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Full Length Article

EXPERIMENTAL INVESTIGATION ON NATURAL FIBER ALONG WITH SILICA FUME IN CONVENTIONAL CONCRETE

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Abstract: Concrete is globally recognized for its long term service period in the application of concrete. In the region of five billion tons of concrete are utilized more or less in the planet and increasing every year. In view of the environmental problems faced today considering the fast reduction of natural resources like sand and aggregate. Owing to the growth of Science and Technology in recent decades, there is a modification in the practice of concrete along with some additives as the complement for strength and workability. Basalt Fiber is categorized under the Mineral additive and brought into usage in early 1920's in the period of World war for Military purposes. Silica fume is hugely known for its durability and it increases the density of concrete. On Another hand, the building are often subjected to risk of corrosion and Sustainability, the application of any element in the proportions of concrete will possess the property of Resisting and rejuvenating the nature of Concrete.

keywords: Basalt Fiber, Split Tensile Strength, Compressive Strength, Silica Fume

1 Introduction

Concrete was experimenting with various additives for evaluating its physical and mechanical properties along with additives as chemical, natural and mineral additives to examine its changes. It becomes the practices of finding new alternative in order to replace and reduce the consumption of natural resources as well.

Mohamed Bak et al (2016) have applied the Glass reinforced along with the basalt fiber reinforced polymers for visualizing the alteration of properties in concrete in mineralogical studies occupied for it. For flexural strength, Basalt was improved when compared to the Glass fiber while in the impact test values also founded to

declare the similar outcomes and suggested for usage in concrete appliance.(1)

Jung Jin Lee et al (2014) basalt fiber is steady adjacent to alkali solution and only the weight gets retarded in the different chemicals solution and tensile strength gets deteriorate in long times in calcium hydroxide solution and it is suggestible for usage for application in concrete. It was also compared with the glass fiber and it gets satisfactorily enhanced and in case of mineralogical data, there is spoil caused in the surface of the fibers.(2)

PatilDinanjali. S et al (2017) had conducted Split Tensile , compressive and Flexural strength for the concrete along with the basalt fibermade from the volcanic activity of the rocks and addressed that the fiber is non-corrosive and non-metallic fiber as compared to the other fiber as available in the market for resistance and for light weight and provides no toxic reactions towards to concrete with the curing period of 7 days and 28 days. It shows increased the strength in the proportions up to 1% and as long it gets present in the concrete. Over mixing of the basalt will gets segregate over certain period so they should mix with evident time.(3)

The basalt fiber utilized in this evaluation was made in Russia and exhibited the adaptability of 1000 MPa, which was about 30% of the carbon and 60% of the eminent glass (S-glass) fiber. At the point exactly when the filaments were submerged into a stomach settling specialist blueprint, the basalt and glass strands lost their volumes and attributes with a response thing remotely yet the carbon fiber didn't show huge quality decay. From the energized enduring test, the basalt fiber was found to give best obstruction over the glass fiber.The fittingness of the basalt fiber as a supporting material for partner resilient individuals through different exploratory works for quality, mechanical properties, and flexural strengthening. The basalt fiber utilized in this evaluation was made in Russia and showed the adaptability of 1000 MPa, which was about 30% of the carbon and 60% of the great glass (S-glass) fiber. At the point right when the filaments were submerged into a stomach settling operator strategy, the basalt and glass strands lost their volumes and attributes with a response thing remotely yet the carbon fiber didn't show enormous quality decay. From the enlivened enduring test, the basalt fiber was found to give best obstruction over the glass fiber. In any case, the basalt fiber kept about 90% of the common temperature quality of 600 °C for 2 h however the carbon and the glass fibers didn't keep up their volumetric uprightness. In the tests for flexural strengthening assessment, the basalt fiber kept about 90% of the regular temperature quality after introduction at 600 °C for 2 h anyway the carbon and the glass filaments didn't keep up their volumetric uprightness. In the tests for flexural reinforcing assessment, from the outcomes showed in this, two layers of the basalt fiber sheets were acknowledged to be better bracing game plan. In like way, the fortifying doesn't have to interface over the whole length of the flexural part. Precisely when moderate partner propping in any case high obstruction for flame is at the same time scanned for, for example, for structure structures, the basalt fiber reinforcing will be a reasonable elective framework among other fiber supported polymer (FRP) invigorating frameworks.(7)The basalt fiber kept about 600 °C for 2 h anyway the carbon and the glass strands didn't keep up their volumetric uprightness. In the tests for flexural fortifying assessment, the basalt fiber

