International Journal of Innovative Research in Technology and Management (IJIRTM), Volume-3, Issue-2, 2019
ISSN: 2581-3404 (Online)

Behavior of Glass Fiber for M-25 and M-30 Grades of Reinforced Concrete

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ABSTRACT
The present look at has been taken up for evaluating the distinctive grades of concrete. Emphasis has been given to the compressive strength, flexural strength, split test and workability properties of glass fiber concrete beams. This paper offers the outcomes of an experimental investigation carried out on 30 concrete beams, 150 mm 150 mm 700 mm in length. The beams were tested beneath two points loading. Ninety cubes 150 mm 150 mm and 30 cylinders of 150 mm dia and300 mm length with exceptional dosages of glass fiber (0%, 0.5%, 1.o%, and 1.5% & 2.0%) The examiner parameters include first crack load and remaining load. And load became at 5.2 KN/s in 2000 KN compressive checking out system.

Keywords:- Slump value, Iron chips, Compressive strength, Glass Fiber, Grade of Concrete.

I INTRODUCTION

Concrete is presently the most extensively used building cloth. Although many structures are built of concrete, there are nevertheless a few barriers associated with using conventional concrete, any such slow tensile energy and nearly no ductility. Concrete, as a cloth of production, has been conventional for a long term. It is popularly believed that concrete structures are designed for a renovation unfastened working life of over fifty years. However, the enjoy in the past shows that there had been a number of instances of extreme damages or even disasters in some of them, even inside a brief span. A short review of the parameters influencing the deterioration of concrete structures in marine environment indicates that it is a complicated phenomenon that includes information of numerous exceptional factors. These may be extensively classified into two major sections, environmental parameters and material parameters, with the material parameters together with both which can be relevant to the concrete and steel. It is the concrete traits that impact the time to initiation of corrosion to start with and later the cracking of concrete due to corrosion of metallic is of importance. The reinforcements usually in a passive state up to initiation of corrosion and after initiation it's far prompted by the environment in concrete up to cracking and later through the environment itself. The relationships between these have a lot of bearing at the performance of systems In the previous couple of years many researchers. Have started to realize that strain localization additionally takes place for concrete specimens loaded in compression; but, the compressive failure mechanism is more complicated than the tensile failure mechanism.

In addition, the formation of micro-cracks in compressive failure is distributed in a wider region than in tensile failure. For the compression-loaded concrete specimens, there are not any observable cracks not like anxiety loaded specimen. This is due to the fact concrete has nearly tenfold more electricity in compression than in anxiety. However, stress is in reality focused on the crack tip region and micro-cracks form within the loaded course If you aren't yet acquainted with glass fiber strengthened concrete (GFRC) you have to be. GFRC is a specialized shape of concrete with many packages. It can be effectively used to create façade wall panels, fire surrounds, conceitedness tops and concrete counter tops because of its specific houses and tensile power. One of the high-quality ways to without a doubt understand the benefits of GFRC is to take a deeper investigate this unique compound. GFRC is just like chopped fiberglass (the kind used to form boat hulls and different complicated three-dimensional shapes), even though a lot weaker. It's made by combining a combination of great sand, cement, polymer (normally an acrylic polymer), water, different admixtures and alkali-resistant (AR) glass fibers. Many mix designs are available on line, however you'll discover that all proportion similarities inside the substances and proportions used.

Some of the numerous advantages of GFRC encompass: Ability to Construct Lightweight Panels– Although the relative density is much like concrete, GFRC panels can be an awful lot thinner than traditional concrete panels, making them lighter. High Compressive, Flexural and Tensile Strength– The excessive dose of glass fibers leads to high tensile strength whilst the high polymer content material makes the concrete bendy and immune to cracking. Proper reinforcing using scrim will similarly growth the strength of gadgets and is crucial in tasks wherein visible cracks aren't tolerable.

A. The Fibers in GFRC- How They Work

The glass fibers used in GFRC help supply this specific compound its strength. Alkali resistant fibers act as the precept tensile load carrying member while the polymer and concrete matrix binds the fibers together and helps transfer masses from one fiber to any other. Without fibers GFRC could no longer own its power and could be greater vulnerable to breakage and cracking. Understanding the complex fiber community in GFRC is a subject in and of itself. Stay tuned, I'll publish a extra in- depth article on GFRC fibers subsequent week.

