International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in

Vol.3., Issue.5., 2015
(Sept.-Oct.)

RESEARCH ARTICLE

ISSN: 2321-7758

EXPERIMENTAL INVESTIGATION ON SLURRY INFILTRATED FIBER CONCRETE (SIFCON) WITH ALCCOFINE

ANUMOL V. BASHEER[1], AHSANA FATHIMA[2] , ANJU DOMINIC[3]

[1,3] PG Student, Department of Civil Engineering, Indira Gandhi Institute of Engineering and Technology , Kerala, India,

[2] Assistant Professor, Department of Civil Engineering, Indira Gandhi Institute of Engineering and Technology , Kerala, India,

ANUMOL V. BASHEER

AHSANA FATHIMA

ANJU DOMINIC

ABSTRACT

Slurry infiltrated fiber concrete (SIFCON) is a relatively new special type of high performance fiber-reinforced concrete (HPFRC). SIFCON is made by pre-placing short discrete fibres in the moulds to its full capacity or to the desired volume fraction, thus forming a network. The fiber network is then infiltrated by fine liquid cement-based slurry or mortar. The steel fiber content can be as high as 25 % by volume [1].SIFCON contains relatively high cement and water contents when compared to conventional concrete. The density of this zone can be increased with supplementary cementitious materials such as alccofine [2]. Alccofine is a specially processed product based on slag of high glass content with high reactivity obtained through the process of controlled granulation. . In this study the effect of alccofine (0%, 5%, 10%, 15% and 20%) have been examined on two different mix of SIFCON prepared with hooked end steel fiber and crimped roll end steel fiber. Mechanical properties are determined by conducting compressive strength test and flexural strength test.

Key Words: Alccofine, Crimped End Steel Fiber, Hooked End Steel Fiber, HPFRC, SIFCON…

1. INTRODUCTION

One of the important properties of Fibre Reinforced Concrete (FRC) is its superior resistance to cracking and crack propagation. This ability to arrest cracks fibre composites possess increased ductility and tensile strength. Fibers are able to hold the matrix together even after extensive cracking. The net result of all these is to impart to the fiber composite pronounced post cracking ductility which is unheard in ordinary concrete. The change from a brittle to a ductile type of material would increase the energy absorption characteristics of the fiber composite and its ability to withstand repeatedly applied shock or impact loading.

1.1 SIFCON

Slurry infiltrated fiber concrete (SIFCON) is a relatively new special type of high performance fiber-reinforced concrete (HPFRC). SIFCON can be

described as a special type of cement based composite produced with fiber volume fraction values between 5 to 25% .Once the steel fibers have been placed in a mould, then they are infiltrated with fine-grained cement-based slurry. The slurry must be flowable and liquid enough and have sufficient fineness to infiltrate thoroughly the dense matrix in the fiber-filled forms. The infiltration step is accomplished by simple gravity-induced flow or gravity flow aided by external vibration or pressure grouting from the bottom of the bed. Slurry infiltration is achieved by gravity flow aided by a vibrating table. The important factors affect the SIFCON properties are; mortar properties, fiber volume and type, and fiber alignment. The fiber - matrix interface characteristic (fiber-matrix transition zone) is the most important factor which affects the bond strength. It is well known that the transition zone in the mature composite is quite porous and also filled with CH in direct contact with the fiber surface. These characteristics are similar to the aggregate-matrix interfacial transition zone. The fiber-matrix interface density can be increased by incorporating supplementary cementitious material [2].

1.2 Alccofine

Alccofine is a specially processed product based on slag of high glass content with high reactivity obtained through the process of controlled granulation. Owing to its unique chemistry and ultra-fine particle size, alccofine provides requirement of concrete performance. Alccofine can also be utilized as a high range water reducer to improve compressive and flexural strength. Alccofine is known to produce a high strength concrete and is used in two different ways as a cement replacement, in order to reduce the cement content usually for economic reasons and as an additive to improve concrete properties in both fresh and hardened states [3].

2. OBJECTIVE

The main objective is to study the effect of alccofine (0%, 5%, 10%, 15% and 20%) on two different mix of SIFCON prepared with hooked end steel fiber and crimped roll end steel fiber.

