Experiments Study on the Strength Properties of M30 Concrete with Glass Fibers as a Partial Replacement for Cement

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ABTRACT: The construction industry is now working on some of the most well-known and thought-provoking structures in the world. Architects approach their work with a creative mindset, whereas civil engineers approach our job with a focus on strength and durability. Maintaining the appealing appearance of a structure without jeopardising its strength and endurance. This paper looked at the effect of glass fibre on flexural strength, split-tensile strength, and compressive strength for different fibre content in M-30 grade concrete manufactured according to IS 10262. The aggregates utilised have a maximum size of 20mm. . Six cubes were tested to evaluate how they influenced compressive strength, flexural strength, and split-tensile strength. Short filaments with a diameter of 30mm were used in the glass fibres, which were alkali resistant. We investigated at how wet transverse strength, compressive strength, and pulse velocity were impacted by these short fibres.

Key word – Chopped glass fiber and basalt fiber, compressive strength, flexural strength, split-tensile strength, Reinforced, Mechanical

1. INTRODUCTION

1.1 Fiber Reinforced Concrete

Many research have proven that fiber-reinforced composites are more powerful than other composite types. The fiber's principal role is to monitor cracking and improve the fracture toughness of the fragile matrix by bridging during both micro and macro cracking. Inclusion of fibres increases the qualities of this unique concrete at both the early stage and after it has hardened.

1 .2 Basalt Fibers

Basalt fibres are created by melting quarried basalt rock at about 14000 degrees Celsius andextruding it through small nozzles to produce continuous filaments of basalt fibres. Basalt fibres have a similar chemical structure to glass fibre, but they have superior strength properties. It's immune to alkaline, acidic, and salt attack, making it a good choice for concrete, bridges, and shoreline structures.

2. LITERATURE REVIEW

The purpose of this literature review is to thoroughly investigate comparable works by other researchers and to identify research gaps in such studies in order to produce new research discoveries. In this chapter, many researchers' researches into mechanical systems are addressed. flexural and impact strength of cement-based composites, as well as the latest The most recent advancements are presented, as well as a range of applications.

Kumar Shantveerayya and Nikkam Vikasin (2016) The workability of reinforced glass fibre and ground granulated blast furnace slag concrete changes depending on the amount of ground granulated blast furnace slag and glass fibre used, according to the results of a study.

Gupta et al. (2017) The influence of alkali resistant glass fibre in the concrete mixture replacing cementitious component on compressive and flexural strength of M25 grade concrete was investigated, and it was revealed that the glass fibre had no effect on the compressive and flexural strength of the concrete. He was 28 days old when..

3. OBJECTIVE

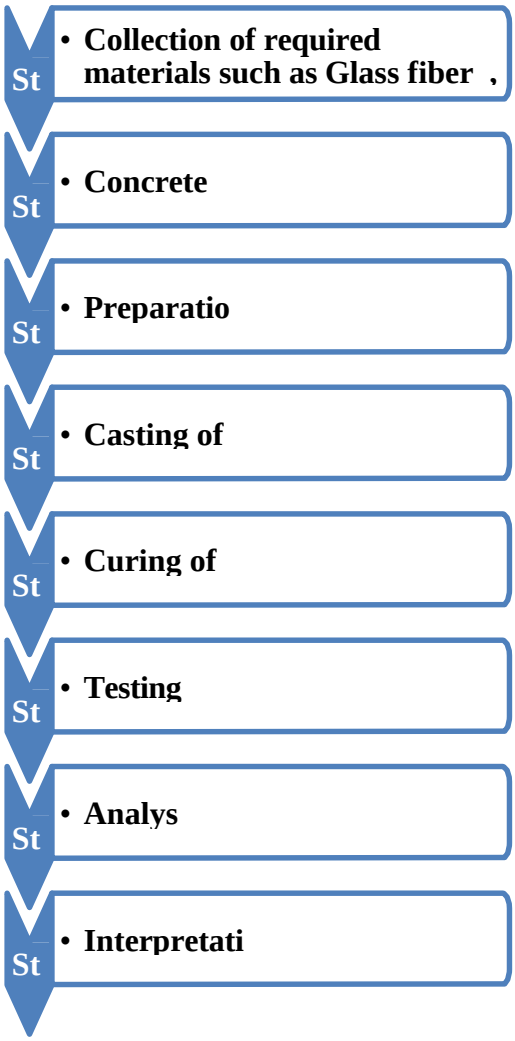
- The purpose of this research is to see how chopped glass fibre inclusion affects the fresh and hardened characteristics of concrete utilising a grade M30 mix design.
- To see how glass fibre affects the compressive, flexural, and split strength of concrete when cement is removed in part.
- To find the best glass fibre proportion in M30 concrete for maximum compressive, flexural, and split strength.
- To assess the quality of concrete made with glass fibre in place of cement.

