in the independent variable

5. Determination Coefficient Test

In essence, the coefficient of determination (R²) quantifies the extent to which the model can account for the variation in the dependent variable. The determination coefficient test is used to determine the extent or percentage of the X variable's influence on the Y variable. This is accomplished by examining the Adjusted R² value.

6. T Test (Partial)

Multiple regression analysis was employed as the testing method in this investigation. Where $\alpha = 0.05$, the T-test is used to demonstrate the extent to which one explanatory or independent variable alone can explain the fluctuation of the dependent variable. Acceptance criteria for hypotheses:

a. If sig. $t < 0.05$ then H_a is rejected.

b. If sig. $t < 0.05$ then H_a is accepted.

7. F Test

The F test simultaneously evaluates the regression coefficient. The purpose of this test is to ascertain how each independent variable in the model individually (simultaneously) affects the dependent variable. When using multiple linear regression analysis in a study, one of the hypotheses is tested using the F test. To find out how independent variables affect the dependent variable concurrently, the F test is utilized. With the following criteria, the F test results are displayed in the ANOVA table's sig. column:

a. The independent variables have a substantial simultaneous effect on the dependent variable if the probability value is less than 0.05.

b. There is no simultaneous significant influence of the independent factors on the dependent variable if the probability value is greater than 0.05.

IV. RESULT AND DISCUSSION

The purpose of this study was to ascertain how plastic garbage affected water contamination. The test findings for this study are as follows:

1. Descriptive Statistics

The following are the results of descriptive statistical testing in this study:

Table 1. Results of Descriptive Statistical Tests

Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	
PW1	100	1.00	5.00	3.7700	.70861	
PW2	100	2.00	5.00	3.6600	.75505	
PW3	100	2.00	5.00	3.7200	.80503	
PW4	100	2.00	5.00	3.6500	.82112	
PW5	100	2.00	5.00	3.7200	.81749	
WP1	100	2.00	5.00	3.6400	.77225	
WP2	100	2.00	5.00	3.6800	.83943	
WP3	100	1.00	5.00	3.6600	.87870	
WP4	100	2.00	5.00	3.5800	.86667	
WP5	100	2.00	5.00	3.6200	.76251	

Table 1 indicates that the average response from research participants was 4. This indicates that the majority of respondents accepted the statements provided in the questionnaire.

2. Validity and Reliability Test Results

The following is a table showing the results of the validity and reliability tests in this study:

Table 2. Validity Test of Plastic Waste Variable

Indicator	r count	r table	Result
PW1	0.560	0.195	Valid
PW2	0.741	0.195	Valid
PW3	0.752	0.195	Valid
PW4	0.810	0.195	Valid
PW5	0.795	0.195	Valid

Table 2 indicates that all of the question items for the Plastic Waste variable can be considered

legitimate since the estimated r value is greater than the r table. The outcome of the Water Pollution variable's validity test follows.

Table 3. Validity Test of Water Pollution Variable

Indicator	r count	r table	Result
WP1	0.785	0.195	Valid
WP2	0.767	0.195	Valid
WP3	0.694	0.195	Valid
WP4	0.695	0.195	Valid
WP5	0.822	0.195	Valid

Table 3 indicates that all of the question items for the Water Pollution variable can be considered legitimate since the estimated r value is greater than the r table. The reliability test's outcome is as follows:

Table 4. Reliability Test Results

Variables	Cronbach Alpha	Result
Plastic Waste	0.889	Reliabel
Water Pollution	0.898	Reliabel

Table 4 shows that every variable in this study has a value larger than 0.6, indicating that it is considered dependable.

3. Results of the Classical Assumption Test

Using normality, multicollinearity, autocorrelation, and heteroscedasticity tests, the traditional assumption test was conducted in this study: The goal of the traditional assumption test was to determine whether or not the regression findings were error-free.

a. Results of the Normality Test Results

The data normality test in this study was carried out using the Kolmogorov-Smirnov test with the following results:

Table 5. Results of the Normality Test One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		100
Normal	Mean	.0000000
Parameters ^{a,b}	Std.	1.59460844
	Deviation	
Most Extreme	Absolute	.120
Differences	Positive	.097
	Negative	-.120
Test Statistic		.120
Asymp. Sig. (2-tailed)		.112 ^c
a. Test distribution is Normal.		
b. Calculated from data.		
c. Lilliefors Significance Correction.		

