



Toughness Factors Reflections ONM-40 CC by Part Ousting Cement by SCBA & Adding Siyali fibre

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Authors' contributions

This work was carried out in collaboration among all authors. Author RPB carried out the laboratory works. Author SPM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SN and SP managed the analyses of the study. Author MS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Globally, the concrete is the vastly used material in the construction sector. It is a product of naturally available materials with the some chemical processes that generates solid waste, and GHG gases from the factory that pollutes soil, air and water. The demand for cement is gradually rising due to urbanization, industrialization and modernizations, and augmented it is short supply. The sustainable partial or fully replaced products used for replacement of cement is to be invented to obtain from recycled wastes and must be non-pollutant of atmosphere and ecofriendly. Researches must be made with the low cost waste materials like red mud, GGBS, fly ash and many others. The present research is the ousting element sugarcane bagasse ash (SCBA) as a partial replacement of cement. To improve the tensile properties of concrete, attempts are made to add small closely space out and evenly discrete natural organic Siyalifibre with the SCBA concrete which can provide better properties to concrete like crack remover and mends some static/dynamic characteristics of concrete. The concrete composites made from SCBA and Sialifibre are both environment friendly materials having both cementing and fibre reinforcing properties. Present

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study is to prepare of a concrete composite with a mix design of M40 grade and study compressive, tensile and split tensile strengths. The study should try with a composite concrete with Sialifibre and SCBA at various proportions and verify its crack resistant and strength improving/ deteriorating properties. For the present work of concrete, it is found to be advantageous with 10% ,20% SCBA with a partial substitute of cement and Siyali Fiber at various dosages like 0%, to 2.0% with increment of 0.5% added to cement volume.

Keywords: Concrete; cement; sugarcane Bagasse ash; Siyali Fiber; mechanical properties.

1. INTRODUCTION

Construction sector; parallel with urbanization is fast growing industry diligences in the globe. The concrete plays a pivotal role in the architecture-engineering and construction industry and it is the most extensively anthropogenic construction material. Concrete on the long run is deliberated as a durable and sustainable element which requires less maintenance during its life span. Concrete plays a very important role for achieving a high strength at the early age of time to fulfill the requirement of the structures. The less and endurable life of a conventional concrete under the different types of climatic conditions conventional, concrete possesses major deficiencies like a low bond strength, a low tensile strength, a high permeability and also develop more cracks. Addition of fibers can surge strength, and also shrink plastic and drying shrinkage by striking the crack proliferation. Steel as reinforcement has surpasses the poor 5% problem tensile strength in comparison to compressive properties, but lacks in satisfying the micro crack formation while setting from greenness and plastic shrinking while weathering.

To overcome these lacunae, the researcher is interested in improving the properties by using sugar factory waste ash as replacement of cement in different proportions and natural fibers to satisfy the cracking and shrinking problems. Sugar cane bagasse fibre ash (SCBA) has been tried by different researchers for its similar cementitious properties and vis a vis a waste can produced concrete of higher strength and better mechanical characteristics. The sugar cane baggies are only a waste to sugar factory and used for fuels. After use the waste ash is SCBA. The disposal of the ash to open air causes threats of flies and vector diseases for the deterioration of the atmosphere. To avoid the environment impact, the bagasse is recycled before use to replace cement as a part to solid waste management. Application of the SCBA improves the flexural, cementitious properties and provides impact toughness properties of

cement concrete (CC) by Sialifibre. The light weight material fiber of Siali is a low cost product and widely available in Indian forests. Other natural fibers can have also impact like Siali is coconut fiber, creeper. Natural fibre are not only strong and of light mass, but also a relatively very cheap and cut in to small pieces easily. The contemporary research includes the use of a novice natural fibre and waste ash. This Siali fibre is discrete, discontinuous, arbitrarily disseminated all over the cement concrete matrices. They also reduce the workability of green concrete, marginally improve the strength properties.

