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An Experimental Investigation on Fibre Reinforced Concrete Using Waste Polymer Fibre

Pawan Sharma[1], A K Jha[2]

[1]M. Tech. Scholar, Lakshmi Narain College of Technology, Bhopal, Madhya Pradesh, India

[2]Associate Professor, Department of Civil Engineering, LNCT, Bhopal, Madhya Pradesh, India

ABSTRACT

The expanding measure of waste material from industry is a concerning reality that has started the manageability issues of nature and environment of earth surface. The creation of fiber in the business represents the a dangerous atmospheric devation by discharging the carbon dioxide and other destructive gases in the environment amid its assembling. It additionally process squander at the season of assembling and utilizing on the field. Along these lines, definition of cement with mechanical waste can help in limiting the natural and biological issues. In this investigation fiber (squander polypropylene fiber) was utilized as an extra material of bond concrete. Polypropylene fiber (PPF) is a manufactured hydrocarbon polymer which was added to improve the quality of the solid for example compressive and split rigidity. In this investigation, we arranged number of examples by changing level of mechanical waste polypropylene fiber I. e. (0%, 0.25%, 0.5%, 0.75% and 1.00%). The thickness of Fiber Reinforced Concrete (FRC) was tried following setting up the solid blend while the compressive quality and the split rigidity of the Fiber Reinforced Concrete (FRC) were tried following 7 and 28 days of restoring. Results demonstrate that the thickness of new Fiber Reinforced Concrete (FRC) marginally or irrelevantly diminishes from 2397 kg/cm3 to 2393 kg/cm3 with the expansion of polypropylene fiber. The expansion of waste polypropylene fiber expands the quality of Fiber Reinforced Concrete (FRC) for all relieving ages up to a specific point. From that point onward, there is a sudden decrease in the quality of the Fiber Reinforced Concrete (FRC). The expansion of 0.5% polypropylene fiber is suggested for the greatest quality with least coefficient of weakness. The expansion of 0.5% waste polypropylene fiber increment the compressive quality around 10% and 17% split rigidity of the Fiber Reinforced Concrete (FRC).

Keywords : Polypropylene Fiber, Fiber Reinforced Concrete, Rice Husk Ash, Polyethylene Terephthalate, Fiber Reinforced Mortar

I. INTRODUCTION

Bond concrete is the most extensively utilized development material on the planet. There is a worry to find out about it and to enhance its properties. Utilizing waste and reused materials in bond concrete blends ending up progressively critical to oversee and treat both the strong waste produced by city waste and industry.

Plastic is a standout amongst the most essential developments of twentieth century substance or material. The measure of plastic expended every year has been developing progressively and turns into a genuine ecological inconvenience. For comprehending the transfer of substantial measure of reused plastic material, utilization of plastic in solid industry is considered as sensible application. As per some specialist utilized plastic material particles included as total in the bond solid blend and decided their physical, synthetic, and mechanical properties.

The result demonstrated that the expansion of polymeric materials in divisions 10% in volume within a bond framework does not include a critical variety of the concrete cement mechanical highlights. Some specialist determined the utilization of expended plastic jug squander as a fractional substitution of the fine total inside composite materials for building applications. The examination exhibits that the plastic containers destroyed into little PET particles might be utilized effectively as an incomplete substitution of the fine total in cementitious a solid composite, which seems to display an alluring minimal effort material with steady or dependable properties and which would assist to determine a portion of the strong waste inconveniences made by plastics generation. Henceforth in this examination, the chances to utilize the waste plastic in bond concrete blends have been explored and contrasted and control tests. In this area, just the situations where the plastic is utilized as stringy material in cement are introduced. The distinctive properties of the different kinds of sinewy waste material are spoken to. At long last, the conceivable future examinations on the modern waste polymer as stringy material in the bond mortar and concrete solid blend are assessed in this work.