1) Casting GFRC

Commercial GFRC generally makes use of two distinct techniques for casting GFRC: spray up and premix. Let's take a short have a look at both as well as a more price powerful hybrid method.

2) Spray-Up

The application system for Spray-up GFRC is very similar to Concrete in that the fluid concrete aggregate is sprayed into the bureaucracy. The process uses a specialized spray gun to use the fluid concrete mixture and to reduce and spray long glass fibers from a non-stop spool at the identical time. Spray-up creates very robust GFRC due to the high fiber load and lengthy fiber length, however shopping the equipment may be very high priced.

3) Premix

Premix mixes shorter fibers into the fluid concrete combination which is then poured into molds or sprayed. Spray weapons for premix don't need a fiber chopper, however they could still be very costly. Premix additionally has a tendency to possess less strength than spray- up since the fibers and shorter and placed extra randomly all through the mixture.

One final choice for creating GFRC is the usage of a hybrid technique that makes use of an inexpensive hopper gun to apply the face coat and a handpicked or poured backer mix. A thin face (without fibers) is sprayed into the molds and the backer blend is then packed in with the aid of hand or poured in much like everyday concrete. This is an affordable manner to get commenced, however it's far critical to carefully create each the face mix

and backer mix to ensure similar consistency and make-up. This is the approach that maximum concrete countertop makers use. Just like ordinary concrete, GFRC can accommodate a diffusion of artistic gildings which include acid staining, loss of life, vital pigmentation, decorative aggregates, veining and greater. It can also be etched, polished, sandblasted and stenciled. If you may believe it, you could do it, making GFRC a awesome choice for developing concrete counter tops and particularly three-dimensional concrete elements.

II OBJECTIVES OF THE STUDY

To study the Flexural behavior of glass fiber reinforced concrete members.

III GLASS FIBER

Glass fiber is made up from 200-four hundred individual filaments which are gently bonded to make up a stand. These stands may be chopped into diverse lengths, or blended to make material mat or tape. Using the traditional blending strategies for everyday concrete it isn't possible to combine more than about 2% (by means of volume) of fibers of a duration of 25mm. The principal equipment of glass fiber has been in reinforcing the cement or mortar matrices used in the production of skinny-sheet merchandise. The commonly used verities of glass fibers are e- glass used. In the reinforced of plastics & AR glass E-glass has insufficient resistance to alkalis found in Portland cement wherein AR-glass has improved alkali resistant traits. Sometimes polymers are also delivered within the mixes to enhance some bodily homes including moisture movement.

Table 1: Physical properties of glass fiber.

Name	Value	Unit
Type	E-Glass fiber	-
Young's modulus	73000	MPa
Tensile strength	1900-2600	MPa
Elongation	0-3.2	%
Density	2600	Kg/m^3
Length	25	Mn

A. Cement:

Cement acts as a binding agent for materials. Cement as carried out in Civil Engineering Industry is produced by means of claiming at excessive temperature. It is admixture of calcareous, siliceous, aluminous materials and crushing the clinkers to a great powder. Cement is the most expensive materials in concrete and it's miles to be had in extraordinary paperwork. When cement is mixed with water, a chemical response takes region because of which the cement paste sets and hardens to a stone mass. Depending upon the chemical compositions, setting and hardening residences, cement may be extensively divided into following classes.

Table-2: Physical properties of Mycem PPC cement		
Initial setting time	Minutes	90
Final setting time	Minutes	190
Compressive strength		
3 days	MPa	27
7 days	MPa	35
28 days	MPa	51
Specific Gravity		
Mycem PPC Cement		3.15
Drying Shrinkage		
Drying shrinkage	%	0.030
Declared % of fly ash in PPC		
Fly ash % in PPC	%	34.88%

B Standard Consistency and Initial Setting Time

Standard consistency of cement is defined as that water content at which the needle of the apparatus fails to penetrate the specimen by 5mm from bottom of the mould.

C. Specific Gravity Test for Cement

Table-3: Specific Gravity Test for Cement.

