

Experimental Investigation on Recycle Plastic in Concrete

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ABSTRACT: Plastics are inexpensive, lightweight and durable materials, which can readily be moulded into a variety of products that find use in a wide range of applications. As a consequence, the production of plastics has increased markedly over the last 60 years. However, current levels of their usage and disposal generate several environmental problems. Around 4 per cent of world oil and gas production, a non-renewable resource, is used as feedstock for plastics and a further 3–4% is expended to provide energy for their manufacture. Every year more than 500 billion plastic bags are used (nearly one million bag per minute). Hundreds of thousands of sea turtles, whales and other marine mammals die every year from eating discarded plastic bag for mistaken food. In a landfill or in environment, Plastic bags take up to 1000 year to degrade. Many researches were conducted to use industry by products such as fly ash, silica of concrete. India has a population of over 1 billion and a plastic consumption of 4 million tonnes.

Recycling is one of the most important actions currently available to reduce these impacts and represents one of the most dynamic areas in the plastics industry today. Recycling provides opportunities to reduce oil usage, carbon dioxide emissions and the quantities of waste requiring disposal. Here, we briefly set recycling into context against other waste-reduction strategies, namely reduction in material use through downgauging or product reuse, the use of alternative biodegradable materials and energy recovery as fuel.

Advances in technologies and systems for the collection, sorting and reprocessing of recyclable plastics are creating new opportunities for recycling, and with the combined actions of the public, industry and governments it may be possible to divert the majority of plastic waste from landfills to recycling over the next decades. Therefore using recycled plastic in concrete is a newly proportioned idea which could be made into greater potential. Recycled plastic is used a partial replacement for coarse aggregate. As 100% replacement of natural coarse aggregate (NCA) with plastic coarse aggregate (PCA) is not feasible, partial replacement at various percentages of 10% 20% and 30% were examined.

KEYWORDS: NCA, PCA, biodegradable

I. INTRODUCTION

Concrete is a crucial building material utilized all over the world. Aggregates are the vital constituents of the concrete. The mining of aggregates in rivers has led to deterioration of river basins, also increase in pollution and changes in pH level. The process of extraction of sediments causes the river to cut its channel through the bottom of the valley floor in both upstream and downstream of the removal site. The sand mining in rivers had gone up to such an extent that in many countries, there is a legal prohibition on sand mining. Even In places where there is no debar, nowadays satisfactory sand is not promptly available which is required to transport sand over a long distance. The search for an alternate source is of high- priority. Artificially manufactured sands are used as a substitute to the natural sands but are uneconomical. If an appropriate industrial or agricultural by-product, which is a waste material, is used to replace sand partially it will diminish the problems and complications due to the inadequacy of sand . On the other hand, it will also

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be an environment friendly technique of disposal of huge quantities of materials that would otherwise contaminate land, air and water . If this waste can be used as a partial sand replacement material in concrete, it will be an extremely valuable resources.

Concrete is the most widely used man made construction material in the world and its second only to water as the most utilized substance in the planet.

Seeking aggregates for concrete and to dispose of the waste from various commodities is the present concern. In the present study the recycled plastics were used to prepare the coarse aggregates thereby providing a sustainable option to deal with the plastic waste .

There are many recycling plants across the world, but as plastic are recycled they lose their strength with the number of recycling. So these plastics will end up as earth fill. In this circumstance instead of recycling it repeatedly, if it is utilized to prepare aggregates for concrete, it will be a boon to the construction industry.

II. MATERIALS AND METHODS

The material used for this experimental work are cement, sand, water, steel fibers, and super plasticizer.

Cement:

Cement is a binder that sets and hardens and can bind other materials together. Ordinary Portland Cement (OPC) 53 grade is used. Cement is a binder that sets and hardens and can bind other materials together. A powdery substance made by claiming lime and clay, mixed with water to form mortar or mixed with sand, gravel and water to make concrete.

Fine aggregate:

Aggregate which passed through 4.75 mm IS sieve and retained on 75 micron IS sieve is termed as fine aggregate. The specific gravity of fine aggregate was 2.6.

Coarse aggregate:

Angular shape aggregate which passes through 20 mm sieve and retain on 10mm are used as coarse aggregate in this project work. The specific gravity of coarse aggregate was 2.64 and fineness modulus of 7 was found out 12.5mm.

Polypropylene:

Properties

Strength, toughness, resistance to heat, chemicals, grease and oil, versatile, barrier to moisture.

Common Packaging Applications

Reusable microwaveable ware; kitchenware; yogurt containers; margarine tubs; microwaveable disposable take-away containers.

III. TESTING METHODS

To determine the hardened properties of concrete standard tests like compression test on cubes for compressive strength, split tensile test on cylinders for tensile strength and flexural test on beams for flexural strength of concrete were carried out at 7days and 28days of curing.

COMPRESSIVE STRENGTH OF CONCRETE CUBES

For compressive strength test, cube specimens of dimensions 150 x 150 x 150 mm were cast for M30 grade of concrete. The moulds were filled with 0%, 10%, 20%, 30% of plastic. Vibration was given to the moulds using table vibrator. The top surface of the specimen was levelled and finished. After 24 hours the specimens were demoulded and were transferred to curing tank wherein they were allowed to cure for 7 and 28days. After 7 and 28 days curing, these cubes

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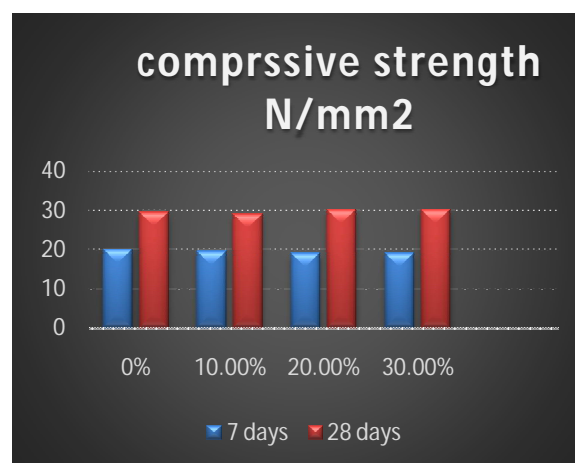
were tested on digital compression testing machine as per I.S. 516-1959. The failure load was noted. In each category three cubes were tested and their average value is reported.