II. OBJECTIVE OF WORK

The vital goal of this exploration work is to develop a practical and eco neighborly answer for the utilization of mechanical waste fiber in cement by presenting them as sinewy material for creating a bond solid blend. This examination work or proposal is directed to accomplish the accompanying targets:

1. To examination the physical and mechanical execution of modern waste polymer fiber utilized in the solid blends.
2. To set up the different extents of polymer adjusted solid utilizing mechanical waste fiber.
3. To decide the ideal utilization of mechanical waste fiber in the bond solid blend, which delivers the best concrete of having better properties like thickness test, compressive quality and split elasticity.
4. To review the chance of utilizing modern waste fiber in bond solid blend.
5. To decide the compressive quality, split elasticity of the polymer adjusted solid which is made of modern waste fiber.

III. MATERIALS AND TESTS PERFORMED ON THEM

To efficient research the enhancement in the mechanical properties of the fibre reinforced concrete, preliminary planning, procedures and methods must be wisely selected. The criteria to evaluate mechanical properties are based on the activities to plan and preparation, which carried out by before the testing of the fresh and hardened properties of Fibre reinforced concrete (FRC). These various activities are as follows:

- Aggregate Impact Value test
- Water absorption test on aggregate
- Sieve analysis test on aggregate (Coarse and Fine)
- Fineness test on cement
- Setting time test on cement
- Selection of dosages of fibre in concrete
- Selection of the mix
- Concrete mixing
- Preparation of the test samples.

Testing is an activity required in the majority of the engineering research work, where it comprises or consists all preparation and plan of action to be taken and being situated into performance subsequently. This chapter describes preliminary design and planning such as experimentation of the coarse and fine aggregates, selection of fibres with fibre volume dosage rate, target strength of concrete specimens, mix proportioning and number of mix batches and

concrete specimens required to meet up the scope of this thesis work.

Materials used in our Work:-

The materials those were used in our thesis work are as follows:-

- Binding material i.e. Cement
- Fine aggregate (Sand)
- Coarse aggregate
- Industrial waste polypropylene fibre

MIX DESIGN AND TESTING OF PREPARED SAMPLES

The procedure of selecting appropriate ingredients of concrete and determining their relative quantity with the objective of producing a cement concrete of the required compressive strength, flexural strength, workability and durability as economical as possible, is termed as the concrete mix design. In our study mix design was done by BIS mix design method which is based on Bureau of Indian Standards **(14) BIS: 10262-2009**

Mix Design Calculations:-

The mix calculations per unit volume of concrete according to IS code shall be as follows:

1- Volume of concrete = 1 m^3 eq. **1**

2- Volume of cement $= \frac{\text{Mass of cement}}{\text{Specific gravity of cement}} \times \frac{1}{1000}$

$= \frac{359}{3.15} \times \frac{1}{1000} = 0.114\ m^3$ eq. **2**

3- Volume of water $= \frac{197}{1} \times \frac{1}{1000} = 0.197\ m^3$ eq. **3**

4- Volume of all aggregate = [eq. 1 – ({eq. 2 + eq. 3})]

= 0.689 m^3 eq. **4**

5- Mass of coarse aggregate = (eq. 4) x Volume of coarse aggregate x Specific gravity of coarse aggregate x 1000

= 0.689 x 0.61 x 2.65 x1000

= 1113.77 kg

6- Mass of fine aggregate = (eq. 4) x Volume of fine aggregate x Specific gravity of fine aggregate x 1000