Specific gravity test	Weight(kg)	cement(weigh t in kg)
Weight of pycnometer	W1=0.644kg	0.644
Weight of pycnometer+cement	W2=0.844kg	0.844
Weight of pycnometer+cement + kerosene	W3=1.321kg	1.321
Weight of pycnometer+ kerosene	W4=1.144 kg	1.141
Specific gravity W2-W1/(W2-W1)-(W3-W4)0.79		3.15

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D. Fine Aggregates:

The material we have used as fine aggregate in this project is ROBO SAND. Robo sand is an ideal substitute to river sand. It is manufactured just the way nature has done for millions of years. Robo sand is created by a rock-hit – rock crushing technique using state of the art plant and machinery with world class technology. Created from specific naturalrock, it is crushed by a three stage configuration consisting of a Jaw crusher followed by a Cone crusher and finally a Vertical Shaft Impact or (VSI) to obtain sand that is consistent in its cubical particle shapes and gradation. Robo sand is the environmental friendly solution that serves as a perfect substitute for the fast depleting and excessively mined river sand. Robo sand 0–4.75 mm is suitable for all concrete preparations and is used across all segments such as independent houses, builders RMC Plants, Concrete Batching Plants and Infrastructure Concrete works.

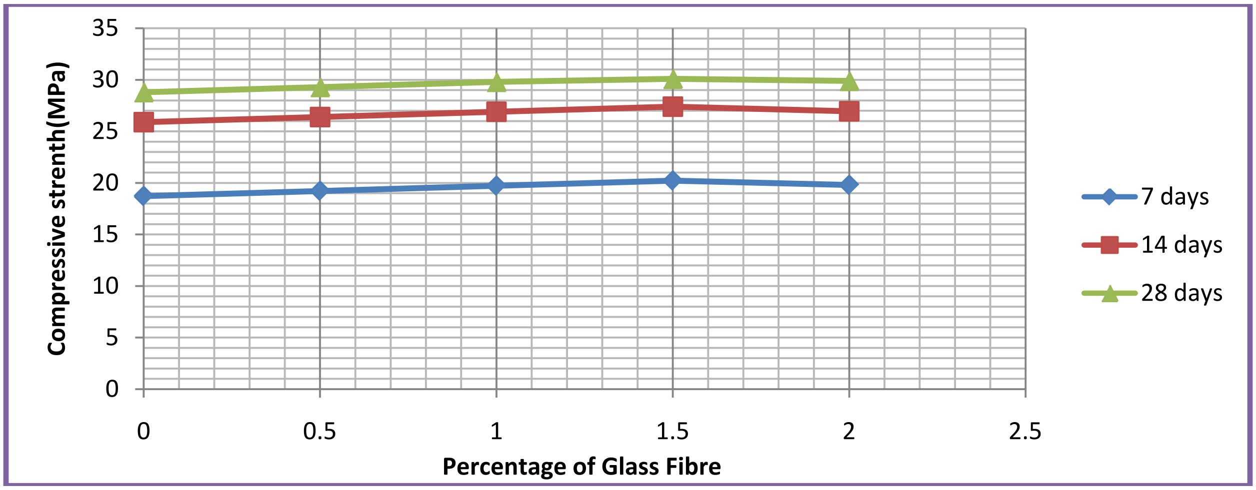
Figure 1: fine & coarse aggregate.

Figure 2: Compression, Split Tensile and Flexural Test Machine.

IV RESULT

Table 4: Result of cube (Grade M-25) compressive strength in Mpa.

% of glass fiber	Compressive strength in Mpa			Average compressive strength in MPa		
	After 7 days	After 14 days	After 28 days	7 days	14 days	28 days
0%	18.82	25.90	28.8	18.72	25.9	28.8
	18.72	25.90	28.90			
	18.62	25.90	28.70			
0.5%	18.92	26.30	29.20	18.92	26.1	29.1
	18.82	26.00	29.00			
	19.02	26.00	29.10			
1.0%	19.1	26.20	29.50	19.1	26.2	29.4
	19.2	26.40	29.50			
	19.0	26.20	29.20			
1.5%	19.4	26.70	29.90	19.4	26.7	29.8
	19.5	26.80	29.70			
	19.3	26.60	29.80			
2.0%	19.2	26.30	29.50	19.2	26.3	29.4
	19.3	26.40	29.50			
	19.1	26.20	29.20			



Graph 2: Variation in compressive strength according to % of glass fiber (Grade M-25).

