

# Transforming Plastic Waste into Durable Tiles: An Ecofriendly Tiles Constructions

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## ABSTRACT

*Transforming plastic waste into construction tiles is one of the best recycling habits that could health for a greener environment. The study utilized a descriptive experimental research design in order to answer the objectives of the study wherein 15 experts related in the field were the respondents of the study and they were selected using purposive sampling method. The findings found that the respondents were strongly agreed that the transformation of plastic waste into eco-friendly construction tiles was very high level into sustainability and eco-friendly construction materials because of its resistant to water, durability, flammability and mechanical strength. Additionally, the findings imply that the transformed plastic waste into eco-friendly construction tiles had a great impact to reduced plastic waste and sustainable construction materials. Transforming plastic waste into construction tiles was found significant to environment concerns due to chemical and physical composition of plastic which may affect or may contain hazardous materials that may effect to marine eco-system, ground water, ecological imbalance and even human health. Therefore, proper waste management is very important.*

**Keywords:** *Construction Tiles, Transforming, Plastic Waste, Waste Management*

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Date of Submission: 05-04-2025

Date of acceptance: 16-04-2025

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## I. Introduction

Plastic waste is one of the problem in sustaining a greener environment. Because of unique structure and composition of elements of plastic it will remain on earth for thousands of years and cannot be broken down by natural processes. Plastic has been useful for many things, but it also brought out harmful effect to the environment such as leading to a variety of pollution that suffocates suffocate marine wildlife, damages soil and poisons groundwater, and can cause serious health impacts.

Plastics are used in many aspects of modern living including packaging, transportation, appliances, and construction. Each year, the Philippines waste management team generates approximately 2.7 million metric tons of plastic waste, with around 20% or 540,000 metric tons ending up in the ocean. This large amount of plastic waste carries serious risks to marine ecosystems, threatening the health of sea creatures and coral reefs. Plastic pollution also affects coastal communities that rely on oceans for their livelihoods, such as fishing and tourism. The challenge of managing plastic waste in the Philippines highlights the urgent need for effective waste management strategies and public awareness initiatives to reduce plastic consumption and improve recycling practices,(Dokl, Copot, Krajnc, 2024).

Several researches and studies confirmed that plastic is known to be highly flammable materials with high linear burning rate, in order to further improve its physical and mechanical properties and lower its flammability fillers are added to waste plastic matrix. Then, recycling industry rather than solving the problem of plastic disposal is creating more problems and with the influx of plastic waste import, it is getting aggravated. Thus recycling of waste plastic in the most environmentally sound manner and by making its biggest drawback an advantage can be achieved my molding it into tiles for building structures, (Niaki, 2020).

Thus, the researcher aims to examine if plastic can be use as alternative tiles for constructions. It also attempts to determine if such tiles can survive under harmful chemicals and micro-plastics into the environment. It also assesses whether building using recycled plastic is economically applicable and meets the required safety standards. Most other studies on recycling are either from an environmental perspective or an economic one, but this one focus more on the construction's applicability of plastic waste materials.

Due to the wide range of household and industry applications, polymeric materials have become an impartible component of our current lives. Worldwide plastic production is estimated to be around 1.1 billion tons by 2050. Environmental Protection Agency reported that out of tons of plastic waste generated, only 7% is recycled annually. According to (Kalali et al., 2023), the records demonstrated that only 8% of the plastic is

incinerated, and the remaining is landfilled. However, the high energy and cost of landfilling process led to these wastes being released into water bodies. Plastic wastes are not easily degraded and could cause primary environmental contamination. Therefore, proper plastic waste management is the key to solving environmental and sustainability issues.

And to address problems in plastic waste the researcher aims to transform plastic waste into durable, and eco-friendly tiles that can be used for construction purposes.