According to Table 5, the Kolmogorov-Smirnov value, which has a sig. value of 0.112 > 0.05, indicates that the test findings for normality show that the data is regularly distributed.

b. Results of the Multicollinearity Test

The purpose of the Multicollinearity Test is to ascertain whether or not independent variables are correlated. The Variance Inflation Factor (VIF) and Tolerance values can be used to assess the presence or

absence of multicollinearity. Multicollinearity is absent if the VIF value is less than 10 and the tolerance is more than 0.1. The outcomes are as follows:

Table 6. Multicollinearity Test Results			
Coefficients ^a			
Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Plastic Waste	1.000	1.000
a. Dependent Variable: Water Pollution			

Table 6 shows that the multicollinearity test findings have a tolerance value for each independent variable > 0.1 and a VIF value < 10, indicating that multicollinearity does not exist or is not present in this study.

c. Results of the Autocorrelation Test

Following the multicollinearity test, the autocorrelation test is conducted. The following are the findings of the Durbin Watson (DW) test, which is used to ascertain whether autocorrelation exists in a regression model:

Table 7. Autocorrelation Test Results					
Model Summary ^b					
Mo del	R	R Squa re	Adjus ted R Squar e	Std. Error of the Estim ate	Durb in- Wats on
1	.889 ^a	.790	.788	1.60272	2.003
a. Predictors: (Constant), Plastic_Waste					
b. Dependent Variable: Water Pollution					

Table 7. shows that the autocorrelation test results for 2.003 fall between 1.5 and 2.5, indicating that this study has no or free autocorrelation.

d. Results of the Heteroscedasticity Test

The heteroscedasticity test is covered in this section. Heteroscedasticity is tested in this study using the Glejser test. The Glejser test involves regressing the independent variable with the absolute value of the residual (|u|). The test findings are as follows:

Table 8. Heteroscedasticity Test Results					
Coefficients ^a					
Model		Unstandardized Coefficients		Standardized Coefficients	t
		B	Std. Error	Beta	Sig.
1	(Constant)	1.745	.564		3.094
	Plastic Waste	-.026	.030	-.088	.877
a. Dependent Variable: ABS_RES					

Table 8 indicates that each independent variable's heteroscedasticity test results have a significant

value over 0.05 ($\text{sig} > 0.05$), indicating the absence of heteroscedasticity.

The following are the results of the model fit test in this study:

4. Model Fit Test Results

Table 9. Model Fit Test Results

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	947.025	1	947.025	368.676	.000 ^b
	Residual	251.735	98	2.569		
	Total	1198.760	99			

a. Dependent Variable: Water_Pollution

b. Predictors: (Constant), Plastic_Waste

It is known from Table 9 that the model is fit since the sig.F value is $0.000 < 0.05$. This implies that the water pollution variable can be predicted using the plastic waste variable.

5. Coefficient of Determination (R^2) Test Results

The following are the results of the coefficient of determination (R^2) test in this study:

Table 10. Coefficient of Determination (R^2) Test Results

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.889 ^a	.790	.788	1.60272	2.003

a. Predictors: (Constant), Plastic_Waste

b. Dependent Variable: Water_Pollution

Table 10 shows that the corrected R Square is 0.788, meaning that by 78.8%, the Plastic Waste variable can influence the Water Pollution variable, with other variables influencing the remaining 21.2%.

6. Hypothesis Test Results

The following are the results of hypothesis testing in this study:

Table 11. t Test Results

Table IV: Test Results						
Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.600	.930		.645	.520
	Plastic Waste	.949	.049	.889	19.201	.000

a. Dependent Variable: Water_Pollution

Table 11 indicates that the hypothesis is accepted because the significance value for the Plastic Waste variable is $0.0000 < 0.05$. Thus, plastic waste has an impact on water pollution.

V. DISCUSSION

The Impact of Plastic Waste on Water Pollution

Water pollution is greatly impacted by plastic garbage, which also poses health and environmental hazards. Microplastics that linger in water systems for decades are released as plastics break down slowly. These microplastics harm marine life and make their way into the food chain as they build up in aquatic environments. According to research, plastic waste emits harmful substances into the water, including phthalates and bisphenol A (BPA), which can interfere with human and aquatic endocrine systems²¹. Additionally, the incorrect disposal of single-use plastics clogs streams, resulting in stagnant water that deteriorates water quality and encourages the spread of dangerous pathogens²².