Table 5: Result of cube (Grade M-30) compressive strength in Mpa

% of glass fiber	Compressive strength in MPa			Average compressive strength in MPa		
	After 7 days	After 14 days	After 28 days	7 days	14 days	28 days
0%	21.00	29.20	32.60	21.00	29.1	32.3
	21.00	29.00	32.10			
	21.00	29.10	32.20			
0.5%	21.30	29.40	32.60	21.3	29.4	32.6
	21.40	29.50	32.50			
	21.20	29.30	32.70			
1.0%	21.80	30.70	34.10	21.8	30.6	34
	21.90	30.50	33.90			
	22.70	30.60	34.00			
1.5%	22.40	31.00	34.55	22.4	31	34.45
	22.50	29.90	34.65			
	22.30	31.10	34.15			
2.0%	21.165	30.70	34.20	22.165	30.7	34.1
	21.175	30.80	34.10			
	21.755	30.60	34.00			

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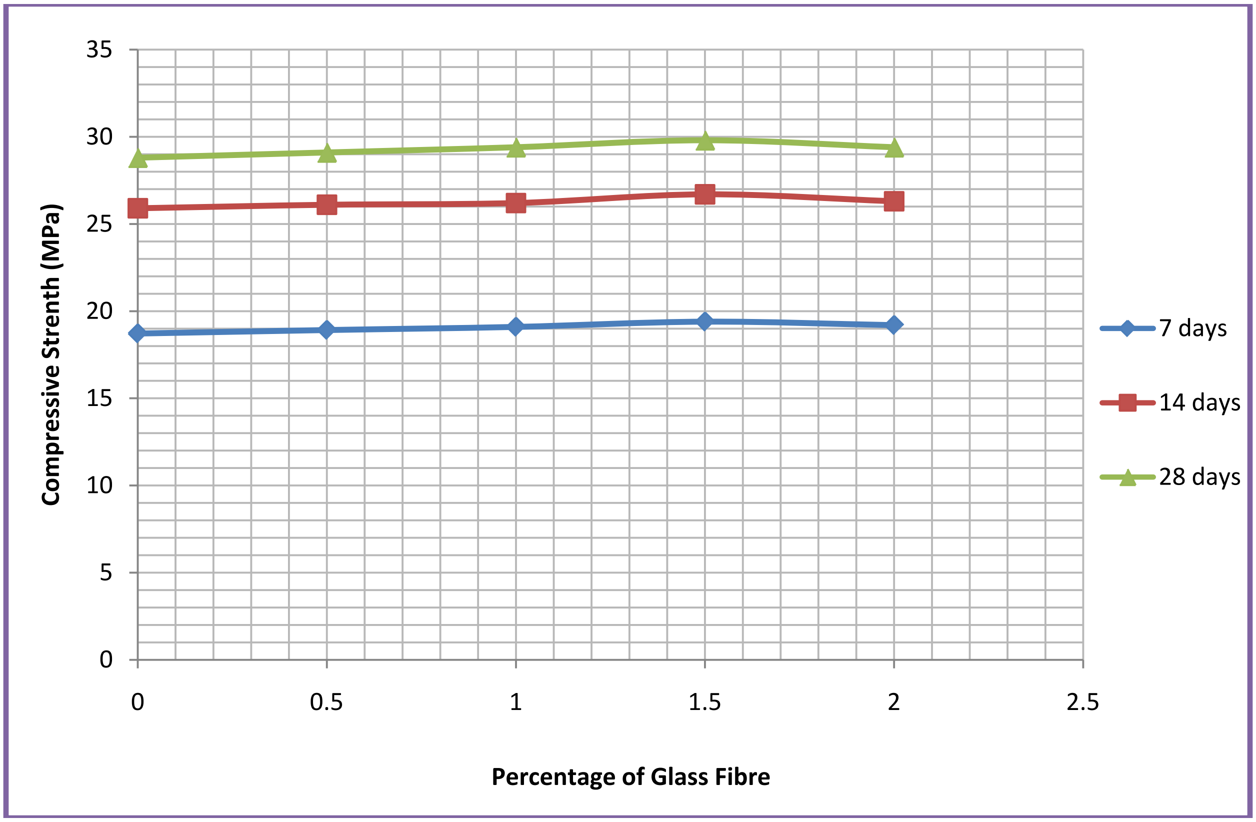
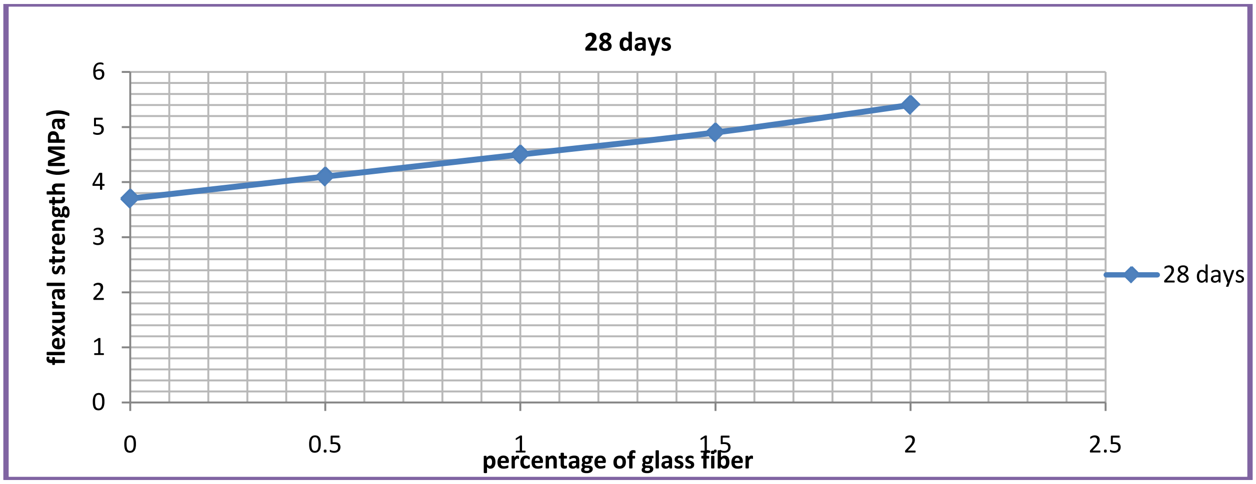


