International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

AN EXPERIMENTAL STUDY OF CEMENT CONCRETE BY ADDITION OF POLYPROPYLENE FIBERS

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Abstract - *Concrete is good at compression comparatively weak in tension. In order to enhance concrete's tensile strength, fibers to be added in concrete mixture. In my study polypropylene fibers had considered as additive to fresh concrete mix of M30grade concrete for study workability and mechanical properties had been carried.*

The properties of concrete had considered are workability, compressive strength, flexural strength, split- tensile strength. The polypropylene fibers of 24mm had taken to this experimental study and percentage of fibers are considered as 0.2%, 0.4%, 0.6%, 0.8%, 1.0% and 1.2% to cement's wt content in mix proportion.

Key-Words: Concrete, Polypropylene fibers, M30, Compressive strength, Split-tensile strength.

1. INTRODUCTION:

In construction field concrete is the important material to build-up the structures like buildings, dams, tunnels, bridges, pavements etc.

As all known that concrete is weak in tensile strength as compared to its compressive strength, so, in order to enhance the tensile strength of concrete some fibers are to be added to concrete mix.

The fibers used are steel, polypropylene, plastic, glass, nylon and coir.

1.1 Polypropylene fibers:

Polypropylene fibers are next generation synthetic fibers, specially designed for construction reinforcement and crack control.

The polypropylene fibers are available in various sizes as 6mm, 12mm, 24mm, in some brands.

2. LITERATURE REVIEW:

- Salahaldein Alsadey, Muhsen Salem had paper on "Influence of Polypropylene Fiber on strength of concrete"

  They made experimental study with fibers of polypropylene on M25 grade concrete and stated that with the increase of fiber content compressive strength increases, even at 2% of fiber content also 28N/mm^{2}is obtained against to 25N/mm^2.

- N. Sohaib, SeemabF, Sana G, R. mamoon had paper "Using Polypropylene Fibers in Concrete to achieve maximum strength"

  They stated that significant change was observed in compressive strength after 7 and 28 days. The optimal percentage of Polypropylene fiber was obtained to be 1.5 % of cement by volume.

- G.M. Sadiqul Islam, Sristi Das Gupta has a paper with title "Evaluating plastic shrinkage and permeability of polypropylene fiber reinforced concrete"

  There study the Concrete's strength and plastic shrinkage were assessed, to 'polypropylene' fiber in different proportions at. 0.10%, 0.15%, 0.2%, 0.25% and 0.3% by volume of concrete. Plane concrete samples were also casted and tested for reference purpose. By addition of 0.1% fiber gave minor reduction 2% in compressive strength while the tensile strength increased by 39%.

- Divya S Dharan, Aswathy Lal had paper "study the effect of polypropylene fiber in concrete"

They conclude that @1.5% of fibers the compressive strength improves to 17% and split- tensile strength was 22% when compared to conventional concrete.

3. METHODOLOGY AND OBJECTIVE:

In this paper an M30 grade of concrete is designed using the code book of IS: 10262:2019 with Fly-ash is used to replace some of the cement content @20% and super plasticizer "MasterGlenium sky 8630" is used to increase the workability without changing the water cement ratio.

The experimental work is carried on cubes of 150*150*150mm and cylinder's having 150mm diameter and 300mm height was consider and beams of 100*100*500mm in the laboratory to study the compressive strength, split –tensile strength and flexural strength of concrete.

The main objective was to observe influence of polypropylene fibers on workability, compressive strength, split tensile strength and flexural strength of concrete.

4. MATERIALS USED:

4.1 CEMENT:

Opc53 grade cement from **KCP** brand is selected for my Experimental study. The considered cement had a specific gravity of 3.15 from experimental value from the laboratory test.

4.2 SAND:

Aggregate passing through 4.75mm sieve is referred as sand. The considered sand was zone-III grade and specific gravity of 2.3respectively.

4.3 COARSEAGGREGATE:

Aggregate which retains on IS: 4.75mm sieve is referred as coarse aggregate. In my experimental study 12.6mm and 20mm aggregates in the ratio of 30:70 were used, and it has a specific gravity 2.85 from the experimental test.

4.4 FIBER:

Polypropylene fiber of 24mm length is used for the study, and it manufactured at "Jogani industry".

4.5 Add MIXTURE:

The chemical admixture "MasterGlenium- sky8630" used as Super plasticizer in my project; this is help for workability of concrete without changing water cement ratio.

