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Properties of Sisal Fibre Concrete with Fly Ash

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ABSTRACT: Image inpainting is the process of restoring the lost or damaged regions or modifying the image contents imperceptibly. It refers to the process of filling-in missing data in a designated region of the visual input. In this paper, the technique presented is for detection and removal of text from images. The system detects text using morphological operations, connected component labelling and a set of selection criteria which helps to filter out non text regions. So, the resultant image is the image with only texts. Text Inpainting is done in two steps. The first step detects the text region automatically, without user interaction and in the second step; the text is removed from the image using exemplar based Inpainting algorithm.

KEYWORDS: sisal fibre concrete, fly ash , compressive strength

I. INTRODUCTION

Fiber-reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibers that are uniformly distributed and randomly oriented. Fibers include steel fibers, glass fibers, synthetic fibers and natural fibers – each of which lends varying properties to the concrete. In addition, the character of fiber-reinforced concrete changes with varying concretes, fiber materials, geometries, distribution, orientation, and densities.

The concept of using fibers as reinforcement is not new. Fibers have been used as reinforcement since ancient times. Historically, horsehair was used in mortar and straw in mud bricks. In the 1900s, asbestos fibers were used in concrete. In the 1950s, the concept of composite materials came into being and fiber-reinforced concrete was one of the topics of interest. Once the health risks associated with asbestos were discovered, there was a need to find a replacement for the substance in concrete and other building materials. By the 1960s, steel, glass (GFRC), and synthetic (such as polypropylene) fibers were used in concrete. Research into new fiber-reinforced concretes continues today.

Fibers are usually used in concrete to control cracking due to plastic shrinkage and to drying shrinkage. They also reduce the permeability of concrete and thus reduce bleeding of water. Some types of fibers produce greater impact-, abrasion-, and shatter-resistance in concrete. Generally fibers do not increase the flexural strength of concrete, and so cannot replace moment-resisting or structural steel reinforcement. Indeed, some fibers actually reduce the strength of concrete.

The amount of fibers added to a concrete mix is expressed as a percentage of the total volume of the composite (concrete and fibers), termed "volume fraction" (V_f). V_f typically ranges from 0.1 to 3%. The aspect ratio (l/d) is calculated by dividing fiber length (l) by its diameter (d). Fibers with a non-circular cross section use an equivalent diameter for the calculation of aspect ratio. If the fiber's modulus of elasticity is higher than the matrix (concrete or mortar binder), they help to carry the load by increasing the tensile strength of the material. Increasing the aspect ratio of the fiber usually segments the flexural strength and toughness of the matrix. However, fibers that are too long tend to "ball" in the mix and create workability problems.

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Some recent research indicated that using fibers in concrete has limited effect on the impact resistance of the materials. This finding is very important since traditionally, people think that ductility increases when concrete is reinforced with fibers. The results also indicated that the use of micro fibers offers better impact resistance to that of longer fibers. Fiber Reinforced Concrete can be defined as a composite material consisting of mixtures of cement, mortar or concrete and discontinuous, discrete, uniformly dispersed suitable fibers. Fiber reinforced concrete is of different types and properties with many advantages. Continuous meshes, woven fabrics and long wires or rods are not considered to be discrete fibers.

II. RELATED WORK

Sisal fibre-cement composites reinforced with long unidirectional aligned fibres were developed and their physical-mechanical behavior was characterized in the present study. Flat and corrugated sheets were cast by a manual lay-out of the fibres in a self-compacted cement matrix and compressed with a pressure of 3 Mpa. Direct tensile and bending tests are performed to determine the first crack, post peak strength and toughness of the composites. Drying shrinkage, capillary water absorption and water tightness tests were performed to characterize the physical properties of the composites. To ensure the composite durability, the ordinary Portland cement matrix was modified by adding metakaolin and calcium hydroxide generated during Portland cement hydration. The durability of the newly developed composite was determined through accelerated aging conditions using hot water immersion test. The developed material presented a multiple cracking behaviour under bending, even when subjected to 6 months of hot water immersion test less than 600C. Scanning Electron Microscopy was used to investigate the microstructure of the composites before and after aging.

Conventional concrete is strong in compression and weak in tension in order to overcome the weakness steel reinforcement is being provided. Researches attempted to inherit the tensile property by introducing synthetic fibres such as poly propylene, asbestos etc., and steel fibres, but they are expensive. Hence they are attempting to use the natural fibres such as straw, elephant grass, palm leaf, coconut coir etc. to incorporate tensile strength in conventional concrete. So that the traditional steel reinforcement on concrete can be reduced.

In this research, sisal is being used in concrete. Thereby, the mechanical properties such as compressive strength, split-tensile strength, and modulus of rupture of M40 grade concrete and by varying the dosage of fibre content from 0.1%, 0.2%, 0.3%, 0.4%, and 0.5%, by volume of cement with optimum length of 35mm obtained from literature review, were found. The optimum dosage of sisal fibre was found to be 0.3%. The flexural behaviour of reinforced concrete beams with 0.3% sisal fibre was compared with conventional concrete properties of M40 grade.

Some of the naturally available fibre named sisal fibre is used as a substitute material to the reinforcement and studied the properties. Concrete is strong in compression and weak in tension. So we will provide the reinforcement to the concrete. Majorly steel is used as the reinforcement. Many of the researches are in progress to find a substitute to this material. Many investigations proposed artificial fibres. Inclusion of fibre reinforcement in concrete can enhance many of the mechanical characteristics of the basic materials such as fracture toughness, flexural strength and resistance to fatigue, impact, thermal shock and spalling. In recent years, a great deal of interest has been created worldwide on the potential applications of natural fibre reinforced cement (NFC) based composites. In the present work, it is aimed to investigate the strength and durability with sisal fibre reinforcement. From the results it shows that, sisal fibre reinforced concrete has improved the characteristics of workability, strength and durability.