Graph 3: Variation in compressive strength according to % of glass fiber (Grade M-30).

Table 6: Result of Beam (Grade M-25) Flexural Strength in Mpa.

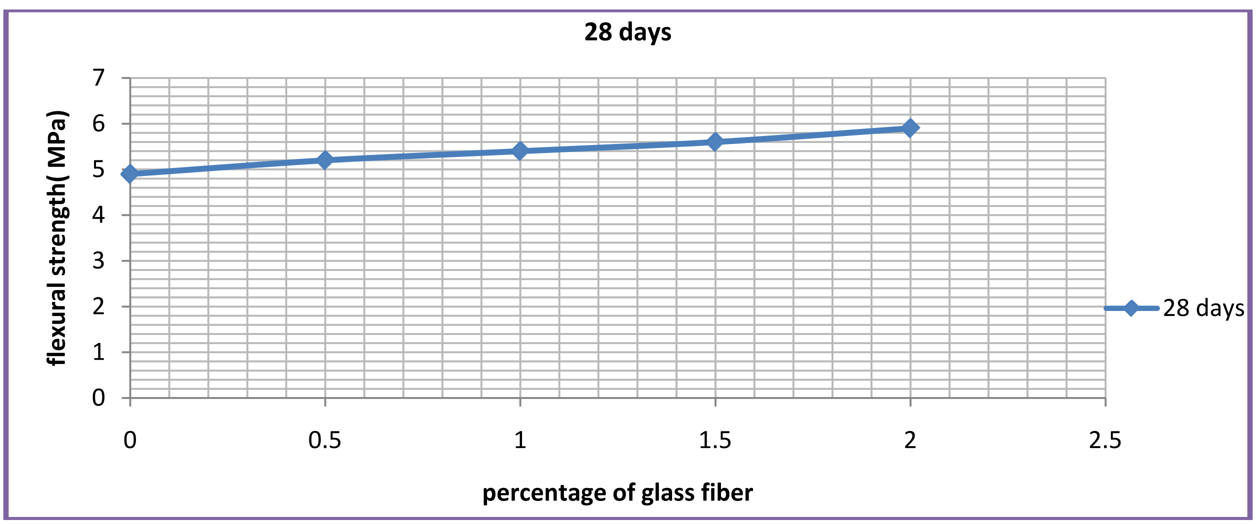
% of glass fiber	Flexural strength	
	Specimen code	After 28 days
0%	G1	3.7
0.5%	G2	4.1
1.0%	G3	4.5
1.5%	G4	4.9
2.0%	G5	5.4