stimulating improved both the yielding and a total nature of the shaft model. From the outcomes showed in this, two layers of the basalt fiber sheets were acknowledged to be better fortifying course of action. In like way, the supporting doesn't have to associate over the whole length of the flexural part. Precisely when moderate aide fortifying at any rate high prevention for flame is all the while looked for, for example, for structure structures, the basalt fiber reinforcing will be a normal elective procedure among other fiber supported polymer (FRP) fortifying frameworks.(7)Effect mechanical properties of basalt fiber invigorated geopolymeric concrete (BFRGC) For the generous SHPB tests on BFRGC models, the improved heartbeat framing techniques were proposed to gain dynamic weight balance and about enduring strain rate stacking over most of the test lengths. BFRGC show have well-built strain rate dependence, and addition around simply with the strain rate. The development of basalt fiber would altogether be able to improve deformation and imperativeness maintenance cutoff points of geopolymeric strong (GC), Also, the perfect volume segment of basalt fiber was presented for BFRGC.(8)

The comfort of basalt strands in order to hold up under the tensions occurring at the surface layer of black-top, which are genuinely presented to the traffic impacts, was investigated. In this particular circumstance, models were conveyed and attempted under Marshall Solidness Test, and the perfect bitumen substance regard for the sums test to be used was settled. In perspective on the chose a motivating force for the perfect bitumen content (5%), three models for all of a movement of different fiber extents were prepared. The perfect motivating force for fiber extent that results in the best security worth was settled. In order to choose if the best fiber extent (0.50%) might achieve a predominant robustness regard for other bitumen substance, extra models were set up with different bitumen totals and with the best and five unmistakable fiber extent regards close to the perfect worth. These models were attempted under Marshall Security Test and the procured results were assessed.(9)

Basalt fiber (BF) is a novel sort of inorganic fiber which is created utilizing the launch of split up basalt shake and is monetarily open. This assessment likewise separates the usage of basalt and glass filaments as fiber support in extraordinary security. It was seen from the test outcomes that there was no fundamental impact of fiber joining on the compressive quality and modulus of versatility of cement. The isolating adaptability of basalt fiber fortified cement (BFRC) stretched out with developing fiber partition anyway there was no augmentation in quality for glass fiber stimulated bond (GFRC) was seen past 0.50% fiber estimation. In a model like isolating resoluteness, the flexural idea of BFRC reached out with developing fiber content in a tenacious manner yet no such change was searched for GFRC after 0.50% fiber content. Break vitality reached out all things considered after 0.25% part for both basalt and glass sustained cement. The KIC and CTODC results of the BFRC demonstrated that BF thought improves the showcase of solid more when stood apart from GFBasalt fiber (BF) is a novel sort of inorganic fiber which is delivered utilizing the discharge of split up basalt shake and is monetarily open. This assessment likewise separates the usage of basalt and glass strands as fiber support in extraordinary