= 0.689 x 0.39 x 2.72 x1000

= 730.89 kg

Table1-Proportion of Different Materials in our Mix

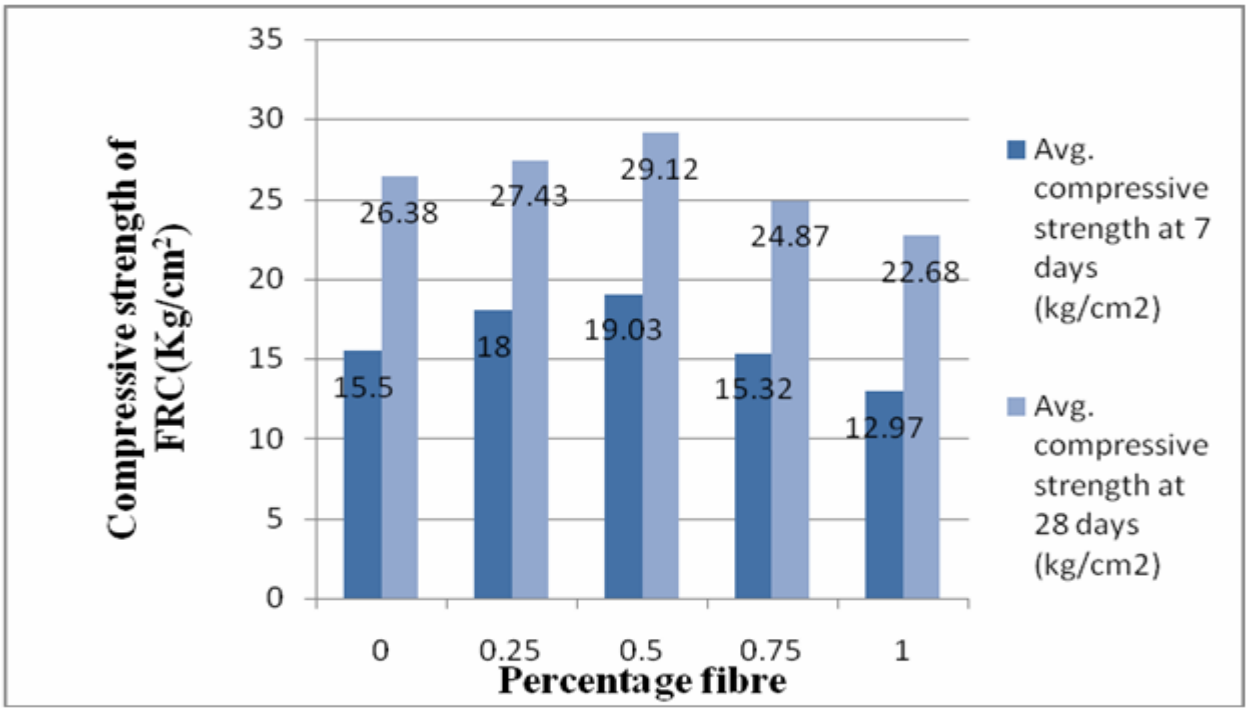
Cement	Fine Aggregate	Coarse Aggregate	Water
359	730.89	1113.77	197 liters
1	2.036	3.102	0.55

IV. RESULTS AND DISCUSSION

This chapter deals with the test results those conducted on the prepared samples for various test like compressive strength and split tensile strength test. The performance of various mixes containing different percentage of polypropylene fibre is discussed in this chapter. All the tests conducted were in accordance with the methods described in the previous chapter

Compressive Strength of Fibre Reinforced Concrete

The compressive strength of all the prepared mixes was determined at the ages of 7 and 28 days for the various addition levels of polypropylene fibre with cement concrete. The values of average compressive strength for different mixes prepared by addition of polypropylene fibre (0%, 0.25%, 0.50%, 0.75% and 1.00%) at the completion of different curing periods (7 days and 28 days) are given in the various Tables below.