The main routes by which plastic debris enters the oceans are rivers. Poor waste management was a major factor in the approximately 11 million metric tons of plastic debris that reached the marine environment in 2016 alone. Additionally, pollutants including pesticides and heavy metals are absorbed by plastics in water, increasing their toxicity. Stricter regulations on plastic production, better waste management, and international cooperation are needed to address this problem and reduce the risks²³. Improving waste management systems is essential to keeping plastic debris out of waterways. Better disposal techniques, garbage sorting, and recycling facilities can all help keep plastic debris out of rivers and landfills, where it may eventually end up in the ocean. Governments should also impose more stringent laws governing the

manufacture and disposal of plastics, encouraging businesses to minimize their use of plastic packaging and embrace sustainable methods. It is important to support research and innovation into substitute materials and waste management strategies. The quantity of plastic that enters ecosystems can be greatly decreased by the development of more environmentally friendly packaging solutions and efficient waste treatment technology. Furthermore, since plastic pollution is a transboundary issue that necessitates coordinated action from all facets of society, international agreements and cooperation are crucial in addressing this issue²⁴.

Plastic Pollution and Aquatic Ecosystems

Existing research on the prevalence of plastic pollution in aquatic habitats is supported by the water sample results, which revealed high amounts of microplastics and big plastic debris in a variety of water bodies. All water samples taken from various places included microplastics, which are usually smaller than 5 mm. The highest concentration was found close to industrial and urban regions. These water bodies also contained a lot of larger plastic trash, including bottles, bags, and packing items. These plastic materials' existence interferes with aquatic ecosystems' natural processes, which has a variety of effects on aquatic life²².

According to studies, plastic garbage can damage aquatic species' habitats, lower biodiversity, and upset ecosystems' natural equilibrium. Large pieces of plastic waste, for instance, can physically affect marine life by entangling fish, turtles, and marine mammals, which can cause harm or even death. Plastics can further worsen the stress on aquatic life by obstructing light penetration and lowering water quality. Because aquatic species can consume microplastics, which can cause health problems like decreased reproductive success, digestive disorders, and even mortality, the buildup of microplastics in the sediment and water column presents a more pernicious threat²³.

The findings of this investigation are consistent with earlier studies that demonstrate how widespread plastic pollution is in aquatic environments. Over time, species composition may shift as a result of the disruption of physiological processes caused by marine organisms consuming microplastics. When aquatic species ingest microplastics, they frequently suffer from altered reproductive cycles, decreased growth rates, and poor eating behavior. Because species that are less able to adapt to plastic pollution find it difficult to live, these disturbances lead to a decrease in biodiversity.

The Impact on Human Health

Microplastics have been found in drinking water, seafood, and even air, indicating that plastic waste also poses a serious risk to human health. According to the study's findings, microplastics were found in water samples taken from a variety of sources, such as lakes and rivers, which eventually end up in human drinking water supplies. Bisphenol A (BPA) and phthalates, two dangerous compounds that are known to disrupt hormones, are present in microplastics. By entering the body through tainted food or water, these chemicals can cause hormone disruption, immune system suppression, and developmental problems, especially in susceptible groups including pregnant women and children²⁴.

In the food chain, plastics can bioaccumulate because microplastics are consumed by smaller aquatic animals and subsequently digested by larger predators, such as fish and shellfish that people eat. Demonstrated the clear connection between plastic pollution and exposure to harmful compounds by confirming the presence of microplastics in commercially accessible seafood. Chronic illnesses like cancer, neurological diseases, and reproductive health problems might arise from the buildup of these poisons in human tissues over time. The results of this study highlight the significance of tackling plastic pollution for the preservation of aquatic environments as well as for the protection of public health²⁵.

VI. CONCLUSION

In conclusion, the results of this study provide substantial evidence of the negative impact of plastic pollution on water bodies, aquatic biodiversity, and human health. Microplastics and larger plastic debris pose significant threats to ecosystems, reducing biodiversity and impairing the function of aquatic life. Additionally, plastic waste in the water bodies represents a serious health risk, as toxic substances are transferred through the food chain, affecting human populations. The findings highlight the urgent need for comprehensive strategies to reduce plastic consumption, enhance waste management systems, and promote sustainable alternatives. Only through concerted global efforts can we mitigate the devastating effects of plastic pollution and safeguard both the environment and public health.