security. It was seen from the test outcomes that there was no essential impact of fiber joining on the compressive quality and modulus of flexibility of cement. The isolating flexibility of basalt fiber strengthened cement (BFRC) reached out with developing fiber partition anyway there was no expansion in quality for glass fiber fortified bond (GFRC) was seen past 0.50% fiber estimation. In a model like isolating firmness, the flexural idea of BFRC reached out with developing fiber content in a tireless manner yet no such change was searched for GFRC after 0.50% fiber content. Break centrality stretched out overall after 0.25% bit for both basalt and glass sustained cement. The KIC and CTODC results of the BFRC demonstrated that BF thought improves the showcase of solid more when stood apart from GFas for split resistance and pliability.(10).basalt-reinforced polymer composites. Polymer composites strengthened by basalt surface and glass surfaces were passed on for these tests. Void substance underneath 3% was assessed for the majority of the composites passed on for the testing program. No fundamental contrasts in Young's modulus, rigidity, flexure quality, shear quality, and weight quality were found between basalt composites and glass composites. (11) Basalt strands supported with a security based cross section as an inventive fortifying material for constrainment of fortified tough individuals. The practicality of the proposed framework is surveyed by looking restriction anticipates solid chambers: (1) uniaxial glass-fiber-supported polymer (FRP) overlays; (2) salt safe fiberglass structures invigorated with a strong based mortar; (3) bidirectional basalt covers preimpregnated with epoxy pitch or latex and after that fortified with a security based mortar; and (4) a strong based mortar coat. The assessment displayed that limitation subject to basalt strands fortified with a strong based mortar could be a promising reaction for beaten several prerequisites of epoxy-based FRP covers.(12) The material qualities and movement length of two currently open basalt fiber bars were overviewed. Test outcomes show that flexural structure of resilient individuals strengthened with basalt fiber bars ought to guarantee weight disappointment and fulfilling the value prerequisites. ACI 440.1R-06 effectively predicts the flexural furthest reaches of individuals stimulated with basalt bars, in any case it essentially wastes the avoidance at association weight level. Utilization of hacked basalt strands had little influence on the solid compressive quality; notwithstanding, on an essential level updated its flexural modulus.(13).

The new solid properties incorporated the going with tests: hang, Vebe hang, Vebe time, solid temperature, air substance and unit weight. The solidified solid properties picked were compressive quality, static modulus, flexural quality, load-redirection direct, association of weight distraction turns, ASTM sturdiness records, first break solidness, post split lead, Japanese standard framework for quality records and proportionate flexural quality. The test outcomes demonstrate that the basalt fiber can be effectively blended in the solid with no balling, cross or separation. There was a discernable expansion in the post split vitality assimilation most extreme and adaptability because of the advancement of basalt strands.(14)Modern squanders, slag and fly fiery remains, were utilized to pass on geopolymeric solid (GC), and which was strengthened with short basalt fiber.

Mechanical properties of basalt fiber strengthened geopolymeric concrete (BFRGC) of three diverse structure attributes were explored utilizing a 100-mm-detachment across over split Hopkinson weight bar (SHPB), and strain rate repercussions for dynamic compressive quality, crucial strain and unequivocal vitality upkeep were considered. For the liberal SHPB tests on BFRGC models, the improved heartbeat surrounding strategies were proposed to get dynamic weight congruity and basically suffering strain rate stacking over an immense fragment of test terms.(15)

2. Materials and Methods

Materials

Materials taken for the study purpose was Silica fume and Basalt fiber along with the M-Sand as Fine aggregate. The materials taken from the study as shown in Fig.1.The materials that are evaluated for the Performance their quality to the application of it in concrete.

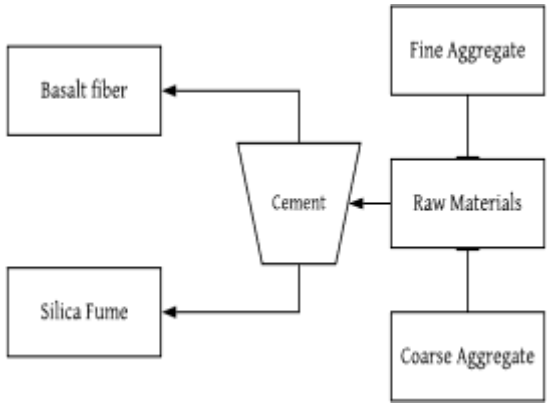

Fig.1. Flowsheet of Mix proportions

2.1.1 Silica Fume

Silica fume is in addition acknowledged as Micro-Silica, made as of the Alloys of Ferro/ Silica material which is known for the function of reducing the small vacuum pores in the Concrete which will slowly affect the serviceability of the concrete. It is very pozzolanic in nature were also used for high and strength and durability purposes.

