

Innovative Techniques Of Waste Plastic Used In Concrete Mixture

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ABSTRACT

Disposal of plastic waste in an environment is considered to be a big problem due to its very low biodegradability and presence in large quantity. The proposed concrete which is made up by adding waste plastic as a partial replacement of fine aggregate in varying proportion will test for compressive strength, split tensile strength and flexural strength. It shows an appreciable improvement in the properties of concrete as compared to the conventional concrete. The samples are prepared in M20 concrete mix with required water /cement ratio. Each specimen are cured for 28days. The results are compared with normal concrete.

Keywords: *Fibre reinforced concrete, Waste plastic fibres, strength and workability characteristics.*

I. INTRODUCTION

Concrete is a versatile material for civil engineering construction. It has many advantageous properties such as good compressive strength, durability, specific gravity and fire resistance. It has some bitter properties, like- low tensile strength, brittleness, lower impact strength, heavy weight, etc. Still concrete is better option than any other available materials for civil engineering constructions. Some of the properties can be enhance by adding fibers with another ingredients of the concrete. The fibers inclusion in concrete acts as unwanted micro crack arrester. In presence of fibers the crack prorogation is delayed which helps in improvement in static and dynamic properties of concrete. The consumption of plastic has grown substantially all over the world; it leads to create large quantities of plastic-based waste. Plastic waste is the one of the challenge to dispose and manage as it is non biodegradable material which is harmful to our beautiful environment. The polyethelene teraphthelne (PET) bottles are recycled and used for different purposes. Further research to evaluate the use of plastic waste in concrete production is therefore required. This is the background of our present study. The waste polyethelene teraphthelne (PET) bottles were converted into fibers and added in concrete as an additional ingredient of concrete. The cube and cylinder compressive strength of conventional and plastic fiber reinforced concrete were determined. The results are then analyzed and compared.

II. ENVIRONMENTAL EFFECTS

In India, domestic waste plastic are causing considerable damage to the environment and hence an attempt has been made to understand whether they can be successfully used in concrete to improve some of the mechanical

properties as in the case of the steel fibers. The primary objective of this investigation is to study experimentally the properties of fibre reinforced concrete containing polythene fibres. The properties of concrete namely, compressive strength and flexural strength were studied. Plastic bags are popular with consumers and retailers as they are a functional light weight, strong, cheap and hygienic way to transport food and other products. As they used plastic bags, most of these are become to waste and some are recycled. Each year, plastic bags are consume approximately 500billion to 1trillion in world wide. That is over 1million bags are consumed per one minute. Particularly in China, the total number of plastic bags used is 3 billion per day. According to the number of plastic bags used, it can be affected to the environment. Plastic bags create visual pollution problem and can have harmful effect on aquatic and physical animals. Also plastic bags are especially components of the litter stream due to their size and it takes a long time to completely degradation.

III.OBJEECTIVE OF STUDY

- 1) To utilize the plastic waste generated everyday and makes its effective use in concrete in order to prevent the ecological and environmental strains by them.
- 2) The study of polythene waste in a concrete as a plastic fiber to improve the properties of concrete.

IV. MATERIALS AND METHODOLOGY

4.1 Material :

4.1.1. Cement: The cement used in the experimentation was 53-grade ordinary port land cement, which satisfies the requirements of IS: 12269-1987 specifications.

4.1.2.Fine Aggregate: Those fractions from 4.75 mm to 150 micron are termed as fine aggregate. The river sand and crushed sand is be use in combination as fine aggregate conforming to the requirements of IS: 383. The river sand is wash and screen, to eliminate deleterious materials and over size particles.

4.1.3.Coarse Aggregate : The fractions from 80 mm to 4.75 are termed as coarse aggregate. The Coarse Aggregates from crushed Basalt rock, conforming to IS: 383 is be use. The Flakiness and Elongation Index were maintained well below 15%.

4.1.4.Water: Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Since it helps to from the strength giving cement gel, the quantity and quality of water is required to be looked into very carefully.

4.1.5. Waste Plastic: The waste plastic fibres were obtained by cutting waste plastic pots. The waste plastic fibres obtained were all recycled plastics. The plastic fibres were not obtained from granules. The fibres were cut from steel wire cutter and it is labour oriented.

4.2.METHODOLOGY

The main objective of this experimental investigation is to find out the effect of different aspect ratios of waste plastic fibres on the workability and strength characteristics of fibre reinforced concrete.