2. LITERATURE REVIEW

Greater spare of cement by SCBA causes in a superior ordinary consistency and improves durability of setting time period. The workability of concrete exhibited little reduction as the with increase of SCBA (Birukhailu et al. [1]). The sugarcane bagasse ash obtained from sugarcane industry in particle size can be replaced as the fine aggregate in high strength cement concrete (Naik, T.R et. al. [2]). The upper level of substitute of SBCA with fibre of Siyali had showed slight bleeding and segregation tendency. Up to 20% SBCA replacement can be used as a replacement of cement as 5 to 7% enhancement in density cement concrete in different concrete mixes (Vijay Vikram A. S. et. al., [3]). Past researches in the same subject has reported of cement concrete as a weak in tensile strength and even the RCC has limited ductility and a little resistance to cracking (P. Loganathan, et al. [4]). The workability properties and improvement to strength are achieved when Siyalifibre is applied additionally to the RCC under diverse mix ratios with an additional mixing with fiber had proved reduced amount of compressive strength (Rahuman A. et al, [5]).

The replacement of SBCA cement conc. in 0-25% ratio, the properties of concrete improved

like compression, young's modulus, tension, and flexure by 10% (S. P. Rao et al, [6]). Small decrease of concrete strength was observed while % of increase in replacement of SCBA percentage, but to achieve the required strength, one has to increase the days of curing (Subramanian et al. [7]). Despite of the changes in compressive strength of the CC due to various quantity of substitute, a large market has been explored for various concrete products with SCBA blended CC. can be feasible. These primary structural submissions are having medium to low strong point requirements SCBA/CC is better benefiting. The SCBA/CC is active in concrete making as a part substitute of cement due to the improved strength (Adejoh, et al, [8]).

Presently, many industrial and agricultural wastes are used to replace cement to avoid/reduce land uses to nature like GGBS, marble dust, pumicrete etc. (Mishra S P et al. [9], Madhurima das et al; [10] and Samal j. et al [11]) Cement has been replaced by different substitutes like, red mud , GGBS, Ferrochrome dust, Pumicrete and other cementitious materials to improve concrete properties, but less work has been done for the improving of the tensile properties Nayak S et al, [12] and Ojha B. et al, [13].

Technological performance of fiber reinforced cement-based mortars; fibre coated cement mortars; wind turbine blade wastes used as ingredients in mortars for ecofriendly use; city sewage sludge; ceramic waste are used as

composite ingredients used in CC and mortar preparation to save nature. Present study of composite cement concrete manufacture with SCBA and Siali fiber which is less researched have been considered as the scope of study.

2.1 Objective

- To assess the consequence of SCBA/CC as a part substitute of cement on workability & strength of CC.
- To investigate the result of Siali fibre on the strength properties of SBCA/CC.
- To evaluate the optimum use of SCBA (%), & Siali fibre to get maximum result.
- To find fibre performance in flexural strength of concrete for various mixes was evaluated to demonstrate the fiber synergy in bridging the large crack widths.
- A comparative assessment of different percentage of fiber concretes was evaluated systematically and the relative performance compared to conventional concretes to be investigated.

3. METHODOLOGY

Present study investigates the use of SCBA recovered from burnt ashes as waste product of sugar factory and a biological waste by replacing cement along with a fibrous balk of a tree commonly available in India called Sialifibre to be added to give improved tensile properties to concrete. The methodology is provided in the Fig 1.



Fig. 1. The Methodology



Fig. 2. Sugarcane bagasse ash

The OPC (ordinary Portland cement) of 43 grades was employed in the research. It was tried best to take all precautionary measures to prepare a high quality concrete using the fresh cement from factory outlet. The coarse and fine aggregates (Sand) used in the cement concrete (CC) from the nearby sand quarry from bed of the river Mahanadi. Black hard granite chips of uniform size of 12mm and the water used from the laboratory tap of Centurion University of Technology and Management to maintain a suitable distribution of particle size and better packing. The Siali fiber has been procured from Forest Dept. Govt of Odisha and Sugar cane bagasse ash from nearby Dhenkanal Sugar mill, Odisha (Fig. 2).