4. EXPERIMENTAL INVESTIGATIONS AND METHOLOGY

- Materials Used

The following are the materials used in the investigation.
Cement (OPC 53 grade)
Glass fiber
Fine Aggregates
Coarse Aggregates
Super plasticizer

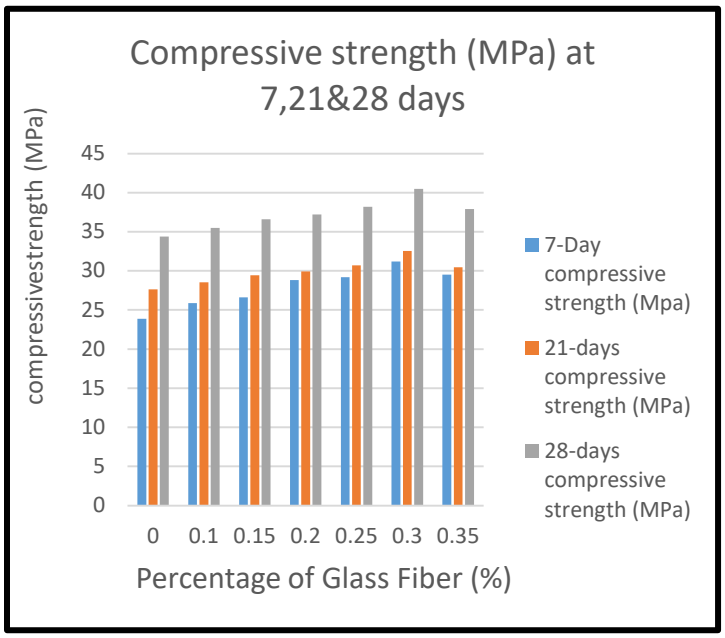
Flow chart of proposed methodology



5. RESULT

5.1 Concrete Cube Compressive Strength

The compressive strength of three samples was examined for seven days, and the results are presented in tabular form. The results for 7 days compressive strength is shown in Figure