Basalt fiber

Basalt fiber is a new product advent in building field. It is collected from the material such as plagioclase, pyroxene and olivine. Basalt fiber is non-metallic fiber made from basalt rock. It is non-toxic in air and also non-Combustible. The properties of basalt fiber are tabulated in table.1

- It is incredibly resistant to chemical erosion.
- It also functions well in a wide range of temperature.

Colour	Golden Brown
Density	2.67 gm/cm^3
Tensile strength	2.8 -3.1 Gpa
Elongation	85-150%
Modulus of elasticity	85-87 Gpa

Table 1 Physical properties of Basalt fiber

Cement

Cement is the primary essential material in concrete, which give the bonding property to the solid. The exploitation of connection is for generally differing conditions; the sorts of concrete that could be utilized supplementary substances, changing man-made arrangement, and utilizing varied crude materials have come about to the need of the development businesses for explicit reason. The cement testes are tabulated in Table 2. These are largely essentially grouped into Portland and Non – Portland bonds. The Ordinary Portland concrete was characterized into three evaluations to be specific 33 evaluation, 43 evaluation and 53 evaluation relying on the

quality of bond when tried according to IS 4031 – 1988.

Sl.no	Physical property	53 Grade cement
1.	Specific gravity	3.15
2.	Fineness	260m^2/Kg
3.	Initial setting time	120 minutes
4.	Final setting time	300 minutes
5.	Soundness in mm	7

Table 2 Physical properties of Cement

M-sand:

Natural river sand was used as fine aggregates. The properties of sand were determined by conducting tests as per IS:2386 (Part-1). The results obtained from sieve analysis are furnished in Table. The results indicate that the sand conforms to zone 2 of IS: 383 – 1970.

Combine with the different in particle shape, size, angularity, texture, and with the grading of fine aggregate may affect the properties of Portland cement concrete that are important to its behaviour in service. Characteristics of the aggregate influence the void ratio existing in the fine aggregate as shown in Table3.

Natural sand which is cubical or round with smooth surface texture. The workability being by its cubical, rounded and smooth texture. Sand which is used here is taken from River bed. Particles of this sand have smooth texture and are blackish.

Coarse Aggregate:

The importance of using the right kind and class of aggregates cannot be overemphasized. The fine and coarse aggregate normallyreside in 60% to 75% of the concrete volume (70% to 85% by mass) and strongly organize the concrete freshly mixed and hardened properties, mixture proportions, and market. Fine aggregates,in general consist of natural sand or crushed stone with mainlyparticle smaller than 5mm (0.2 in).

S.no	Physical property	M -Sand
1.	Specific gravity	2.60
2.	Fineness modulus	2.78
3.	Bulk density(kg/m3)	1690
4.	Grading Zone	2

Table 3: Physical properties of fine aggregate

Coarse aggregates consist combination of gravels with particles size of larger than 5mm and generally between 9.5 mm and 37.5 mm. The stone jelly test on Table 4. .Someof the natural aggregate deposits, called pit-run rock, comprise of rock and sand that can be willfully utilized in cement after insignificant preparing. Normal rock and sand are typically burrowed or dug from a pit, stream, lake, or seabed.Crushed stone is created by pounding quarry shake, rocks, cobbles, or huge size rock. Squashed air cooled impact heater slag is additionally utilized as fine or coarse total. The totals are normally washed and evaluated at the pit or plant.

S.no	Physical Property	Values
1.	Specific gravity	2.65
2.	Fineness modulus	2.85
3.	Bulk density (kg/m^3)	1600

Table 4: Physical properties of Coarse aggregate

3. Results and Discussion

The tests were conducted for evaluating the basic property of the cement, fine and coarse aggregate such as soundness, Fineness and setting cement as conduced on the 53-grade cement and their results were in permissible limits. The primary tests that defines the Strength and Serviceability of the concrete were compressive strength

and Split Tensile Strength was conducted for the Silica fume of 2.5,5 and 7.5% along with 2,3 and 4 % pf Basalt fiber.