The compressive strength was calculated as follows in Table: 1 and Figure: 1
Compressive strength (MPa) = Failure load / cross sectional area.

TABLE 1: COMPRESSIVE STRENGTH OF CONCRETE CUBES

Fig 1: COMPRESSIVE STRENGTH

% of plastic	Compressive strength N/mm ²	
	7 days	28days
0%	20	30
10%	19.5	29
20%	19	30
30%	19	30



SPLIT TENSILE STRENGTH OF CONCRETE CYLINDERS

For Split tensile strength test, cylinder specimens of dimension 150 mm diameter and 300 mm length were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank wherein they were allowed to

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cure for 28 days. These specimens were tested under compression testing machine. In each category three cylinders were tested and their average value is reported.

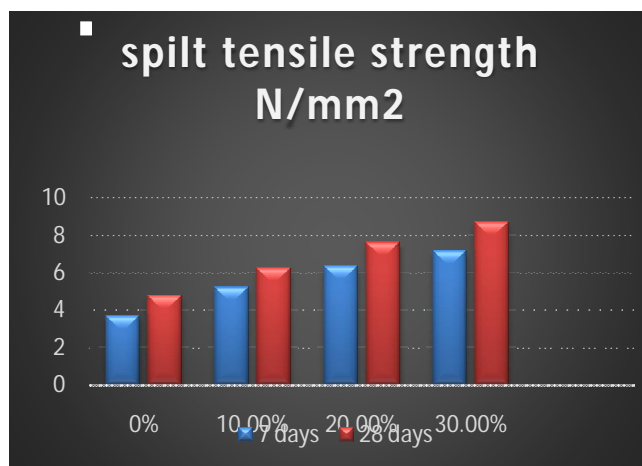
Split Tensile strength was calculated as follows in Table :2 and chart in Figure :2

Split Tensile strength (MPa) = $2P / \pi DL$, Where, P = failure load, D = diameter of cylinder, L = length of cylinder

TABLE 2: TENSILE STRENGTH OF CONCRETE CYLINDERS

% of PLASTIC	Spilt tensile strength N/mm ²	
	7 days	28days
0%	3.71	4.78
10%	5.22	6.25
20%	6.38	7.65
30%	7.19	8.74

Fig: 2 SPILT TENSILE STRENGTH



FLEXURAL STRENGTH OF CONCRETE BEAMS

For flexural strength test beam specimens of dimension 1600x150x100 mm were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank wherein they were allowed to cure for 28 days. These flexural strength specimens were tested under two point loading as per I.S. 516-1959, over an effective span of 400 mm

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on Flexural testing machine. Load and corresponding deflections were noted up to failure. In each category three beams were tested and their average value is reported.

The flexural strength was calculated as follows in Table: 3 and chart in Figure: 3

$$\text{Flexural strength (MPa)} = PL / bd^2$$

Where,

P = Failure load,

L = Centre to center distance between the support = 400 mm,

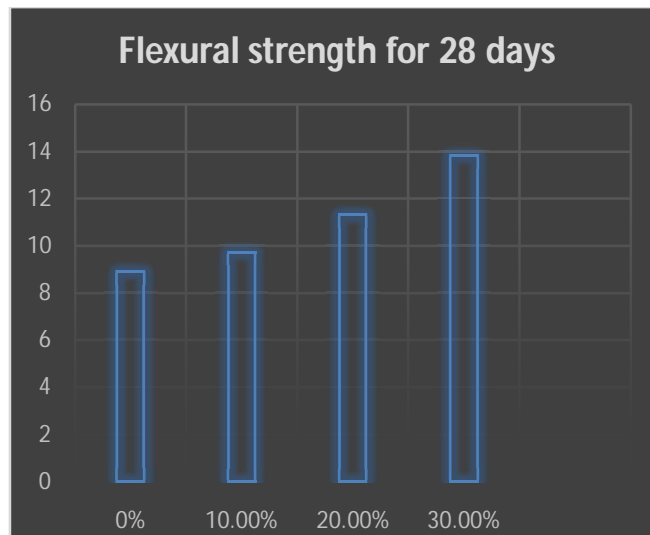
b = width of specimen=150 mm,

d = depth of specimen= 100 mm.

TABLE: 3 FLEXURAL STRENGTH OF CONCRETE BEAMS

% of PLASTIC	Flexural strength (N/mm ²)
	28 days
0 %	8.9
10 %	9.7
20%	11.3
30 %	13.8

Fig: 3 FLEXURAL STRENGTH



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IV. CONCLUSION

- It was concluded that the strength was increased due to the increased in plastic content.
- The compressive strength at 2% is higher than that of the normal concrete both in 7 days and 28 days.
- The tensile strength at 2% gives higher strength than that of the control concrete cylinder.
- The flexural strength at 2% gives higher strength than that of normal concrete beam.

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