Graph 4: Variation in flexural strength according to % of glass fiber (Grade M-25).

Table 7: Result of beam (Grade M-30) Flexural strength in MPa.

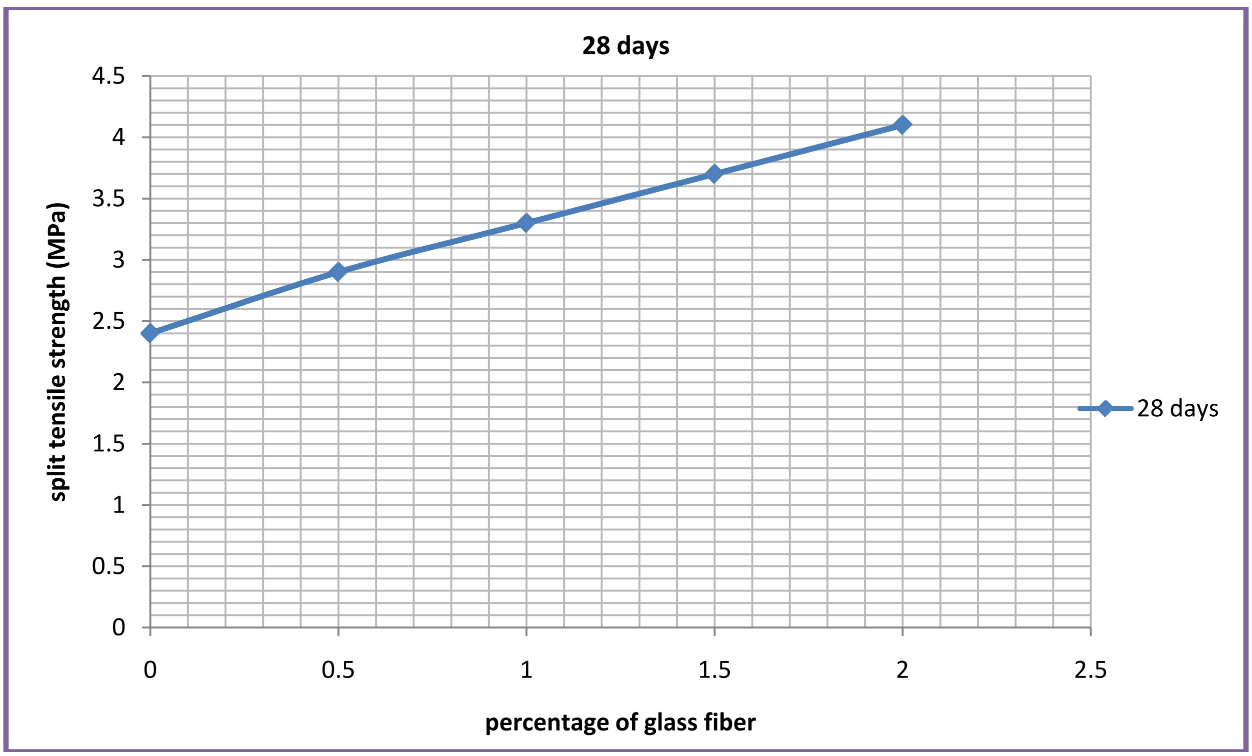
% of glass fiber	Flexural strength	
	Specimen code	After 28 days
0%		4.9
0.5%	G5	5.2
1.0%	G6	5.4
1.5%	G7	5.6
2.0%	G8	5.9



Graph 5: Variation in flexural strength according to % of glass fiber (Grade M-30).