Compressive Strength Test

Compressive strength test was conducted on the specimens of the concrete mould as design per the Indian standards code of practices for Construction. Compressive strength was tested on the Samples which shows the resistance of the load given to the sample in maintain time period in the CTM machine. At certain point of time, the Cracks will gets appeared on the concrete cube and it begins to crushes and tends to fail. The recorded reading shows the Ultimate Bearing Strength and Stress value is noted in N/mm_2.In the Fig.2. The average of three samples were taken and tested and the values was also taken on various curing periods as 7,14 and 28 days and the values were plotted against the Stress developed.

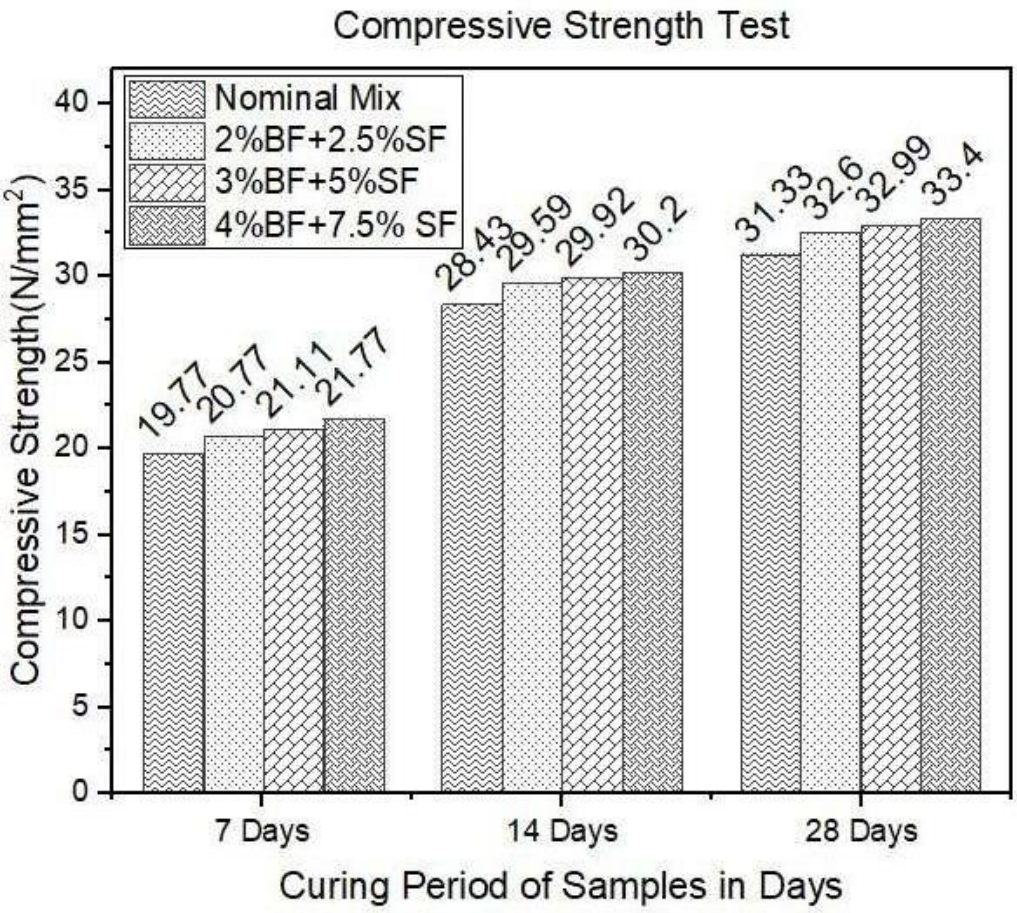

Fig.2. Compressive strength Values

The strength gets increased as the long as the Curing of concrete increases, it was also proved to be actual fact as in the case of additive to the concrete in this study. The additive shown the improved results as that of the Nominal mix and over the extended period of curing. Among three proportions, 4% Basalt fiber with 7.5 % of silica fume considered as the best in 7, 14 and 28 days of curing time and optimal for the application in the structure purpose.