4.6 MIX DESIGN:

- Grade of concrete : M30
- Type of exposure : severe
- Cement content : 288 kg/m^3
- Fly ash content : 72 kg/m^3
- Sand content : 567.26 kg/m^3
- Aggregate content : 1340 kg/m^3
- Water cement ratio : 0.4
- Super plasticizer : 0.8% to cement wt

4.7 MIX RATIO:

Cement:flyash:sand:aggregate=1:0.25:1.97:4.65

5. RESULTS AND DISCUSSION:

The specimens which were cured in curing tank, tested with the help of UTM. The cubes were tested for compressive strength after curing of 7 and 28days. The cylinders and beams are tested for concrete's split-tensile strength and flexural strength of after curing of 28 days.

s.no	%of fibers	7-day's compressive strength (mpa)	28-day's compressive strength (mpa)
1	0	29.32	40.2
2	0.2	31.23	41.9
3	0.4	32.31	42.6
4	0.6	34.98	43.95
5	0.8	35.86	44.96
6	1.0	34.98	44.29
7	1.2	33.89	43.54

Table-1: Compressive strength of cubes

Figure-1: testing of cube

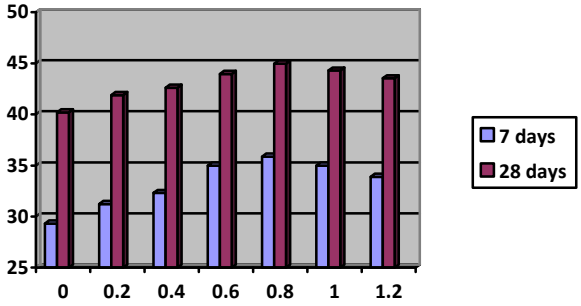

Chart- 1 compressive strength of cubes

s.no	% of fibers	28-days split tensile strength (mpa)
1	0	2.84
2	0.2	2.97
3	0.4	3.22
4	0.6	3.38

5	0.8	3.48
6	1.0	3.54
7	1.2	3.41

Table-2: Split-tensile strength of cylinders

Figure-2 Testing of cylinder

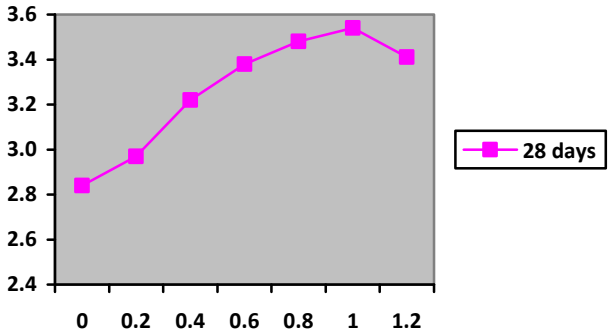

Chart -2: split tensile strength of cylinders

s.no	%of fibers	28-days flexural strength (mpa)
1	0	5.85
2	0.2	6.01
3	0.4	6.03
4	0.6	6.25
5	0.8	6.42
6	1.0	5.86
7	1.2	5.89

Table-3: Flexural strength of beams

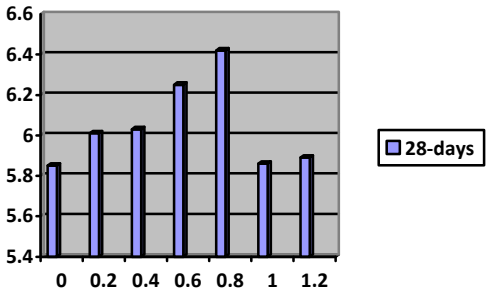

Chart-3: flexural strength of beams

Figure-3: Testing of beam

6. CONCLUSIONS:

From the observations and experimental results the following conclusions are made:

- There is no change in workability of concrete up to 1% of fiber content in mix.
- The compressive strength increases up to 0.8% of fibers and slightly decreases after 1% of fibers.
- The split tensile strength of concrete increases up to 1.0% of fibers in concrete and slightly decreases at 1.2%.
- Flexural strength rises up to 0.8 % of fibers and declines marginally, after 0.8% of fibers.

Future work:

The next work is to study and observe the influence of hybrid fibers such combination of steel and polypropylene in concrete for workability and mechanical properties.

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