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STRENGTH PROPERTIES OF FRC USING GLASS FIBRE AND POLYPROPYLENE

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Abstract:

Concrete is one of the primary materials in a variety of studies in the building industry. In order to increase its properties such as workability, strength, durability and other applications, as well as to reduce production costs, alternatives in concrete are also required in civil technology. Containing the fibrous content, fiber-reinforced concrete (FRC) increases the structural strength of this material. It comprises small, equal sized and randomly-oriented discrete fibres. Fibers include steel, glass fibres, synthetic and natural fibres, each with a range of properties. Furthermore, fiber-reinforced concrete change characteristics with various concretes, fibre materials, geometry, distribution, orientation and permeability. In shotcrete, fibre-reinforcement is used especially but can also be used in regular concrete. Normal fibre reinforced concrete is used mainly for ground floors and floors but can be used for a wide variety of construction sections.

Key words: natural fibres, fiber-reinforced concrete (FRC), polypropylene

1.0 INTRODUCTION

Concrete is the most commonly used construction material in the world. Beta processing includes materials such as cement, fine aggregates, rough aggregates, water and admixtures. The use of concrete grows more rapidly due to infrastructure growth and construction activities. However, the effects on concrete production are negative: continuous mining of aggregates from natural resources, ecological imbalances and deterioration of the environment are responsible. In the construction sector this environmental reason has caused much problem. Since ancient times, fibres have been used for concrete strengthening, although the technology has considerably advanced as is the case in other regions. Stroke and morter were used in early age for manufacturing mud bricks and horsehair for strengthening them. With the advent of fibre technology, cement was improved in the early 20th siècle by asbestos fibres. In the mid-20th century substantial study has been underway into the use of concrete reinforcement composites.

2.0 LITERATURE REVIEW

Containing synthetic fibers, fiber-reinforced concrete (FRC) enhances structural integrity. It comprises small, uniformly distributed and randomly oriented discrete fibres. The fibres include steel and glass fibres, synthetic and natural fibres, each of which has different characteristics.

S. Hemalatha, et.al. [1] The Plain Beton is delicate in nature and has poor tensile strength. The reinforcement bars are then places in plain concrete to obtain the tensile force. Since fibre reinforced concrete is the building materials most frequently used. Fibre is a material that is readily available.

K. Chandramouli, et.al. [2] Based on the experimental research, the addition of glass fibre to concrete resulted in a decrease in bleeding. Reducing bleeding increases the surface integrity of concrete, improves its homogeneity and decreases the possibility of cracks in which construction is limited.

Koothan Bhaskar, et.al. [3] Conventional concrete output is improved by the addition of concrete fibres. As a consequence, the rigidity of the concrete is decreased, which also guarantees its reasonable ductility.

Koorosh Gharehbaghi1,et. al. [4] Fiber Reinforced Concrete (FRC) may be higher than traditional Concrete due to its material feature. This is due to the compounds and elements of the internal FRC material. In addition, in comparison with conventional cement, FRC can significantly increase its flexural strength

Ramachander Damera et. al. [5] In this study, the brick-based mortar addition is being explored in comparison with existing methods to increase the reinforcing properties of the walls. The importance of stone mould is also studied in new approaches to comparatives of stone and mortar.

D.Varun kumar et. al. [6] In this analysis, M 30 grade studied the properties of concrete enhanced in the ratio of 0 percent by partly substituted ceramic powder, 5 percent by weight of cement in concrete, 10 percent and 15 percent by weight. The characteristics of the fresh concrete are examined such as slumping cone testing and hardness and durability properties are also considered for hardened concrete strength and split tungsten strength at 7-28 and 56 days of age.

3.0 Materials and Methods

The properties of materials used in the project work and the chemical compositions of materials used are briefly explained in this chapter. Fibers are partly substituted with cement because it gives concrete more strength and advantages of using these materials [7]. In developing society materials are so important that we equate ages with them. In the earth's origin, the Stone Age, people used only natural materials such as stone, clay, skins and wood. The Bronze Age began around 3000 BC when people learned copper and how to make it stronger with alloys. The use of iron and steel, a more effective material for war began around 1200 BC. The next major step was to find a low-cost steel process around 1850 that allowed the railways and the development of modern industrial infrastructure.

Polypropylene fibre:

Polypropylene fibres are strong, but have poor tensile strength and elasticity modulus. They have the characteristics of plastic stress strain. In addition, their ability to interact with the capillary pressure from which water bleeding on the cement surface decreases the possibility of plastic deposition by evaporation of water.

