Utilization Of Waste Plastic in Manufacturing of Bricks

Sneha D
Assistant Professor
Department of Civil Engineering
Dr.Ambedkar Institute of Technology, Bengaluru, Karnataka, India

Abstract — Plastic waste which is increasing day by day becomes eyesore and in turn pollutes the environment, especially in high mountain villages where no garbage collection system exists. A large amount of plastic is being brought into the tourist trekking regions are discarded or burned which leads to the contamination of environment and air. Hence, these waste plastics are to be effectively utilized. Low-density polyethylene bags are cleaned and added with sand at particular percentages to obtain high strength bricks that possess thermal and sound insulation properties to control pollution and to reduce the overall cost of construction; this is one of the best ways to avoid the accumulation of plastic waste which is an on-degradable pollutant. This alternatively saves the quantity of sand/clay that has to be taken away from the precious river beds/mines. The plastic waste is naturally available in surplus quantity and hence the cost factor comes down. Also coloring agents can be added to the mixture to attain desired shades. Hence in this project, an attempt is made to study regard the properties of the brick which is manufactured using plastic wastes. The present work deals with the manufacturing and analysis of bricks made with waste plastic (LDPE) and fine aggregates. The bricks produced are light weight, have smooth surface and fine edges, do not have cracks and have high crushing strength and very low water absorption. The bricks are manufactured by heating waste plastic to temperature range of 120 to 150 degree centigrade and mixing sand to the molten plastic.

Keywords: Waste Plastic Bricks; Low-Density Polyethylene (LDPE); Sustainable Construction Materials; Plastic Waste Recycling; Compressive Strength Analysis; Eco-Friendly Brick Manufacturing;

I. INTRODUCTION

Plastic waste is a major environmental problem because it is non-biodegradable, difficult to dispose of, and releases harmful gases when burned, causing serious health and environmental issues. Recycling waste plastics such as LDPE by melting them and mixing them with sand to produce plastic-sand (Eco) bricks provides an effective and sustainable solution for waste management. These eco-bricks reduce the consumption of natural resources like clay, lower construction costs, and promote the reuse of large quantities of plastic waste generated from households and industries. Plastic soil bricks offer several advantages, including higher compressive strength, lower water absorption, improved durability, and reduced greenhouse gas emissions compared to conventional bricks. Therefore, the use of recycled plastic in construction supports sustainable development, conserves resources, and encourages further research into eco-friendly building materials.

A. Objectives

- To develop an efficient way and to effectively utilize the waste plastics.
- To reduce the consumption of natural resources such as clay for the manufacturing of bricks/tiles.
- To minimize and reuse generation of waste plastic on the land and water to avoid land and water degradation and consequent pollution hazard.
- To reduce the dumping area of waste plastics.
- To produce cost-effective materials which a common person can afford easily.
- To compare strength of Bricks casted with mixture of liquid form of waste plastic and natural soil to Burnt bricks and fly ash bricks.
- To vary the percentage of plastic in bricks to determine the strength performance.
- Cost comparison in between bricks casted with mixture of liquid form of waste plastic and natural soil to Burnt bricks and fly ash bricks.
- To determine the optimum percentage of plastic and sand in bricks.
- To compare water absorption value of Bricks casted with mixture of liquid form of waste plastic and natural soil to Burnt bricks and fly ash bricks

B. Materials Used

Plastic is a widely used material due to its light weight, durability, low cost, and ease of moulding. However, it is non-biodegradable and remains in the environment for hundreds of years, causing serious pollution. The increasing amount of plastic waste generated from municipal solid waste has become a major environmental concern. Reusing waste plastic in construction materials is an effective method of waste management and helps conserve natural resources. In this project, Low-Density Polyethylene (LDPE) waste plastic is used because it melts easily and hardens on cooling, acting as a binding material in the manufacture of soil bricks.

Polyethylene is available in different forms such as Low-Density Polyethylene (LDPE), High-Density Polyethylene (HDPE), and Ultra-High Molecular Weight Polyethylene (UHMWPE). LDPE is flexible, tough, and chemically resistant, making it suitable for this project. HDPE has higher strength and stiffness and is commonly used for pipes and containers, while UHMWPE possesses excellent impact and wear resistance and is widely used in medical and industrial applications.

Plastic offers several advantages, including low weight, durability, high strength, easy moulding, and long service life. However, it also has disadvantages such as being non-renewable, difficult and costly to recycle, low heat resistance, and causing environmental pollution if not disposed of properly.

All rights reserved by www.ijsrd.com

Sand is another important material used in this project. It is a naturally occurring granular material composed mainly of silica and is widely used in construction. Good-quality sand should be clean, well graded, chemically inert, free from organic matter, clay, salts, and silt, and should contain hard, angular, and durable particles. These properties improve the strength, stability, and durability of the soil bricks.

II. METHODOLOGY

1) Collection of Materials

Collect the required materials such as LDPE waste plastic, sand, and moulds.

2) Fixing the Proportion of Sand and Plastic

Determine the required mix ratio of sand and melted LDPE plastic for brick preparation.

3) Preparation of Mould

Clean and prepare the brick moulds before casting to obtain the desired shape and dimensions.

4) Casting of Brick

Mix the materials thoroughly, pour the mixture into the moulds, and allow it to cool and harden.

5) Testing of Brick

Test the manufactured bricks for properties such as compressive strength, water absorption, and durability.

6) Result and Comparison

Analyse the test results and compare the performance of plastic-sand bricks with conventional bricks to evaluate their suitability for construction.

