EXPERIMENTAL STUDY OF CEMENT CONCRETE BY USING NYLON FIBRE

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Abstract

Concrete is very important construction material in construction. The quality of concrete explains the strength of building. In this research the strength of concrete is enhanced by adding of nylon fiber in the range of 2%, 4% and 6%.Nylon is a very resilient fiber, synthetic, fibrous material that is known for its high tensile strength, abrasion resistance and chemical stability. The Compressive strength and Split Tensile strength have been evaluated in M 30 grade concrete and the results compared with conventional concrete. While increasing the percentage of nylon fiber the mechanical properties like compressive strength and split tensile strength increased.

Keywords: nylon fiber, compressive strength, split tensile strength.

1. Introduction

Concrete is stronger in compressive strength but weaker in tensile strength. The Glass Fiber and Nylon Fiber having a length of 50mm and a fiber content of 5%, by mass of cement are added in the concrete mixture for the production of GFRC and NFRC which results decreasing compressive strength and increasing split tensile strength (11). The result of polyethylene reinforced concrete with the percentage of 40 gives more tensile and flexural strength when compared with Nylon fiber mixed concrete. But Nylon containing concrete has higher flexural strength (5). R-Nylon fibers more effective in improving the mechanical qualities compared with recycled nylon fibers (3). When increasing glass fiber specific wear rate decreases and it is lowest achieved at 30 % of glass fiber(1).Optimum friction and wear performance was obtained when the Nylon fiber volume fraction was 35% (6). FRC is having high mechanical characteristic when compare with conventional concrete (12).

2. Experimental Work

The various characteristics of materials have been found. Fig 1 shows the nylon fiber mixed in a concrete.

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Material	Specific gravity
Cement	3.15
Coarse Aggregate	2.82
Fine Aggregate	2.66
Nylon fiber	1.17
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Table 1.Specific Gravity of Materials

Material	Properties of Material
Cement used	OPC 43 grade
Nominal size of the coarse aggregate	20 mm
Cement Content	320kg/m ³
Maximum W/C	0.45
Workability	85mm(slump)
Exposure condition	Severe
Method of Concrete	Manually
Degree of Supervision	Good
Type of Aggregate	Crushed Angular

 Table2. Specific Gravity of Materials

The water absorption of fine aggregate and coarse aggregate has been done for checking the durability of materials that has been used in nylon fiber reinforced concrete and the values shown in the Table3.

Material	Properties of
	Material
Coarse aggregate	0.5%
Fine aggregate	2.78%

Table 3.Water Absorption

The fineness modulus of fine Aggregate has been done by sieve analysis and the value is 3.29%. The Impact value of coarse aggregate has been found as a 26% by Aggregate Impact Value Testing Machine. The physical properties of materials used in concrete shown in the following tables.

S.No	Property	Result
1	Normal consistency	30%
2	Initial setting time(min)	45
3	Final setting time(min)	360

Table 4. Physical Properties of Cement

The locally available sand is used as a fine aggregate and the properties shown in the Table 5.

S.No	Property	Result
1	Specific Gravity	2.66
2	Fineness Modulus	4.45

3	Water Absorption	2.78%
Table 5. Physical Properties of fine aggregate		

S.No	Property	Result
1	Specific Gravity	2.82
2	Water Absorption	0.5%
3	Texture	Angular shaped

Table 6.Physical Properties of coarse aggregate

The quantity of materials has to be used in Nylon Fiber Reinforced Concrete has been found by mix design. From that the water cement ratio is taken as a 0.4 and it has been tabulated below.

Materials	% of	Weight of	w/c
	material	material in kg	ratio
Cement	100	2.5	
Fine aggregate	100	3.85	0.40
Coarse aggregate	100	5.175	0.40
Nylon fiber	2	0.05	

Table7.Quantity of Materials



Fig 1.Nylon Fiber Reinforced Concrete



Fig 2.Compressive Strength on Cube



Fig 3.Split Tensile Strength on Cylinder

The compressive strength of conventional concrete has been evaluated and compared with nylon fiber reinforced concrete. The average compressive strength of conventional concrete is 30.7N/mm²

Conventional	Load	Compressive
cube	(kN)	Strength(N/mm ²)
1	610	27.11
2	720	32
3	740	32.89

Table8. Compressive Strength of Conventional Concrete at 28 days

The mechanical properties like compressive strength in the age of 7 days and 28 days have been found by using of Compressive Testing Machine.

% of	Load (kN)	Compressive
Nylon		Strength(N/mm ²)
2	410	18.22
4	270	12
6	250	11.11

Table9.Compressive strength at 7 days

% of	Load (kN)	Compressive
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Nylon		Strength(N/mm ²)
2	460	20.44
4	750	33.33
6	310	13.78

Table10.Compressive strength at 28 days



Fig 4.Compressive Strength Results

The split tensile strength of conventional concrete in the age of 28 days has been found.

Conventional Cylinder	Load (kN)	Split tensile Strength(N/mm ²)
1	100	1.41
2	95	1.34
3	95	1.34

Table11. Split Tensile Strength of Conventional concrete

The split tensile strength of Nylon Fiber Reinforced Concrete in the age of 7 days and 28 days has been found.

% of	Load (kN)	Split tensile
Nylon		Strength(N/mm ²)
2	80	1.13
4	95	1.34
6	90	1.27

Table12 Split Tensile Strength at 7 days

% of Nylon	Load (kN)	Split tensile Strength(N/mm ²)
2	105	1.49
4	110	1.56
6	80	1.13

WWW.ijreat.org Published by: PIONEER RESEARCH & DEVELOPMENT GROUP Table13. Split Tensile Strength at 28 days



Fig 5.Split Tensile Strength Results

3. Results and Discussion

The mechanical characteristics like compressive strength and split tensile strength of nylon fiber reinforced concrete (2%, 4% and 6%) has been evaluated at the age of 7 days and 28 days.

At the addition of 2%, 4% and 6% nylon fiber in concrete, the compressive strength at 28 days more when compared with 7 days compressive strength.

At the addition of 4% nylon fiber gives more compressive strength when compared with remaining percentage and also conventional concrete.

At the addition of 4% nylon fiber gives more split tensile strength when compared with remaining percentage and also conventional concrete.

From the results up to 4% of adding the nylon fiber gives the compressive strength and split tensile strength increase gradually.

By adding the nylon fiber in plain cement concrete has been increase the compressive strength and split tensile strength.

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