Figure: Polypropylene fibre

Glass fibre

Glass fiber-reinforced concrete uses fibre glass to strengthen the concrete, similar to fibre glass insulation. The glass fibres also help to insulate and stabilize the concrete [8]. Glass fibres also prevent concrete from stretching due to mechanical or thermal stress over time.

Figure: Glass fibre

Coarse Aggregate:

Aggregates are the world's most processed materials. The aggregate is used for reinforcing the overall composite material. As a result of the relatively high hydraulic conductivity value, aggregate is commonly used in drainage system such as base-work, septic drainage fields, wall drains for retention and roadside drainage.

Fine aggregate

The sand is a granular substance naturally produced, consisting of rock and mineral reservoirs. Local sand is used in this analysis as a fine aggregate. Tests such as particular gravity and seven analyses to guarantee fine aggregates' characteristics as described out in the Indian standards.

Physical Properties of materials

The accuracy of cement has a major influence on the speed of hydration and thus the rate of strength gain and the rate of heat growth. Fine cement provides a wider area for hydration and therefore faster and higher strength development.

Table: Physical Properties of Fine aggregates and coarse aggregates

S.No.	Property tested	Result obtained
1	Specific gravity	2.66
2	Fine aggregates Specific gravity	2.24

Mix design:

The construction of the concrete mixture includes the economical option of the relative characteristics of cement, fine aggregate, rough aggregate and water. Whereas the principal requirements for acceptance are compliance with characteristic strength, it is implicit that the concrete must be workable in the fresh state, waterproof and robust in hardened state. Mix design based on the recommended guidelines is simply a process of making an initial decision on the optimal combination of ingredients and actual mixed proportions.

- Grade Designation: M20
- Type of cement: OPC 53 grade OPC
- Maximum size of Aggregate: 20mm
- Minimum cement content: 394Kg/m^3
- Maximum Water-Cement ratio: 0.5
- Workability: Slump

4.0 RESULTS & DISCUSSIONS

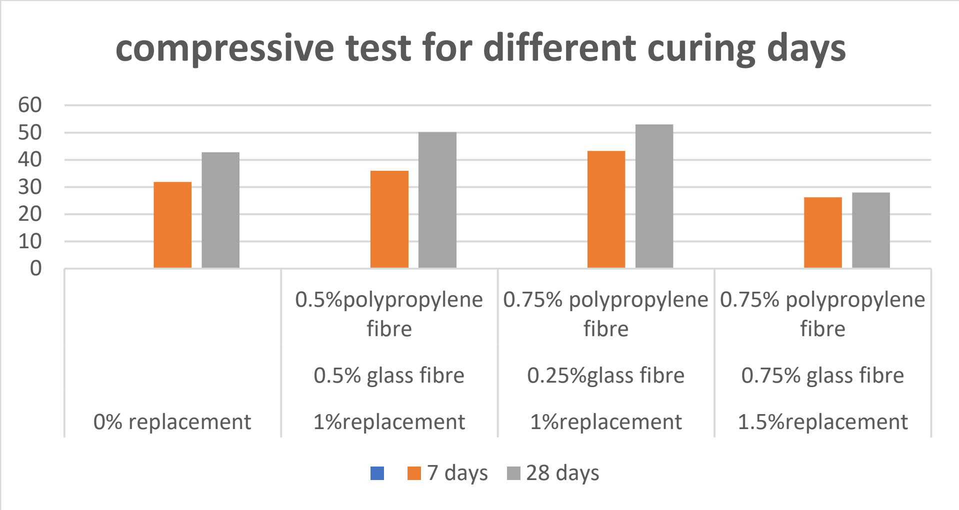
The collected data were analysed from testing on cube, cylinder compression power, split fibre tensile strength concrete. Batons cubes are demoulded after 24 hours and can be cured at ambient temperature and concrete cubes are cured for 7 days and 28 days in the glass container. The average compressive strength of the cubes was three cubes and the average value was calculated. Both blends have been acceptable and the design compression resistance has been achieved. A total number of 24 cubes and 8 cylinders were casted for 0%,1%(0.5%GF+0.5%PF),1%(0.25%GF+0.75%PF) ,1.5%(0.75%GF+0.75PF)

Compression Strength Test:

The strength of the compressive material or Loading capacity of the 3000KN machine. structure resists load which reduces the size as against the resistance of the pulley, which resists loads which tend to extend. In other words, compressive resistance resists compression, while tensile tolerance resists strain. he compressive strength of concrete is given in terms of the characteristic compressive strength of 150 mm size cubes tested at 7, 14, 28 days (f_{ck}).