4. MATERIALS AND THEIR PROPERTIES

4.1 Cement

The OPC of 53 grades compliant to IS 12269-1987 has been utilized in this project work. Physical Properties of cement as tested in the CUTM Laboratory are specific gravity (sp. gr.) 3.13, uniformity (Consistency) of 31%, fineness of 3%, with initial and final times of setting are 81 and 146 min. and soundness of 2%.

4.2 Fine & Coarse Aggregate

Natural sand collected from approved sand quarry of the Mahanadi River near the Kuakhai bifurcation point has sp. gr. (2.6) was taken as fine aggregate and the sieve analysis results of sand was conducted complying to (IS 383 (Part III)-2016[14]) to assess the grading outline. The black hard granite crushed stones free from weather skins of uniform maximum size (20 mm) was taken as coarse aggregate. The result such as Fine & Coarse aggregates having specific gravity 2.6, fineness modulus 2.7 and 2.4, water absorption 3.02 and 3.04, bulk density 1666 Kg/m³ and 1457 Kg/m³.

4.3 Sugar Cane Bagasse Ash (SCBA)

The residue obtained after grinding the sugarcane, the waste fibrous material left are called bagasse which is a cellulose fiber. The bagasse obtained was burnt and the ash is called the bagasse ash which is a source of biomass and valued waste in sugar plant. Commonly, they are used as fuel in the manufacturing process. The ash left after burning is about 10% of the total bagasse recovered. The bagasse ash may contain ≈8-10% of unburnt carbons, silica and alumina which possessed the cementitious properties. Kanchan L. (2013) [15] and Reddy G. N. K. 2015[16]. The sugar plant disposes these as free to the nature which when decays and impart problem to the surrounding. The boilers also release CO₂ to the atmosphere as suspended particulate matter (SPM) on burning of the bagasse's mass. The sugar cane bagasse is used (or other fuels) during ignition (start of burning) of the boiler or when the bagasse is wet to support combustion may produce SO_x and NO_x (noxious gases) that pollute the air. The raw SCBA is acquired from the sugar factory at Dhenkanal, Odisha. The physical and the chemical properties are shown in Table 1 and Table 2.

4.3.1 Siyali fiber (Chemistry)

Its common name is Maloo Creeper, Bauhinia climber, Camels foot climber. It's botanical name is BAUHINIA VAILI of Family: CAESALPINIACEAE (Gulmohar family). Synonyms: *Bauhinia racemosa*, *Phanera Vaili* (BAUHINIA VAILI-Maloo Creeper www.Flowersofindia.net) Fig -3

Siyali is a plentiful, handy, renewable, low-cost, and recyclable celluloses fiber utilized for many domestic and industrial products. Siyali can be used as inert filler or also as reinforcement in various composite constituents. The Siyalifibers is also similar to bamboo fibers, coir fibers are jute fibers used for the purpose. The SCBA+

Siyali fiber composites have great strength with reasonable tensile and flexural strengths, and also eco-environmentally. SCBA Siyali CC were examined and observed improvement in shear strength. It enhances the modulus of rupture along with elasticity. Addition of SCBA improves the Compressive strength of CC. The Siyali fiber can reduce the micro cracks of concrete after setting imparts light weight and also lowers the thermal conductivity along with bulk density. There is a decrease in the thermal conductivity in SCBA + Siali composite specimens. The composite can prove as sound alternative that can solve the problem of environment degradation and energy concern. Siyalifibre can be cut to 20-25mm length and conveniently used for the trial specimen with aspect ratio of 50-100.

The SCBA + Siali fibers can be used of the properties are shown in Table 3 and Fig 3.