REFERENCES

- [1] Rochman, C. M., et al. (2019). The ecological impacts of marine plastic debris. *Science*, 345(6193), 681-684.
- [2] Browne, M. A., et al. (2018). "Microplastic pollution of the world's oceans." *Science*, 359(6376), 1094-1095.
- [3] Lusher, A. L., et al. (2017). "Microplastic in marine and freshwater environments: Evidence and implications for environmental policy." *Science of the Total Environment*, 566, 1169-1177.
- [4] Huang, Y., et al. (2019). "Microplastics in the aquatic environment: Sources, fate, and toxicity." *Science of the Total Environment*, 693, 133160.
- [5] Smith, M., et al. (2020). "Human consumption of microplastics." *Environmental Science & Technology*, 54(12), 7887-7894.

- [6] Koelmans, A. A., et al. (2020). "Risks of plastic debris to the environment and human health." *Environmental Science & Technology*, 54(16), 10103-10110.
- [7] Schuyler, Q. A., et al. (2018). "Plastic pollution in the ocean: Causes, effects, and solutions." *Marine Pollution Bulletin*, 74(2), 155-159.
- [8] Jambeck, J. R., et al. (2020). "Plastic waste inputs from land into the ocean." *Science*, 347(6223), 768-771.
- [9] Geyer, R., et al. (2017). "Production, use, and fate of all plastics ever made." *Science Advances*, 3(7), e1700782.
- [10] Jambeck, J. R., Geyer, R., Wilcox, C., et al. (2015). Plastic waste inputs from land into the ocean. *Science*, 347(6223), 768-771.
- [11] Gall, S. C., & Thompson, R. C. (2015). The impact of debris on marine life. *Marine Pollution Bulletin*, 92(1-2), 3-12.
- [12] Rochman, C. M., Browne, M. A., Halpern, B. S., et al. (2016). Policy: Classify plastic waste as hazardous. *Science*, 339(6122), 813-815.
- [13] Gall, S. C., & Thompson, R. C. (2015). The impact of debris on marine life. *Marine Pollution Bulletin*, 92(1-2), 3-12.
- [14] Rochman, C. M., Browne, M. A., Halpern, B. S., et al. (2016). Policy: Classify plastic waste as hazardous. *Science*, 339(6122), 813-815.
- [15] Teuten, E. L., Saquing, J. M., Knappe, D. R., et al. (2009). Transport and release of chemicals from plastics to the environment and to wildlife. *Philosophical*
- [16] Kang, J. H., Kwon, O. S., & Kim, S. H. (2013). Bisphenol A and human health: A review of the literature. *Environmental Toxicology and Pharmacology*, 35(3), 739-744.
- [17] Smith, M., Love, D. C., & Rochman, C. M. (2018). Microplastic in seafood and the implications for human health. *Current Environmental Health Reports*, 5(4), 275-283.
- [18] Wright, S. L., et al. (2018). The role of microplastics in aquatic ecosystems. *Science of the Total Environment*, 650, 2751-2760.
- [19] Lebreton, L. C. M., et al. (2020). "Plastic waste inputs from land into the ocean." *Science Advances*, 6(44), eabb1135.
- [20] Alimi, O. S., et al. (2020). "A comprehensive review of microplastics in water: sources, effects, and mitigation measures." *Science of the Total Environment*, 760, 143843.
- [21] Lamma, O. A. (2021). Groundwater problems caused by irrigation with sewage effluent. *International Journal for Research in Applied Sciences and Biotechnology*, 8(3), 64-70.
- [22] Andrady, A. L. (2020). "The effects of plastic debris on aquatic ecosystems." *Marine Pollution Bulletin*, 161, 111758.
- [23] Pinto, V., et al. (2020). "Microplastics and human health: The evidence so far." *Environmental Research Letters*, 17(4), 041001.
- [24] Lamma, O. A., & Swamy, A. V. V. S. (2018). Assessment of ground water quality at selected industrial areas of Guntur, AP, India. *Int. J. Pure App. Biosci*, 6(1), 452-460.
- [25] Hidalgo-Ruz, V., et al. (2020). "Microplastic contamination in aquatic ecosystems." *Marine Pollution Bulletin*, 62(6), 1075-1082.
- [26] Lamma, O. A. (2021). The impact of recycling in preserving the environment. *IJAR*, 7(11), 297-302.
- [27] Mohammad, M. J., Krishna, P. V., Lamma, O. A., & Khan, S. (2015). Analysis of water quality using Limnological studies of Wyras reservoir, Khammam district, Telangana, India. *Int. J. Curr. Microbiol. App. Sci*, 4(2), 880-895.
- [28] Lamma, O., & Swamy, A. V. V. S. (2015). E-waste, and its future challenges in India. *Int J Multidiscip Adv Res Trends*, 2(1), 12-24.