## **II. Literature Review**

Dhawan, Bisht, Kumar, Kumari, & Dhawan (2019), stated that waste plastic bags being non-biodegradable and its extreme durability makes its disposal process difficult. Plastic solid waste present challenges and opportunities to the societies regardless of their technological advance and sustainability awareness.

Singh (2021), revealed that recycling of plastic waste is the best strategy for solid waste management. It is one method by which one can reduce its negative impact on the environment and prevent depletion of resources and can therefore decrease energy and material usage per unit of output and so yield improved eco-efficiency.

According to Bhogayata and Arora (2018), the utilization of plastic waste as a fine aggregate in concrete mixture for obtaining product of high compressive and flexural strength along with mechanical resistance comparable to conventional concrete product. In addition, building flexible road pavements by incorporating waste plastic into the matrix in road construction, bitumen plays an important role of the binder, but it has poor water resistance.

In the study findings of Puttaraj, Parangi, Gagan, Shivu, & Manjunath (2020), shown that floor tiles made from plastic waste had better results compared to normal tiles. The physical and mechanical properties, water absorption, transverse resistance and impact were found efficient compared to with normal tiles. The construction floor tiles made from plastic waste are durable and corrosion resistant, good insulation for cold, heat and sound saving energy, it is economical and has a longer life with maintenance free, hygienic, clean, light weight and ease of processing or installation.

### **Statement of the Problem**

The study aims to transform plastic waste into eco-friendly tiles for constructions. It sought to answer the following questions:

1. How may the transformation of plastic waste into eco-friendly tiles for construction be describes in terms of:
  - 1.1. durability;
  - 1.2. resistant to water;
  - 1.3. corrosion;
  - 1.4. mechanical strength; and
  - 1.5. flammability level?
2. What is the impact of transformed plastic waste into eco-friendly tiles constructions in:
  - 2.1. Reducing Plastic Waste;
  - 2.2. Reducing Pollution; and
  - 2.3. Sustainable construction materials?
3. Is transforming plastic waste is significant to environmental concern?

### **SIGNIFICANCE OF THE STUDY**

This study aims to determine the potential of transforming plastic waste into eco-friendly tiles for sustainable construction and help conservation of environment. The findings could have a significant impact on the environmental advocates, the construction industry, the waste management sectors, community, researcher, and future researchers.

### **CONCEPTUAL FRAMEWORK**

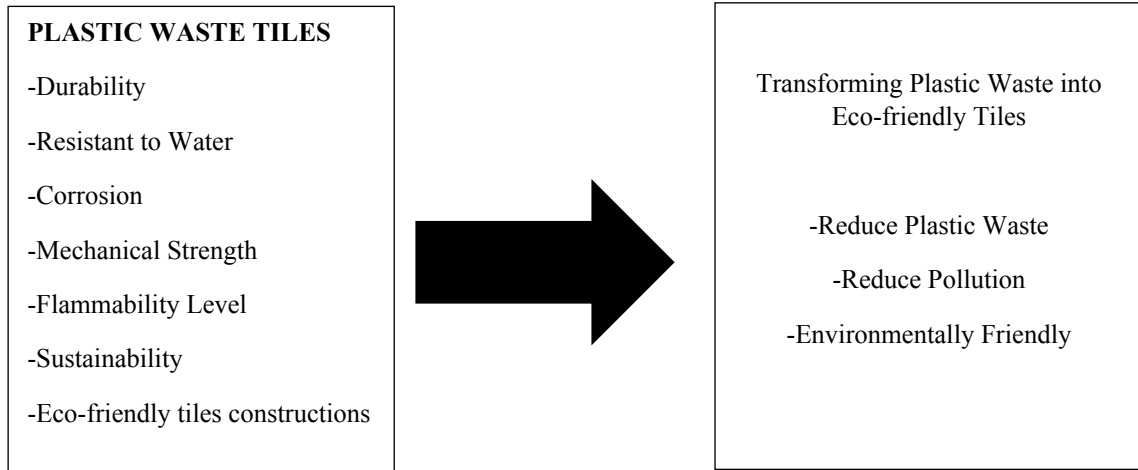
This conceptual framework of the study was based on the sustainable theory of development. The theory aims to evolve from pursuing the single goal of sustainable use of resources towards world's social and economic transformation.