4.4 Water

Water is essential and low cost ingredient during cement concrete making. It contributes to the hydration reaction with cement. The strength is imparted to the quantity of cement and quality of water. The selection of water is important for the

strength of concrete. In the present research, the potable water is considered for the concrete mix. Clean supply water available from the college water supply system (Centurion University of Technology and management) which was used for the casting as well as the curing of the test specimens (IS 456 2000[17]).

4.5 Super Plasticizer

To maintain a lowest and optimum W/C ratio, and to obtain is the required mark of workability, chemical admixtures like super-plasticizer must be applied to lessen the W/C ratio. By efficiently managing the W/C ratio, the required design strength can be achieved. The Master Rheobuild 1125 was used in the present study as the super plasticizer. This super plasticizer is a polymer of sulphonated naphthalene and has a high ranged retarding admixture used in the Cement Concrete. The superplasticizer can be helpful in slump retaining capabilities having a density range 1.24 ± 0.02 at 25°C , pH $< 0.2\%$, Chloride ion content > 5 , with Dose limit 0.5 to 1.2% by mass of concrete (IS 9103; 1999 and reaffirmed 2004) [18].

Table 1. Physical properties of SCBA

#	Properties	Sample result
I	Cubic Density	575 kg/cum
II	Specific gravity (sp. gr.)	1.90gm/cc
III	Average particle size	0.1-0.2 μm

Table 2. Chemical properties of SCBA

Compound	Weighs(%)
SiO ₂ (Sulphur dioxide)	73%
Al ₂ O ₃ (Aluminum oxide)	6.7%
Fe ₂ O ₃ (Ferric oxide)	6.3%
CaO (Calcium oxide)	2.8%
MgO (Magnesium Oxide)	3.2%
P ₂ O ₅ (Phosphorous pentoxide)	4.0%
Na ₂ O (sodium oxide)	1.1%
K ₂ O (Pottassium oxide)	2.4%
Loss of Ignition	0.9%

Table 3. Properties of SIYALI fibre

Properties	Value
Colour	Brown
Specific gravity (sp. gr.)	1177 kg/cum ³
Absorption of Water	93%
Tensile strength	95 to 118 Mpa
Aspect ratio	50 to 100



Fig. 3. Siyalifibre- Bauhinia vaili fibre

5. EXPERIMENTAL WORK & TEST

5.1 Mix Design

According to the IS 10262 – 2009[19] code, and by using the above test results, the mix design was accepted for M40 grade of CC. A Trail mix for M40 grade was prepared by the mix design and the mix .The laboratory work has been done in the university laboratory, Jatni, the physical properties of ingredients were identified as per the available normal laboratory processes. The IS 456-2000[17] code of practice is employed to calculate the targeted compressive strength. It is observed that the cement content required for mix proportioning exceeds the design stipulation.

The formula used is ($f_{ck}' = f_{ck} + 1.65 s.$) as per IS-10262:2009 Standard deviation,

$S=5 \text{ N/MM}^2$. Therefore, target strength $=40+1.65S =48.25 \text{ N/MM}^2$. The replacement of SCBA 10%, 20% and the addition of Siyali Fibre varied from 0%, 0.5%, 1.0%, 1.5%, and 2% by mass of cement and the specimens were casted. The quantity of ingredients like SCBA, Siali fiber and the other ingredients are cement =360 kg/ cum, water= 144 kg/ cum, the sand (fine aggregate) = 647 kg/cum, the black hard granite as coarse aggregate = 1252 kg/cum, super plasticizer = 1% of cement, and the W/C ratio as 0.40,

The settled design mix by proportions in mass was (1:1.79:3.37). The casting of cubes, beams and cylinders were made and cured by water of water vat at CUTM for 7,14 and 28 days for various mix ratios and substitutes (Table 4).