B. Experimental Investigation

- A mould of size 20cmx10cmx10cm is prepared.
- 5, 10, 20, 30, 40, 50, 60, 70, 80% of plastic (LDPE) by weight of sand is cleaned and heated to a molten state.
- Then sand is added at intervals with proper mixing.
- The hot mix is poured into the moulds and then compacted by vibration.
- Before pouring the mixture into the mould the oiling should be done
- After oiling is been done sand has been sprinkled on the inside portion of the mould.
- The mould should be unmoulded on the leveled surface.
- The bricks are demoulded after 15 min and air dried for a period of 24hr for proper heat dissipation.
- Each mixed proportion bricks were prepared and tested for compressive strength in the Compression testing machine (CTM).
- Bricks of different mix proportions are prepared, for each brick 1kg of the sand is added with varying percentage of plastic.

C. Tests conducted

- Compression Test
- Water Absorption Test
- Hardness Test
- Soundness Test

Crushing strength of bricks is determined by placing brick in compression testing machine. After placing the brick in compression testing machine, apply load on it until brick breaks. Note down the value of failure load and find out the crushing strength value of Brick.

The plastic soil bricks do not absorb water since the plastic materials will cover the soil particles and plastic material does not absorb any water so that the water absorption of plastic soil bricks are on an average according to our tests is 1.96.

Sand in (kg)	Percentage of plastic%	Average water absorption
1.0	5%	-
1.0	10%	-
1.0	20%	-
1.0	30%	-
1.0	40%	-
1.0	50%	4.96
1.0	60%	1.4
1.0	70%	1.12
1.0	80%	0.36

Table 1: Water Absorption test

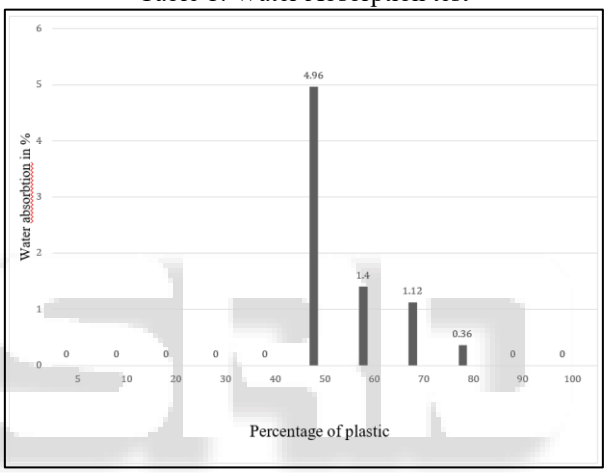

Chart 1: Percentage of Plastic v/s Water absorption

SR no	Percentage of plastic %	Compressive strength in (N/mm²)
1	5%	-
2	10%	-
3	20%	-
4	30%	-
5	40%	-
6	50%	6.57
7	60%	3.91
8	70%	4.33
9	80%	6.08

Table 2: Compressive Strength for various %plastic

All rights reserved by *www.ijsrd.com*

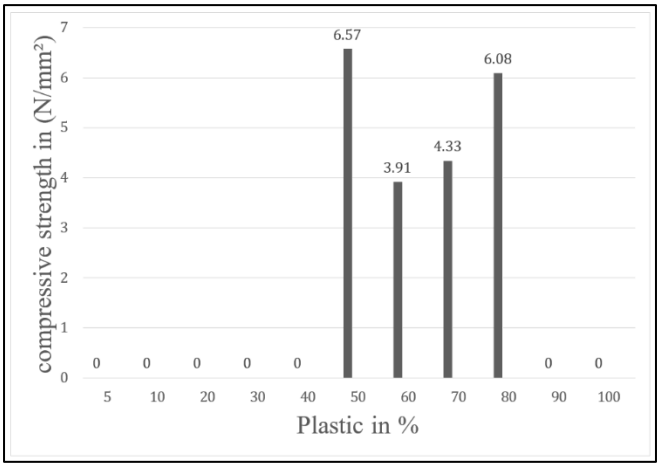

Chart 2: Percentage of Plastic v/s Compressive strength

III. CONCLUSIONS

The compressive strength increases with increase in plastic content compared to conventional brick.

- For 50% plastic content the compressive strength increased to 6.56N/mm2.
- Compare to 50% plastic content the different plastic contents bricks whose compressive strength is decreased.
- The maximum compressive strength obtained is 6.56 N/mm2 which is nearly equal to the compressive strength of second-class brick [7 N/mm2].
- The efficient usage of waste plastic has resulted in effective usage of plastic waste and there by solve the problem of safe disposal.
- Plastic brick possesses more advantages which includes cost efficiency, resource efficiency, etc.,
- Plastic brick is also known as “Eco-Bricks” made of plastic waste which is otherwise harmful to all living organisms can be used for construction purposes
- It increases the compressive strength when compared to burnt bricks.
- Walls constructed using plastic bricks have been less costly as compared to the regular bricks and also, they provide greater strength than burnt bricks.
- Plastic bricks reduce the usage of clay in making of bricks.
- We conclude that the plastic bricks are useful for the construction industry when we compare with Fly Ash bricks and 3rd class clay bricks.
- The manufacturing cost could be reduced further by replacing the river sand with fly ash/quarry dust or other waste products.
- The natural resources consumed for the manufacturing of Plastic bricks are very much less when compared to its counterparts.
- Owing to the numerous advantages further research would improve the quality and durability of plastic bricks.

All rights reserved by *www.ijsrd.com*