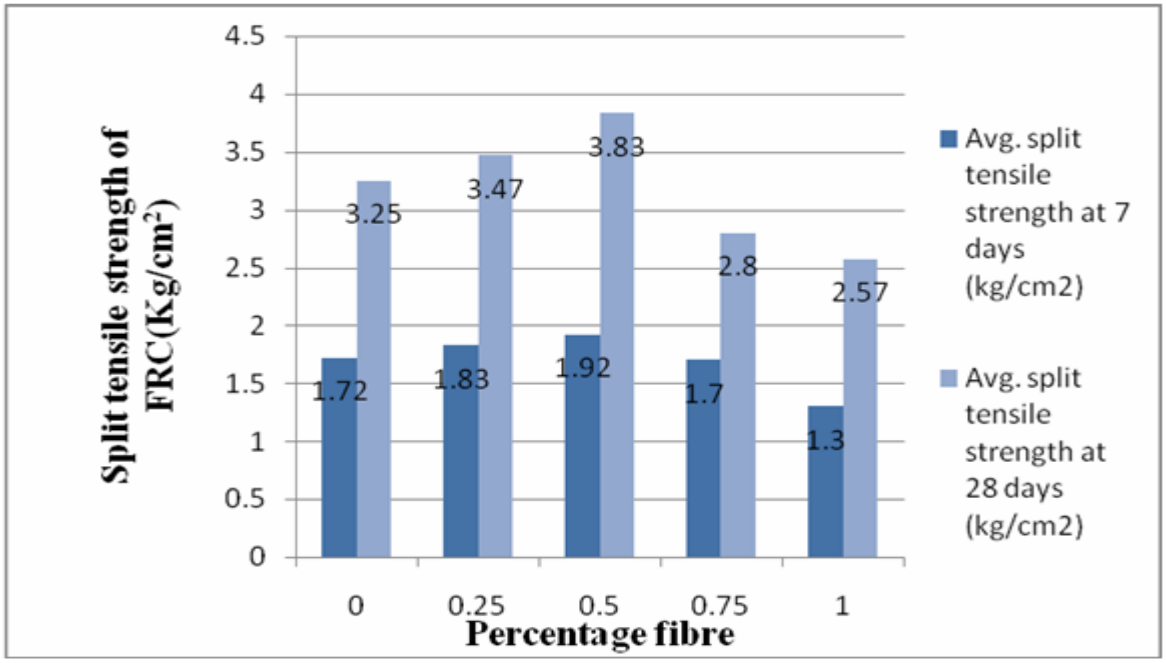


Figure 2 : Combine Test Results of Split Tensile Strength

V. CONCLUSION

After the detail analysis of the test results we can say that the addition of waste polypropylene fiber significantly affect the 7 and 28 days compressive strength and split tensile strength of the Fibre Reinforced Concrete (FRC). From the critical difference, it can be clearly seen that the addition of waste polypropylene fiber in certain amount i. e. 0.50% of the weight of cement increases the compressive strength up to 10 % as well as split tensile strength increases around 17 % than conventional concrete. Experimental results also shows similar trend. Hence, the results of statistical analysis are equivalent to the experimental results. From the experimental investigation this research work can be concluded as follows:-

- The addition of waste polypropylene fibre does not affect very much the density of concrete mix.
- The gradual increase seen in the compressive strength of Fibre Reinforced Concrete (FRC) at 7 days and 28 days curing with 0.25% and 0.50% addition of fibre but after that it starts reducing the compressive strength with increase of fibre addition.
- The gradual increase seen in the split tensile strength of Fibre Reinforced Concrete (FRC) at 7 days and 28 days curing with 0.25% and 0.50% addition of fibre but after that it starts reducing the split tensile strength with increase of fibre addition.
- The addition of waste polypropylene fiber increases the strength of concrete for all curing ages up to a certain point. After that there is an abrupt reduction in the strength of the Fibre Reinforced Concrete (FRC). Because at higher dosage, concrete loses its ability to make a proper bond.
- The mix which was prepared with the addition of 0.50% fibre with 0.55 W/C ratio posses the maximum compressive as well as tensile strength. Therefore this mix is recommended for maximum strength.

VI.FUTURE WORK

Further research and investigations were highly recommended and should be carried out to understand more mechanical properties of fibre

reinforced concrete. Several recommendations for future studies are mentioned below:

- The addition of fibre in concrete reduces the workability of the concrete so the effect of super plasticizer on FRC can be checked by preparing the test samples with addition of super plasticizer.
- More investigations and laboratory tests should be done to study on the mechanical properties of fibre reinforced concrete (FRC). Such application of fibres was recommended in testing on concrete slabs, beams and walls or conducting more tests such as abrasion, shatter, shear, impact, blasting or creeping of concrete.
- The combination of two or more short fibres may tend to provide more efficient mechanical properties of structure. So further investigation can be carried out by the combination of different types of short fibres into the concrete mix.
- The mechanical properties of fibre reinforced concrete may be different in various temperatures. So the tests on freeze-thawing conditions were recommended for future study

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