Table 4. Mix proportion

OPC Cement	Fine Agt. (Sand) (kg/m ³)	CA: HG chips (20mm)	Water/ cum of CC	Super plasticizer
360.52	643.151	1252.43	144	3.605
1	1.79	3.37	0.40	0.011

6. CONDUCTING ACTIVITIES (Added as per Suggestion)

The experimental programme was designed to study the mechanical properties of Fiber reinforced concrete of M40 with replacement of cement with SCBA for study of compressive, split tensile, flexural strength. The programme consists of casting curing and testing a total specimen of cubes (150mmx150mmx150mm), beams, cylinders (150 m 300 mm) were casted in batches wise with 10%, 20% consecutive SCBA doses and addition of Siyali fiber. The cubes of M40 were utilized for finding the compressive strength (UTM machine), the split tensile strength is determined by the help for compressive strength, cylinders are used for finding the split tensile strength and the prisms or beams were used to find the flexural strength of composite concrete of different mixes i.e. SCBA, Siyali fiber and cement concrete by adding ConplastSP430 (G), as plasticizer. The proportion of mix is 0.7 – 2 lit of conplast-sp430(G) for 100Kg of Cement. An over dose of double the recommended amount of will result in very high workability.



Fig. 4. Mixing casting and testing of curing of SCBA + Siali Ash cubes concrete



Fig. 5. Compressive strength test machine CTM and curing of cubes, cylinder, beams

The methods for preparation of cubes, cylinders and beams are shown in Fig. 4 and Fig. 5.

7. RESULTS

The test result of compressive, split tensile and flexural tests performed on fresh concrete and cement with replacement of sugarcane bagasse ash in 10% and 20%, and Siyali Fiber at 0,0.5,1,1.5 and 2% at different percentages are presented in the tables below while the casting and testing processes are performed.

7.1 Compression Test

A cube specimen of size (150mmX150mmX 150mm) was casted and tested under universal testing machine (UTM). The observed results of the compressive strength tested are as per IS - 516: 2012 and can be calculated as given by;

$$f_c = (P / A)$$

Where, f_c = compressive strength (CS) of cube in N/mm^2 ; P = specimen failure Load in N and A = Area of cross sectional in mm^2

The compressive strength CS of CC test results of the SCBA + fiber concrete mixtures and observation results are represented in Fig. 1. The

results signifies the addition of fibers provide increase in the compressive strength with respect to conventional M40 concrete mixes as the max strength observed was 48.20MPa in avg. after 28 days curing; wherein the addition of SBCA, there has been a marginal increase in the CS. Further Siyali fiber combinations with 2% (SB5) exhibited the highest CS of 46.86 MPa. The value recorded for Siyali fiber combination of sugar cane bagasse showed the good hardened surface of the concrete for various mixes [IS 516].[20]

Also, it is observed strength gain in case of hybrid fibre-reinforced concrete is noticed when the reinforcement index and the fibre distribution accompanied by fibre spacing provided the maximum improvement in the strength characteristics. However, the effects of fibre additions are not clearly seen in the case of compressive properties since failure is other than fracture wherein the stressing offibres is not experienced. This can be justified by the theoretical mechanics that the compressive direction has not provided adequate development of tensile stress in the concrete specimen and due to the platen effect. As a result, the extreme fibres stress in the concrete is converted into a shear stress and results in a diagonal tensile failure (Fig. 6).