Concrete was prepared by a mix proportion of 1: 1.435: 2.46 with a W/C ratio of 0.48 which correspond to M20 grade of concrete. The different aspect ratios of fibres like 0, 30 and 50 were adopted in the experimental programme. Waste plastic fibres were added to the dry mix at the rate of 0.5% (by volume fraction). The entire mix was homogeneously mixed with calculated quantity of water and plasticizer. The compressive strength test specimens were of dimensions 150 x 150 x 150mm. The split tensile strength test specimens were of dimensions 150mm diameter x 300mm length. The flexural strength test specimens were of dimensions 100 x 100 x 500mm and impact strength test specimens were of dimensions 250 x 250 x 30 mm. These specimens were cast and tested after 28 days of curing as per IS specifications. When the mix was wet the workability test like slump test, compaction factor test and flow tests were carried out. After 28 days of water curing the specimens were weighed for their density and tested for their strength. The different strength parameters of waste plastic fibre reinforced concrete like compressive strength, tensile strength and flexural strength were found for different percentage addition/replacement of cement by Micro silica-600 as the case may be. The compressive strength tests were conducted as per IS: 516-1959 on specimens of size 150 x 150 x 150 mm. The tensile strength tests were conducted as per IS:5816-1999 on specimens of diameter 150 mm and length 300mm. Indirect tension test(Brazilian test) was conducted on tensile strength test specimens. Flexural strength tests were conducted as per IS:516-1959 on specimens of size 100 x 100 x 500mm. Two point loading was adopted on a span of 400 mm, while conducting the flexural strength test.

V. EXPERIMENTAL RESULTS

The following Tables give the details of the experimental results

5.1 COMPRESSIVE STRENGTH TEST RESULTS -

The following Table No 5.1.1 gives the compressive strength test results of waste plastic fibre reinforced concrete with different aspect ratio of fibres.

Aspect ratio of fibre	Failure load(kn)	Compressive strength (Mpa)	Average compressive strength(Mpa)
0	608.22	27.03	27.18
	589.33	26.19	
	637.65	28.34	
30	676.89	30.08	29.64
	637.65	28.34	
	686.7	30.52	
50	676.1	30.05	30.15
	672	29.87	
	686.7	30.52	

5.2.TENSILE STRENGTH TEST RESULTS –

The following Table No 5.2.1 gives the tensile strength test results of waste plastic fibre reinforced concrete with different aspect ratio of fibres-

Aspect ratio of fibres	Failure load (kn)	Tensile strength(Mpa)	Average Tensile strength(Mpa)
0	206	2.91	2.84
	191.3	2.7	
	206	2.91	
30	206	2.91	3.08
	206	2.91	
	245.25	3.46	
50	220.72	3.12	3.2
	225.63	3.18	
	235.44	3.32	

5.3.FLEXURAL STRENGTH TEST RESULTS-

The following table no.5.3.1 gives the flexural strength test result of waste plastic fibre reinforced concrete with different aspect ratio of fibres.

Aspect ratio of fibres	Failure load (kn)	Flexural strength(Mpa)	Average flexural strength (Mpa)
0	13.73	5.49	5.67
	14.91	5.96	
	13.93	5.57	
30	14.32	5.72	5.85
	14.12	5.65	
	15.49	6.19	

50	16.08	6.43	6.23
	14.22	5.68	
	16.38	6.55	

VI. OBSERVATIONS AND DISCUSSIONS

Based on the experimental results the following observations were made:

1. It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the compressive strength from zero aspect ratio to 50 aspect ratio. After an aspect ratio of 50, the compressive strength goes on decreasing. Therefore, the higher compressive strength can be achieved for the aspect ratio of 50 and the percentage increase in the compressive strength is 11%
 2. It has been observed that the waste plastic fibre reinforced concrete shows an increasing trend in the tensile strength from zero aspect ratio to 50 aspect ratio. After an aspect ratio of 50, the tensile strength goes on decreasing. Therefore, the higher tensile strength can be achieved for the aspect ratio of 50 and the percentage increase in the tensile strength is 13%.
 3. It has been observed that the waste plastic fibre reinforced concrete show an increasing trend in the flexural strength from zero aspect ratio to 50 aspect ratio. After an aspect ratio of 50, the flexural strength goes on decreasing. Therefore, the higher flexural strength can be achieved for the aspect ratio of 50 and the percentage increase in the flexural strength is 10%.
 4. It is observed from the literature (Rafat Siddique) that the steel fibre reinforced concrete with an aspect ratio of 55 and percentage of steel fibre 0.5% results in 8%, 20% and 10% increase in the compressive strength, tensile strength and flexural strength as compared to 11%, 13% and 10% increase in the compressive strength, tensile strength and flexural strength for waste plastic fibre reinforced concrete respectively.
- Thus, waste plastic fibre reinforced concrete can be compared with that of steel fibre reinforced concrete.

VII. CONCLUSIONS

It can be concluded that an aspect ratio of 50 is a good aspect ratio for the production of waste plastic fibre reinforced concrete and it yields maximum strength characteristics and good workability.

1. Thus the waste plastics, which are environmental pollutants, can be used in the production of waste plastic fiber reinforced concrete.

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