Table 8: Result of beam (Grade M-25) Split tensile strength in MPa.

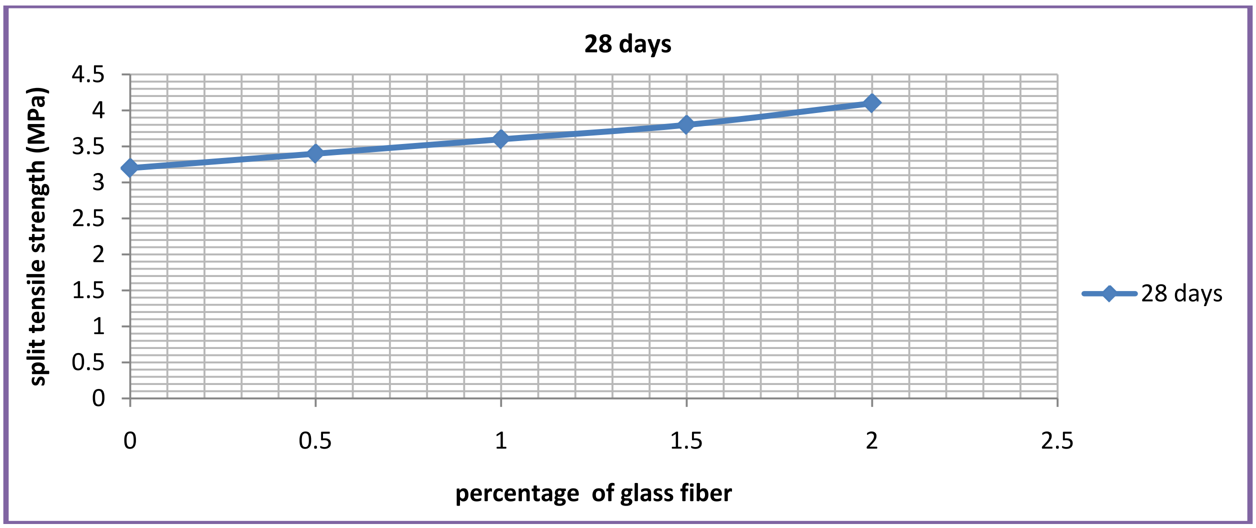
% of glass fiber	Split tensile strength(MPa)	
	Specimen code	After 28 Days
0%	S1	2.4
0.5%	S2	2.9
1.0%	S3	3.3
1.5%	S4	3.7
2.0%	S5	4.1



Graph 6: Variation in split tensile strength according to % of glass fiber (Grade M-25).

Table 9: Result of beam (Grade M-30) split tensile strength in MPa.

% of glass fiber	Split tensile strength (MPa)	
	Specimen code	After 28 Days
0%	S1	3.2
0.5%	S2	3.4
1.0%	S3	3.6
1.5%	S4	3.8
2.0%	S5	4.5



Graph 7: Variation in split tensile strength according to % of glass fiber (Grade M-30).

V CONCLUSION

Based on the experimental investigation the following conclusion is given within the limitation of the test result.

1. Addition of iron chips and glass fiber resulted in significant improvement on the strength properties of concrete (M-25 and M-30) grade.
2. Compared to plane concrete the fiber addition resulted in better strengthening (compressive, tensile and flexural) properties of concrete.
3. The reinforcing efficiency of fiber addition was dependent on the optimum dosages level of iron chips and glass fiber up to 1% to 1.5% of fibers since increased fiber addition resulted in loss workability.

4. The maximum increase in compressive strength was observed of concrete grade M-25 & M-30 respectively at 1.5% of iron chips and glass fiber.

5. Compressive strength was decrease of both concrete grade in case of 2% steel fiber and glass fibe**r**.
6. Tensile strength is continuously increased with increasing the percentage of iron chips and glass fiber and maximum tensile strength was achieved in the case of 2% iron chips and glass fiber for both grade of concrete M-25 &M-30.

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