Table 5. 7th, 14th & 28th day’s compression test results of cubes

Mix Designation	SCBA	Siyali Fiber	compressive strength (cube)	compressive strength (cube)	comp. strength (Cubes)
Unit			N/mm ²	N/mm ²	N/mm ²
Span curing			7days	14days	28days
NC	0	0	22.11	28.34	35.56
SCBASF1	10	0.5	25.25	32.62	40.52
SCBASF2	10	1	23.51	34.11	45.11
SCBASF3	10	1.5	29.63	33.55	42.28
SCBASF4	10	2	25.52	36.01	43.21
SCBASF5	20	0.5	28.25	34.86	40.17
SCBASF6	20	1	26.55	35.36	43.77
SCBASF7	20	1.5	29.63	34.69	47.86
SCBASF8	20	2	23.96	36.12	42.72

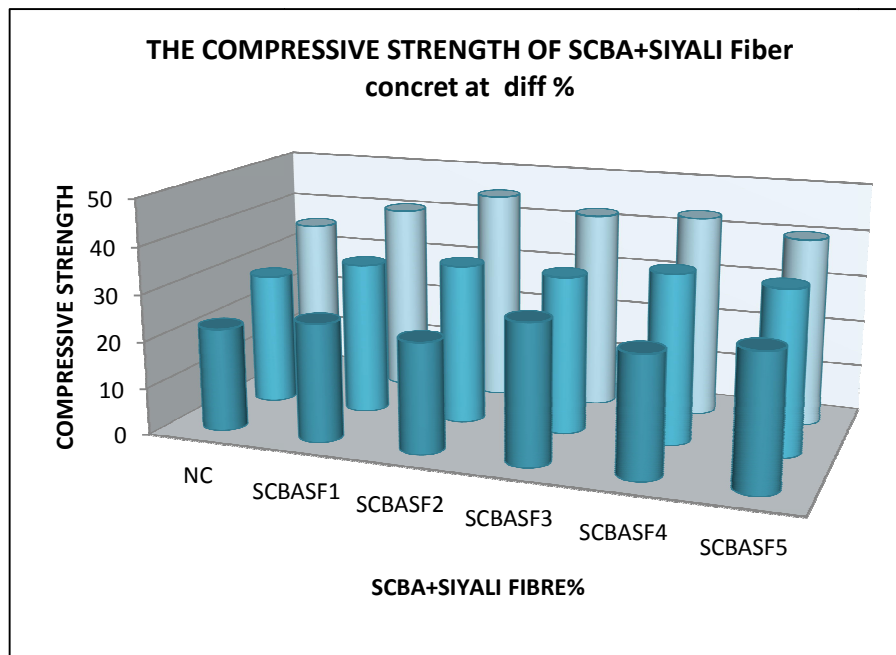


Fig. 6. Comp. strength (after 7, 14, 28 days curing) of (SCBA+Siyali) fibre CC cubes N/mm²

In the case of fibre reinforced concrete specimens, since the matrixes highly strengthened on addition of fibres, the aggregate failure is going to be predominant. The overall results indicated that the modulus of fibre is greatly dependent on the matrix densification for a low-modulus fibre addition. This justifies that in the case of the siyali fibre combinations of low and high modulus, the reinforcing efficiency is greatly enhanced due to the fibre interaction and the corresponding number of fibres available in the crack bridging.

7.2 Split Tensile Strength (STS)

The cylinders of size (150mm φ and 300mm(ht.)) were casted and tested under Universal Testing

Machine(UTM). The STS of the specimen concrete cylinder of 28 days curing is carried out adhering to IS: 5816 -2012 (Fig. 7) and Table 6. The split -tensile strength can be calculated by using the Formula given below:

$$\sigma = 2P/ DL$$

Where, σ =is the Split tensile strength in N/mm²

- P = Load Applied in Newton
- L = cylinder height in millimeter
- D = Diameter of cylinder in millimeter

Tensile strength increment was observed up to 2.0 % addition of fibre is 4.67. The increased tensile strength for M40 mix design with 20% of

SC2.0% addition of fibre was 41.77% and 45.378%, respectively.