Tensile Strength Test

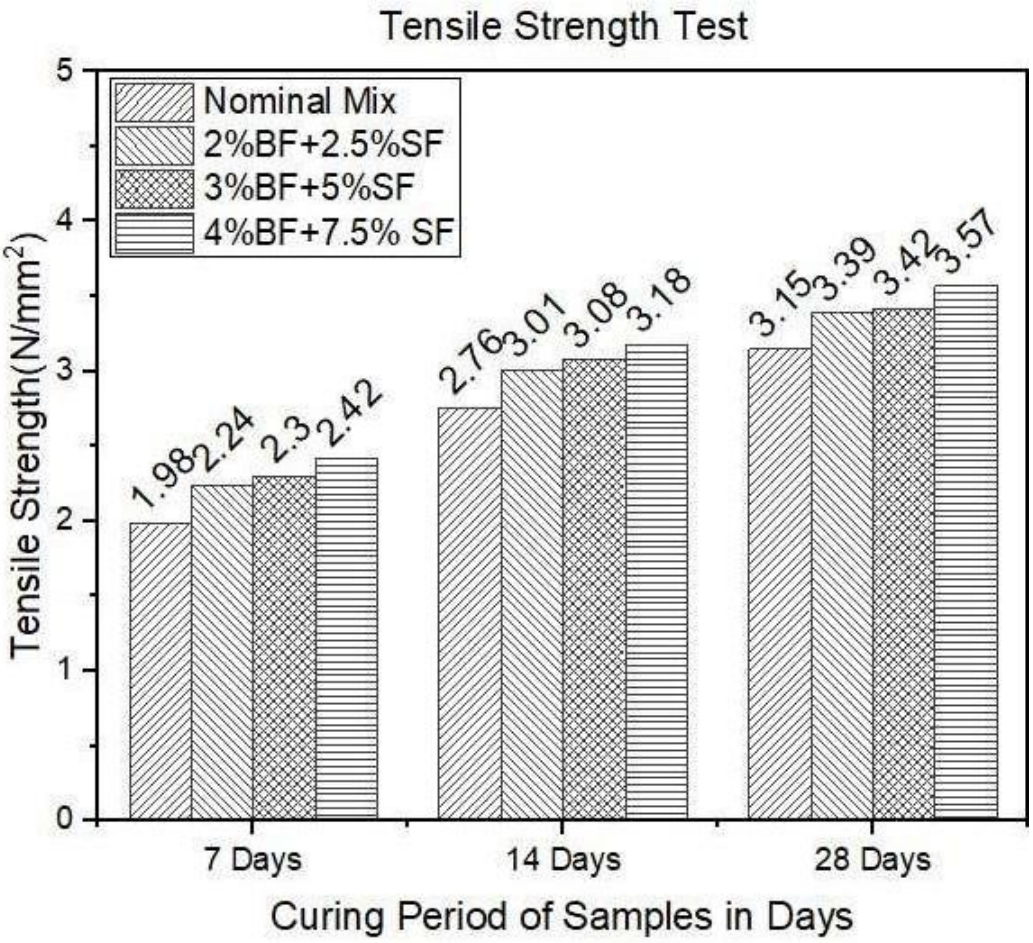

Fig3. Tensile Strength Values

Tensile strength test was tested for the Stability of the cylindrical specimens in the horizontal axis to the point of load application. It defines the stress developed at the point of breakage of the specimen. The tensile strgth of samples are as shoen in Fig.3. The reading was noted and the values were obtained from the various curing periods as 7,14 and 28 days. The results were satisfying in 4% Basalt Fiber and 7.5% silica fume as obtained before in the compressive strength and it is higher than other two mix proportions.

4. Conclusion

M-sand used as a fine aggregate and large use of waste product in addition with silica fume and basalt fiber it increase strength in 7, 14 &28 days. And decrease in age of concrete. In extra benefit it basalt fiber as a non-corrosive.it equalize ecological balance and conservation of natural sources etc.

In addition of basalt fiber in concrete it increases flexural strength when compared to the conventional mix. Basalt fiber is also very good in heat-resistant. The heat-resistant property is very important in all buildings.

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