The theory was related to the study which aims to transform plastic waste into eco-friendly construction tiles in more sustainable and conservation of environment. Thus, independent variables and dependent variables (IVDV) models was utilized to described the relationships among variables.

Figure 1 shows the conceptual paradigm of the study.

**INDEPENDENT VARIABLES**

**DEPENDENT VARIABLES**



**HYPOTHESIS**

1. There is no significant impact on environmental concerns.

**III. METHODOLOGY**

**Research Design**

A descriptive experimental research design was utilized in order to describe the transformation of waste plastics into construction tiles. And also to show relationship among variables in accordance to the objectives of the study.

**Research Instrument**

Survey instrument was utilized to answer the questions and objectives of the study that aims to determine the potential of transforming of plastic waste into eco-friendly construction tiles in more sustainable and conservation of environment.

Thus, this survey instrument is appropriate to the study to help researcher to gather accurate and reliable data to answer the objectives of the study.

The four-point likert scale were used for the respondents of the study can easily response based on the degree of acceptance as shown in Table 1.

**Table 1**  
*Responses Scale*

Scale	Rating Scale	Verbal Description	Interpretation
4	3.25- 4.00	Strongly Agree	Very High level of sustainability and eco-friendly construction materials
3	2.50 -3.24	Agree	High level of sustainability and eco-friendly construction materials
2	1.75- 2.49	Disagree	Moderate level of sustainability and eco-friendly construction materials
1	1.0- 1.74	Strongly Disagree	Low level of sustainability and eco-friendly construction materials

**Statistical Tools**

For the data analysis the following statistical tools were used:

For SOP 1 to describe the transformation of plastic waste into eco-friendly tiles for construction, weighted mean was used.

For SOP 2 to determine the impact of transformed plastic waste into eco-friendly tiles constructions, weighted mean was also used.

For SOP 3, to determine the significant of transformed plastic waste into environmental concerns, Sphearman rho was utilized.

#### IV. RESULTS AND DISCUSSION

##### 1. Transformation of Plastic Waste into Eco-friendly Tiles for Construction

**Table 3.**

*Transformation of Plastic Waste into Eco-Friendly Tiles for Construction*

TRANSFORMING PLASTIC WASTE INTO ECO-FRIENDLY CONSTRUCTION TILES		Weighted Mean	Verbal Interpretation
1.	<b>Durability</b>	3.46	Strongly Agree
2.	Resistant to Water	3.78	Strongly Agree
3.	Corrosion	3.21	Agree
4.	Mechanical Strength	3.12	Agree
5.	Flammability Level	3.23	Agree
<b>Overall Weighted Mean</b>		<b>3.36</b>	<b>Strongly Agree</b>

Table 3 presents the data on the transformation of plastic waste into eco-friendly construction tiles. As shown, the overall weighted mean got 3.36 and verbally interpreted as “Strongly Agree”. The resistant to water rated the highest mean of 3.78 which under verbal description of “Strongly Agree”; whereas the mechanical strength rated the lowest mean of 3.12 and under verbal description of “Agree”.

The findings meant that the respondents were strongly agreed that the transformation of plastic waste into eco-friendly construction tiles was very high level of sustainability and eco-friendly construction materials because of its resistant to water, durability, flammability and mechanical strength. Based on the assessments made, all of the respondents strongly agreed that the construction tiles made from plastic waste had a very low water absorption efficiency, able to resist the penetration of water to a specific degree, water proof and completely protected from the effects of water. Durable in use in years of life or number of operational cycle, had good mechanical strength, good chemical tolerance and can enhance compressive strength.