7.3 Flexural Test

Concrete prisms of size 100x100x500mm were casted and tested under UTM at two points loading. The test is performed according to IS: 516-2002.[20]

The flexural Strength is given below
The modulus of rupture (Fb): $F_b = \frac{pl}{bd^2}$

when a =line of fracture and the nearer support is >20.0cm for a beam of size 15.0cm sample or (> 13 cm for 10 cm size sample beam specimen),

b = width (cm)
d = depth to failure (cm)
l = length of support (cm)

The flexural performance of various combinations is represented graphically in Fig. 8. The observation results ensure that the max. Flexural stress observed was to orthodox concrete (SB1) with a value of avg 4.55 MPa. In the case of Siyalifibre combinations, a marginal increase in the strength was anticipated as compared to the reference concrete mixes. The flexural strength of siyalifibre combinations with 20% of SBCA had shown a significant improvement up to 4.63 MPa which exhibited an increase in the strength, when matched to M40 grade normal concrete. This denotes that the Siyali combination of higher fraction of low-modulus exhibited synergy up to the ultimate capacity of concrete. The comparison of Siyalifibre action among SBCA showed better flexural strength enhancement for various mixes. Similarly, it was observed that the higher cracking stress matched to normal M40 CC.

Table 6. The STS test of cylinders by UTM for different % of mix of SCBA & SIYALI fiber

Mix designation	STS in N/mm ² 7 days	STS N/mm ² 14 days	STS N/mm ² 7 days
NC	3.30	3.31	3.89
SCBASF1	3.66	3.25	4.30
SCBASF2	3.89	4.40	4.48
SCBASF3	3.22	4.10	4.63
SCBASF4	3.90	3.69	4.28
SCBASF5	3.14	3.96	4.68
SCBASF6	4.1	4.98	4.63
SCBASF6	4.69	4.68	4.52
SCBASF7	3.82	4.60	4.59

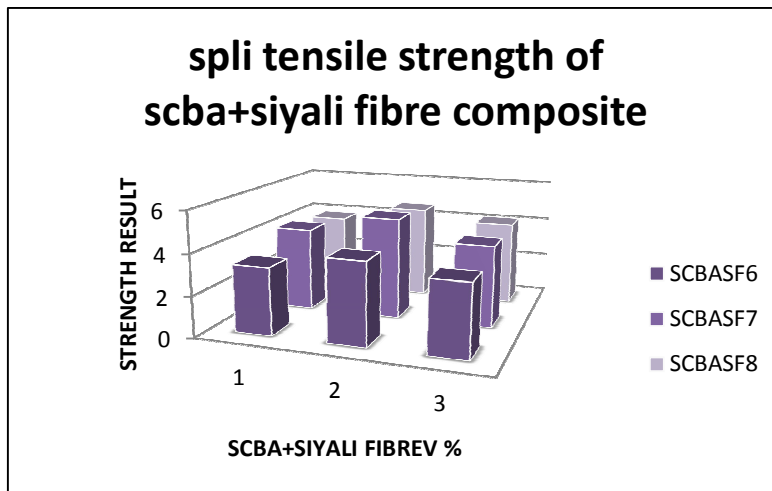


Fig. 7. The split tensile strength (STS) test was conducted for the cylinders by UTM for different % of mix of SCBA & Siyali fibre