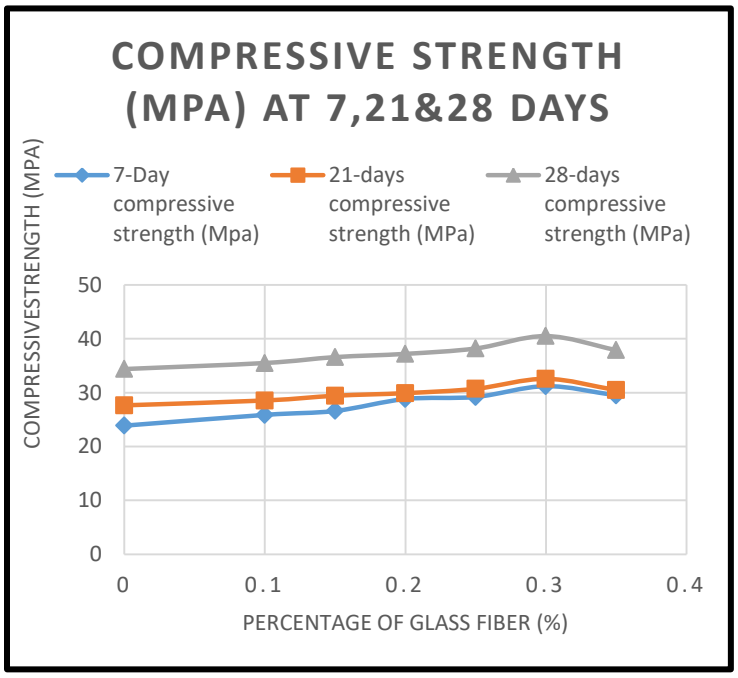


Figure 5.1 7&21, 28 days compressive strength of concrete at different Percentage of Glass Fiber (%)

It can be shown from the experimental findings that adding a particular minimum quantity of glass fibre to concrete increases its compressive strength. After raising the percentage of glass fibre over 3 percent, the compressive strength of the sample decreased. It was

discovered that the highest compressive strength of concrete attained at.3 percent is 40.5 N/mm2 replacement level after 7, 14, and 28 days of curing.

5.4 Pulse Velocity test

It is a non-destructive testing technique (NDT). The method consists of measuring the ultrasonic pulse velocity through the concrete with a generator and a receiver. This test can be performed on samples in the laboratory or on-site.

Criteria for quality of concrete

PULSE VELOCITY	CONCRETE QUALITY
>4000 m/s	Excellent
3500-4000 m/s	Very Good
3000-3500 m/s	Satisfactory
<3000 m/s	Poor

SN	Fibre content (% of the total weight of concrete)	Average velocity(m/s)	Grade of concrete
1	0	4496	Good
2	0.1	4800	Excellent
3	0.2	4364	Good
4	0.3	4611	Excellent
5	0.4	4395	Good
6	0.5	4459	Good
7	0.6	4385	Good
8	0.7	4434	Good

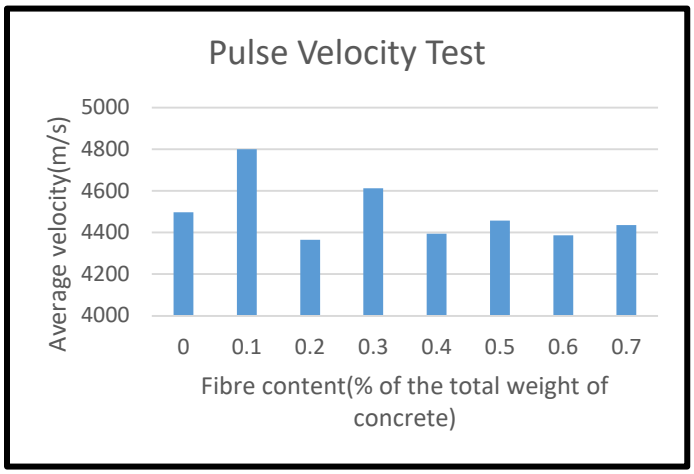


Figure 5.2 Effect of Glass fibers on quality of concrete

6. CONCLUSIONS

In this experimental program the effect of short discrete glass fibers on the compressive, split tensile strength and flexural strength of concrete was studied.

- It can be shown from the experimental results that adding a particular minimum quantity of glass fibre to concrete increases its compressive strength.
- The increase in strength is maximal for 3 percent of Glass Fiber a, and it was discovered that when the percentage of glass fibre increased over 3 percent, the compressive strength of the sample decreased.
- After 7, 14, and 28 days of curing, the highest compressive strength of concrete produced at.3% is 40.5 N/mm2 replacement level.
- The UPV test findings demonstrate that adding glass fibre to concrete lowers the quality marginally, but the overall quality of the concrete remains same. The water absorption of concrete diminishes when glass fibre is added.

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