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III. METHODOLOGY

MATERIAL USED AND THEIR PROPERTIES

Cement: Ordinary Portland cement of 53 grades is available in local market is used in the investigation. The cement used for all tests is from the same batch. The cement used has been tested for various properties as per IS: 4031-1988 and found to be conforming to various specifications of IS: 12269-1987.

Coarse Aggregate: Crushed angular granite from local quarry is used as coarse aggregate. The cleaned coarse aggregate is chosen and tested for various properties such as specific gravity, fineness modulus, bulk modulus etc. The physical characteristics are tested in accordance with IS: 2386 – 1963. The aggregates are free from alkali contents.

Fine Aggregate: The locally available river sand is used as fine aggregate in the present investigation. The cleaned fine aggregate is chosen and tested for various properties such as specific gravity, fineness modulus, bulk modulus etc. in accordance with IS: 2386-1963. The fine aggregate belongs to zone-II. It is free from harm full ingredients.

Water: Water used for mixing and curing is fresh potable water, conforming to IS: 3025-1964 part 22, part 23 and IS: 456-2000. Sometimes an image may contain text embedded on to it. Detecting and recognizing these characters can be very important, and removing these is important in the context of removing indirect advertisements, and for aesthetic reasons.

Fly Ash : Class F fly ash from Rayalaseema thermal power project was used as cement replacement fly ash is conforming to IS3812-9081 of Indian standard specifications. There hopefully will be a lot of fly ash available in the future. Land fill and storing of the fly ash are not environmentally friendly. The world production of fly ash is approximately over 600 M tonnes annually, and only about 10 % of the fly ash is used in concrete. According to Wikipedia 65 % of the fly ash produced from coal power stations is disposed of in landfills.

MIX PROPORTIONING

Five mixes are done with varying percentages of fly ash M1, M2, M3 and M4 are prepared.

MIX 1 consists of selected proportion mixes and fly ash is used in 0% of total weight of cement.

MIX 2 consists of selected proportion mixes and fly ash is used in 40% of total weight of cement.

MIX 3 consists of selected proportion mixes of sisal fibre and fly ash is used in 0.5% and 40% of total weight of cement respectively.

MIX 4 consists of selected proportion mixes of sisal fibre and fly ash is used in 0.8% and 40% of total weight of cement respectively.

IV. EXPERIMENTAL RESULTS

Compressive Strength

Compression test is done confirming to IS: 516-1953. All the concrete specimens are tested in a 2000 KN capacity Compression-testing machine. Concrete cubes of size 150mm x 150mm x150mm and cylinders of size 100mm diameter & 200mm height were tested for crushing strength, crushing strength of concrete was determined by applying load at the rate of 1400 N/cm²/min till the specimens fail. The maximum load applied to the specimens was recorded and divided the failure load with cross-sectional area of the specimens for compressive strength of the concretes. Compressive strength test was conducted on cubes of 150mm*150mm*150 cubes and 100*200 cylinders for the various mixes M1,M2,M3 and M4 of the high volume fly ash are given in the below table

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Compressive Strength Results

MIX (FLYASH%+SISAL%) by weight	1 DAY (MPa)	7 DAYS (MPa)	28 DAYS (MPa)
M1 (0%+0%)	6.29	12.55	24.51
M2 (40%+0%)	6.01	9.83	14.83
M3 (40%+0.5%)	2.28	7.1	12.27
M4 (40%+0.8%)	0.28	3.64	12.20

Table 1.Compressive strength of different mixes

Figure 4.1- Compressive strength of different mixes

Split Tensile Strength

This test is conducted in a 2000 KN capacity Compression-testing machine by placing the cylindrical specimen, so that its axis is horizontal to the plates of the testing machine. Narrow strips of packing material i.e., plywood is placed between the plates and the cylinder to receive compressive stress. The load was applied uniformly at a constant rate until failure by splitting along the vertical axis takes place. Load at which the specimens failed is recorded and the split tensile stress is obtained using the formula based on IS: 5816-1970.

$$F_t = 2P/\pi DL$$

Where, P = Compressive load on the cylinder L =
Length of the cylinder
D = Diameter of the cylinder

The results have been tabulated and graphs are plotted and discussions are in the next chapter Split tensile strength has done for the mixes M1, M2, M3, and M4 of the high volume fly ash roller compacted concrete. The test has conducted on the cylinder of 150mm*300mm. the values of the split tensile strength test at the age of 1 day,7 days,28 days has shown in the table below

Split Tensile Strength Test Results

MIX (FLYASH%+SISAL%) by weight	7 DAYS (MPa)	28 DAYS (MPa)
M1 (0%+0%)	0.88	1.51
M2 (40%+0%)	0.86	1.20
M3 (40%+0.5%)	1.05	1.06
M4 (40%+0.8%)	1.182	1.9

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V. CONCLUSION

From the present it is possible to draw the following conclusions:

1. The slump of the concretes is true slump for all the mixes at 0.64 water/cement ratio.
2. Compressive strength of the concretes is ranged from 0.28MPa to 12.27MPa.
3. Fly ash addition and sisal fibre resulted lower compressive strength.
4. Split tensile strength of the concretes is ranged from 1.05MPa to 1.9Mpa.
5. Visual observations suggested that the fibre is spread in the mix uniformly and which and there was good bond between the fiber and the concrete.

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