Table: Results for compressive test for different curing ages

Curing days	0% replacement	1%replacement 0.5% glass fibre 0.5%polypropylene fibre	1%replacement 0.25%glass fibre 0.75% polypropylene fibre	1.5%replacement 0.75% glass fibre 0.75% polypropylene fibre
7 days	31.9	36	43.2	26.2
28 days	42.81	50.21	53.03	28



Graph: Compressive test for different curing ages

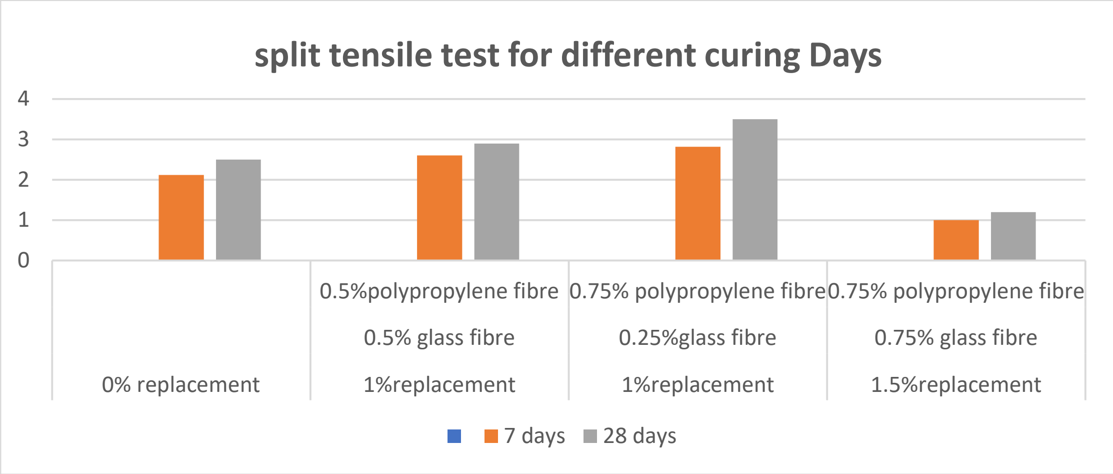
The results for Compressive Strength tested for 7 days of curing. High strength is obtained for 1% replacement when compared to conventional concrete and other percentages. Hence optimum replacement based on 7days of curing is 1%.

Split Tensile Strength

The Split tensile strength of M_{20} grade concrete cylinder of size (300x150mm) made with natural sand and those made with fibres as cement are tested under split tensile testing machine and results are tabulated below:

Table: Results for split tensile test for different curing Days

Curing days	0% replacement	1% replacement 0.5% glass fibre 0.5%polypropylene fibre	1%replacement 0.25%glass fibre 0.75% polypropylene fibre	1.5%replacement 0.75% glass fibre 0.75% polypropylene fibre
7 days	2.12	2.6	2.82	1
28 days	2.5	2.9	3.5	1.2



Graph: split tensile test for different curing Days

It is observed that both the concretes are achieving the target strengths at the age of 28 days. The Split tensile strengths of fibre concrete are slightly higher when compared with normal concrete. The following figures show the Split tensile strengths.

Conclusions

The ideal characteristic strength for cubes is achieved in both traditional concrete and fibre-concrete for the designed mix proportions of M 20 concrete grades. Concrete strength achieved with fibres as a partial substitute for cement requires the efficient use of fibrous concrete with enhanced static and dynamic properties such as tensile resistance, energy absorption characteristics and impact strength and strength of fatigue. A non-usual isotropic strength property in traditional concrete is also given. It would be incorrect, however to assume, that the issue of plain cement will be solved by fibrous cement. The traditional structural concrete is also not likely to be completely replaced. Some of FRC's main static qualities are superior crack resistance and increased ductility with distinct post-cracking behaviour. The significant increase in impact resistance and fatigue resistance permit the application of the new material in many applications where traditional concrete is disadvantaged. It is therefore important that this content be built and used with a new approach that will both improve productivity and economics.

Future Scope

The work can be carried out by granite powder concrete from one or more sources.

1. we can use different combination of fibres.
2. Superplasticizers of different type can be used for increasing the workability of concrete.

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