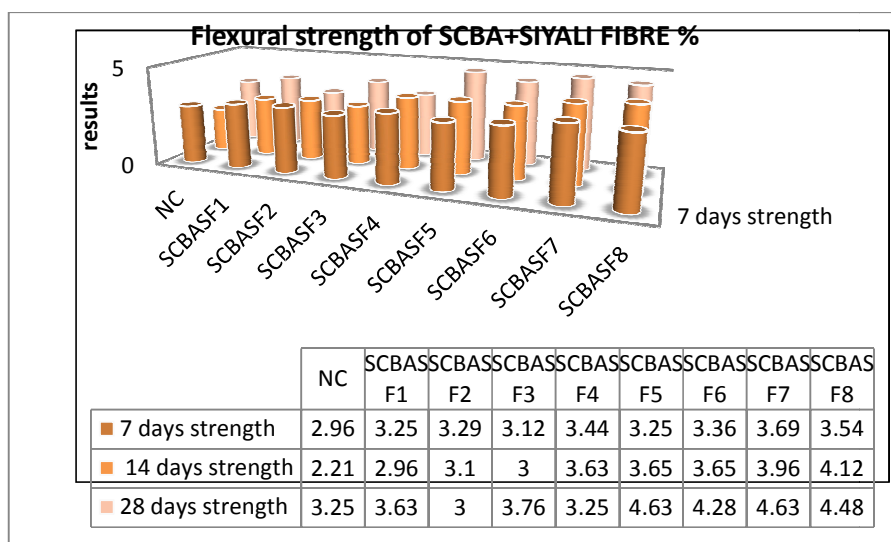


Fig. 8. The Flexural strength test of the beams for different % of mix of SCBA & SIYALI fibre

It can be concluded that the fibre matrix interaction is better enhanced with the fibre combinations. It can also be stated that the fibre matrix is much enhanced by the longer fibre due to the corresponding crack bridging stress developed in the case of longer fibre. However, this is better observed in the case of addition of Siyalifibre that causes the development of sufficient bridging stress during the crack propagation.

8. DISCUSSION

The results of the experimental investigations conducted provide the significant conclusions:

- ❖ SCBA substituted concretes showed favourable improvements on the concrete hardened properties. This necessarily showed improved compressive strength of Siyalifibre concrete (MS5) up to 48.20 MPa and this increase was significant for higher dosage of 1.5 % V_f of concrete.
- ❖ Cement concrete for various mixes can be made economical by partially replacing the cement by sugarcane bagasse ash can also adds some chemical fluid which will strengthen more.
- ❖ It is clearly noted that the produced green, sustainable and eco-friendly cement concrete by partially replacing cement by sugarcane bagasse ash.
- ❖ With the above study, the mean bull's eye strength for M40 grade CC is realized with

part substitute of cement by SBCA with adding of Siyalifibers up to 1.5 % by volume.

- ❖ The SBCA +Siyalifibre RCC of mix at 2% increase in strength up to 34 % in case of normal M40 cement concrete.
- ❖ A maximum STS (4.67 N/mm²) of Siyalifibre reinforced concretes was observed in the case of 2% fibre substituted concrete mixes (MS5).
- ❖ Flexural strength of Siyalifibre concretes showed a significant increase in the strength up to 4.89 MPa at 28 days curing, when compared to the plain concrete 3.30 MPa. However, increased fibre addition does provide anticipated increase in flexural strength and also improves the bending stress.
- ❖ It is also clearly understood that fibre reinforcing efficiency dictates the overall improvement in bending stress leading to a high resistance capacity even after failure.
- ❖ In general, test results indicated that the optimum addition of SBCA and fibre addition of Siyalifibers had contributed to the overall performance for various mixes. Among the different concrete mixes tested, the 20% SCBA substituted in mix (MS5) containing Siyalifibers at 1.5% had shown the overall improvement on the composite toughness.
- ❖ The use of chemical admixture in concrete is beneficial for the better workability and strength because it reduces the water content up to 48%.

- ❖ With a higher level of replacement of SBCA with Siyali showed slight bleeding and segregation tendency. Therefore, it is recommended that up to SBCA 20% only can be used as replacement of cement, i.e. the higher amounts of SCBA more than 20 % must be avoided. It was also noted that enhanced concrete density by 5 to 7% in all the concrete mixes.

9. CONCLUSION

When the normal concrete with SBCA +Siyalifibre mixtures in CC, have appropriate high values of slump and suitable workability possess better strength results. Maximum compressive, flexural and splitting tensile strengths occur. The optimum value is achieved at replacement of 20% of SCBA against cement and addition of 1.5% of Siali fiber. The density of concrete increases with addition of SCBA and Siyali fiber to concrete increases, which imparts the properties of strength.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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