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Effect On Properties Of Concrete By Replacing Natural Sand Partially With Plastic Waste

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Abstract: This project investigates the effect of using waste plastic materials on concrete. Waste plastic were collected from homes. Most plastics are not biodegradable. They will stay in landfills until they are cleaned up. An important problem we are facing is dumping of plastic materials it causes lot of problems. In order to decrease the plastic waste, it can be used in construction field, plastic is inorganic in nature so it does not alter the chemical properties of concrete and also it does not affect the quality and consistency of concrete. The plastic can be as filler material in concrete as well as it can be used to improve the mechanical properties of concrete. Concrete is a composite material consisting of Cement, Water, Fine Aggregate and Coarse Aggregate.

Index Terms **–** LDPE, Plastic LDPE Waste, Plastic Waste, Compressive Strength, Concrete.

I.INTRODUCTION

Plain concrete is a brittle material with low tensile strain and strength capacities. The use of short, discontinuous fibers to strengthen and toughen such materials, which are much weaker in tension than in compression, Concrete, a fundamental construction material, has witnessed increased scrutiny in the face of environmental sustainability. The study focuses on the partial replacement of natural sand with plastic waste in concrete formulations. Plastic waste, a pervasive environmental issue, poses significant challenges in waste management. This research investigates how integrating plastic waste into concrete may offer a dual benefit: addressing the environmental burden of plastic disposal and potentially enhancing concrete properties. The conventional use of natural sand in concrete production has long been a cornerstone of construction practices. However, the escalating demand for concrete, coupled with environmental concerns surrounding sand extraction, necessitates a revaluation of traditional materials. In this context, the integration of plastic waste as a partial replacement for natural sand emerges as a potential solution. This paradigm shift, while promising, raises critical questions and challenges, forming the basis of the problem statement.

Low Density Polyethylene (LDPE):

We are using LDPE (Low Density Polyethylene) in this experiment which is the type of plastic. we are conducting various tests on the concrete cubes casted by using LDPE.

LDPE is a soft, flexible, lightweight plastic material. LDPE is noted for its low temperature flexibility, toughness, and corrosion resistance. It is not suited for applications where stiffness, high temperature resistance and structural strength are required.

Photo No. 1 Low Density Polyethylene (LDPE)

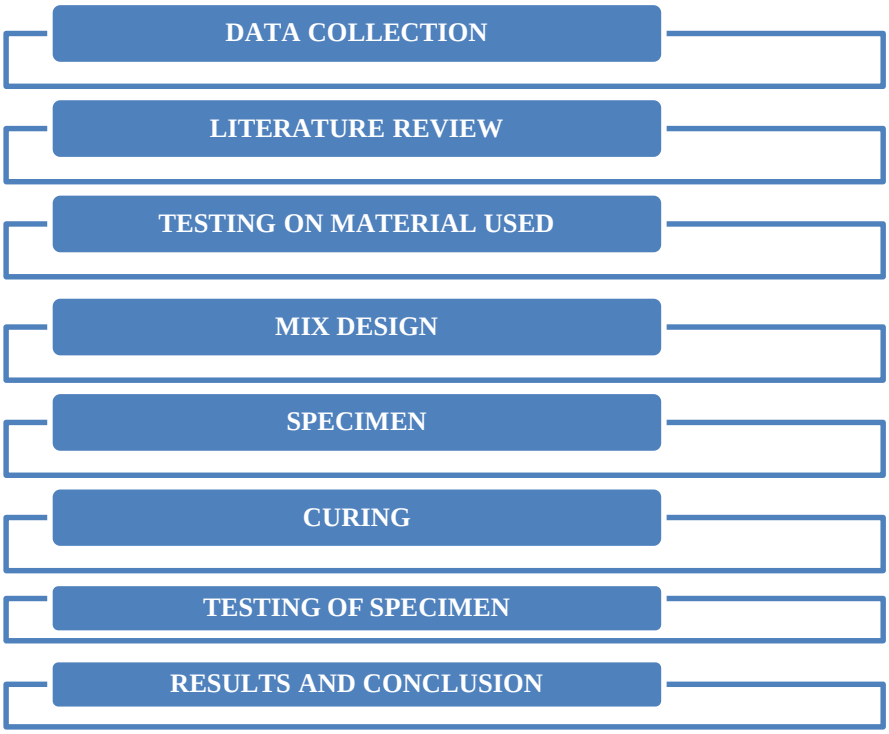
II. OBJECTIVES

1. Check the compression strength of concrete block when plastic waste can be used as core part of concrete block.
2. To determine the percentage of plastic waste which gives more strength when compared to control concrete.
3. To investigate the mechanical behaviour of the components by using waste.

III. MIX MATERIALS

The material details are as follows:
A. Cement
B. Fine Aggregate
C. Coarse Aggregate
D. LDPE Waste
E. Water

IV. METHODOLOGY



The materials used in work are Ordinary Portland Cement (OPC 53 Grade) fine aggregate, coarse aggregate and LDPE. As per IS 4031-1988 if the strength of the cement is not achieved less than 53 N/mm2 then it is known as 53 Grade cement.

V.EXPERIMENTAL WORK

A. Mix Design (M30):

Mix design carried out for M30 grade of concrete by IS 10262:2009 & having mix proportion is 1:2:2.71with water cement ratio is 0.4. The partial replacement of fine aggregate by 5% to 20% of LDPE waste.