The findings was similar to the study findings of Puttaraj, Parangi, Gagan, Shivu, & Manjunath (2020), shown that floor tiles made from plastic waste had better results compared to normal tiles. The physical and mechanical properties, water absorption, transverse resistance and impact were found efficient compared to with normal tiles. The construction floor tiles made from plastic waste are durable and corrosion resistant, good insulation for cold, heat and sound saving energy, it is economical and has a longer life with maintenance free, hygienic, clean, light weight and ease of processing or installation

##### 2. Impact of Transformed Plastic Waste into Eco-Friendly Tiles Construction

**Table 4**

*Impact of Transformed Plastic Waste into Eco-Friendly Tiles for Construction*

TRANSFORMING PLASTIC WASTE INTO ECO-FRIENDLY CONSTRUCTION TILES		Weighted Mean	Verbal Interpretation
1.	Reducing Plastic Waste	3.86	Strongly Agree
2.	Reducing Pollution	3.11	Agree
3.	Sustainable Construction Materials	3.67	Strongly Agree
<b>Overall Weighted Mean</b>		<b>3.55</b>	<b>Strongly Agree</b>

Table 4 shows the data on the impact of transformed plastic waste into eco-friendly tiles for construction. Based on the assessment made by respondents, the results had over-all weighted mean of 3.55 which under verbal description of “Strongly Agree”. Reducing plastic waste rated the highest weighted mean of 3.86 and under verbal interpretation of “Strongly Agree”. However, the variable regarding reducing pollution rated the lowest weighted mean of 3.11 and under verbal description of “Agree”.

The findings imply that the transformed plastic waste into eco-friendly construction tiles had a great impact to reduced plastic waste and sustainable construction materials. The respondents strongly agreed that this kind of eco-friendly process of plastic waste helps to get involved the LGU to participate in improving recycling habits, reduce reliance on single-use plastic and embrace circular economy. In addition, it impacted to sustainable construction materials through turning plastic waste into biodegradable alternatives that provides in a more durable and cost-effective construction tile which help to reduce environment negative effects. This also help to reduce plastic pollution because it turns trash into eco-friendly waste construction materials.

The findings of the study was supported by Yadav, Singh, Bhat and Sharma (2024), concluded that transformed plastic waste into construction tiles/bricks highlighted the recyclability, reusability, waste management implications and contribution to circular economy initiatives.

### 3. **Transforming Plastic Waste is Significant to Environmental Concern**

On the data gathered, transforming plastic waste was significant environment concerns due to chemical and physical composition of plastic which may affect or may contain hazardous materials that may effect to marine eco-system, ground water, ecological imbalance and even human health. Therefore, proper waste management is very important.

Proper plastic recycling and waste management can be addresses through different approaches such as reprocessing different categories of plastic waste into secondary materials; incineration can be used to manage plastic waste if done using the right equipment; policy implantation like increased recycling and waste management; and reducing plastic production.

According to Singh (2021), revealed that recycling of plastic waste is the best strategy for solid waste management. It is one method by which one can reduce its negative impact on the environment and prevent depletion of resources and can therefore decrease energy and material usage per unit of output and so yield improved eco-efficiency.

### **V. Conclusions**

Based on the findings of the study, transforming plastic waste into eco-friendly construction tiles is possible due to a very high level of sustainability and eco-friendly construction materials because of its resistant to water, durability, flammability and mechanical strength. Additionally, transformed plastic waste into eco-friendly construction tiles had a great impact to reduced plastic waste and sustainable construction materials.

### **Recommendations**

Based on the findings and conclusions, it is recommended to continue to embrace recycling habits and proper waste management and increase policy implementation about recycling, waste management and reducing plastic production and single use plastic.

### **Acknowledgement**

The researchers would like to extend their gratitude and acknowledgement to the persons behind the success of this piece of work. To their family, friends, co-workers, and to all would participated and shared their expertise, ideas and knowledge. And above all, highest glory to GOD.

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