B. Compressive Strength and Density of Concrete

Concrete is made up of different percentage of replacement of FA by 5% to 20% and cured. Tested at 7 days and 28 days for determining the compressive, density and other test compared with conventional concrete.




Photo No. 2 Mixing of LDPE **Photo No. 3 Mixing of Concrete** **Photo No.4 Casting of Cube** **Photo No. 5 Compressive Strength Test**

C. Casting Of Specimens

After proper mixing of the concrete the specimen will be casted in Three shape i.e. beam ,cubes and cylinder. The cube will be of size 150mm x 150mm x 150mm. The beam size is 500mm x 100mm x 100mm & The cylinder size is 150mm diameter, 300mm height.

Below table shows the details of the specimen to be casted.

Grade of Concrete	Percentage Replacement of Sand to LDPE (Replacement in %)	No of Cubes
M30	0%	9
	5%	9
	10%	9
	15%	9
	20%	9

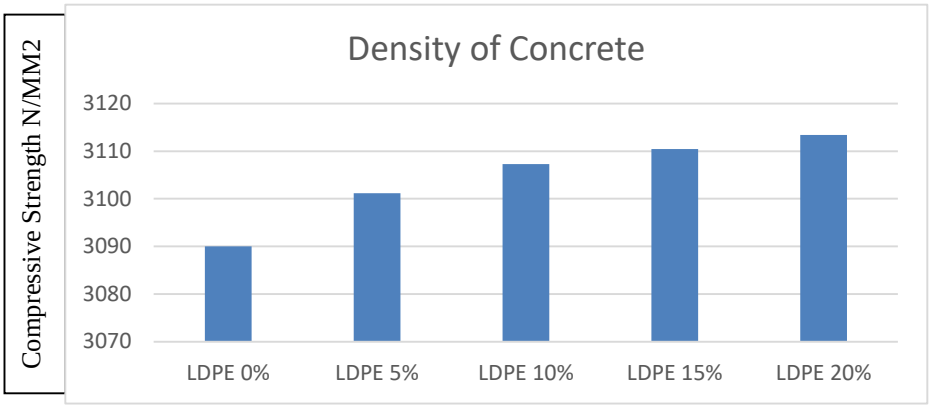
Table No. 1 Details of Specimen

VI. TEST RESULTS

A. Density of Concrete:

Percentage Replacement : LDPE	M30 (Kg/m^2)
0%	3090
5%	3101.17
10%	3107.25
15%	3110.44
20%	3113.40

Table No. 2 Results For Density of concrete

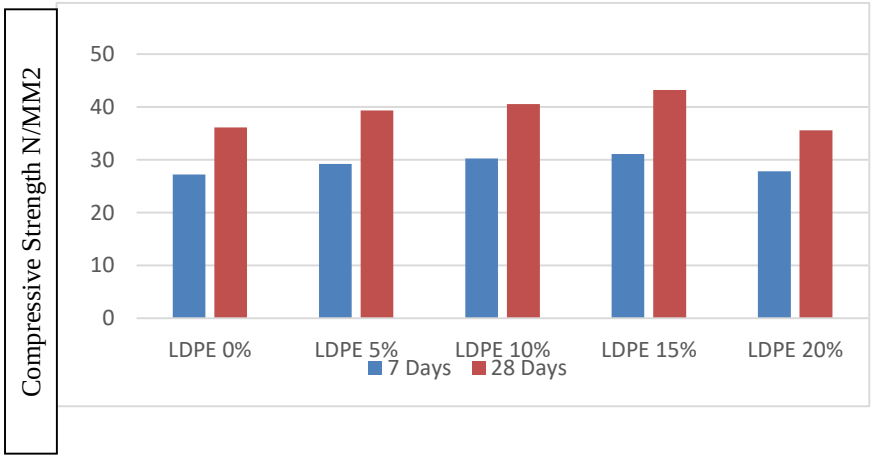


G Graph No. 1 Density of Concrete

The density of grade OPC M30 increases with the increase in percentage replacement of LDPE as fine aggregate (FA). As compare with 0% to 20% it have almost difference of 30.53 Kg/M3 that means it can improve self-weight of structure.

B. Compressive Strength

LDPE %	7 days	28 days
0%	27.20	36.10
5%	29.19	39.30
10%	30.25	40.55
15%	31.11	43.22
20%	27.80	37.55



Graph No. 2 Compressive Strength

Above Results show that there is a marginal increase in Compressive strength in replacement of LDPE at the 15% of at the age of 7, 28 days and gets slightly decreased at replacement of 20%.

VII. CONCLUSION

1. The workability of concrete was affected by using LDPE. We get lower value of slump cone with increase in content of LDPE.
2. Marginal increase in Compressive strength in replacement of LDPE at the 15% of at the age of 7, 28 days and gets slightly decresed Compressive strength at replacement of 20%.
3. The density of grade OPC M30 increases with the increase in percentage replacement of LDPE as Fine Aggregate. The LDPE have high density than fine aggregate, Hence LDPE concrete can be considered as High Density concrete. As compare with 0% and 20% it have almost difference of 30.53 Kg/M3 that means it can improve self-weight of structure
4. From this experiment it concludes that at 15% of LDPE rebound number is maximum.
5. The compressive strength of LDPE concrete decreases as temperature increases due to high dehydration of the calcium hydroxide in the cement as well as generating more water vapour thereby leading to strength reduction. Loss of moisture reduces the weight as temperature increases.
6. As we introduce LDPE in concrete, they help to hold concrete ingredients united.

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