3. MATERIALS AND METHODOLOGY

3.1 Constituent Materials

3.1.1Cement

For this project work Ordinary Portland cement (OPC) of "Dalmia" brand of 53 grade was used.

3.1.2 Fine Aggregate

The fine aggregate used for the study is manufactured sand which is free from deleterious materials and confirms the requirements as per IS: 383-1970.

3.1.3 Water

Portable water in the campus confirming to the requirements of water for concreting as per IS 456:2000 was used throughout the project.

3.1.4 Super Plasticizer

In this study Rheobuild 989 with specific gravity 1.21 was used as super plasticizer. This was obtained from BASF Construction Chemicals (India) Pvt. Ltd.

3.1.5 Steel Fibres

Hooked end steel fibres and crimped roll end steel fibres were obtained from Jeetmull Jaichandlall Pvt.Ltd, Chennai. The length of steel fiber used is 50mm of equivalent diameter 1mm with an aspect ratio of 50.

3.1.6 Alccofine

Alccofine 1203 is a specially processed product based on slag of high glass content with high reactivity obtained through the process of controlled granulation [2]. Alccofine is white coloured powder with ultra-fine particle size. This was obtained from Ambuja Cement Private Limited, Goa.

3.2 Mix Proportion

`There is no reliable standard for SIFCON. The Steel fiber is limited to 8%.

Table-1: Mix Proportion of SIFCON

Materials	Quantity
Cement	1
Fine Aggregate	1
Water-Cement Ratio	0.45
Super Plasticizer	1.5%
Volume of Fiber	8%

3.3 Testing Procedure

The compressive test is carried out on specimens cubical in shape having a size of 150x150x150mm. The compression tests were conducted after 28 days. The cube specimen was tested on compression testing machine of capacity 2000kN. Flexural strength is a measure of an

unreinforced concrete beam or slab to resist failure in bending. It is measured by loading 100 x 100 mm x 500mm concrete beams with a span length of at least three times the depth. Beam specimens were tested at 28 day to obtain the flexural strength of concrete.

Fig-1: Test Setup for Compressive Strength Test

4 EXPERIMENTAL RESULTS

4.1 Compressive Strength Test Results

The following table and graphs gives the overall results of compressive strength for SIFCON with hooked end steel fiber and hooked end steel fibres.

Table-2: Compressive Strength of Cube

S. No.	Alccofine (%)	Compressive Strength (N/mm^2)	
		28Day	
		CR	HE
1	0	56.2	54.33
2	5	60.15	56.00
4	10	68.00	59.00
5	15	70.50	62.15
6	20	57.50	55.00

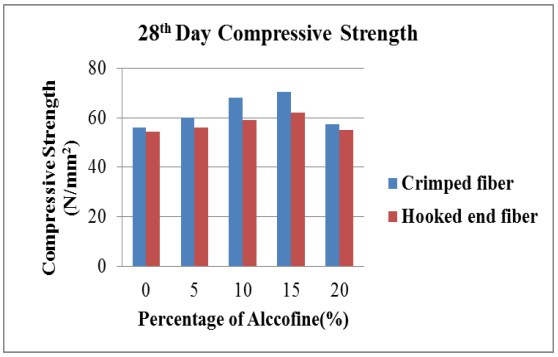

Chart 1-: Variation of Compressive Strength at 28th Day

Compressive strength of SIFCON is highest at 15% alccofine. The compressive strength of crimped fiber is 15% more than hooked end steel fiber.SIFCON with crimped roll end fiber at 15% alccofine has 25% more compressive strength than control mix. SIFCON with hooked end fiber at 14% alccofine has 15% more compressive strength than control mix.

4.2 Flexural Strength Test Results

The following table and graphs gives the overall results of flexural strength for SIFCON with hooked end steel fiber and hooked end steel fibres.

Table -3: Flexural Strength of Beam

S.No.	Alccofine (%)	Flexural Strength (N/mm^2)	
		28Day	
		CR	HE
1	0	30.25	28.00
2	5	32.50	31.50
4	10	39.00	34.50
5	15	44.00	39.50
6	20	31.00	29.00

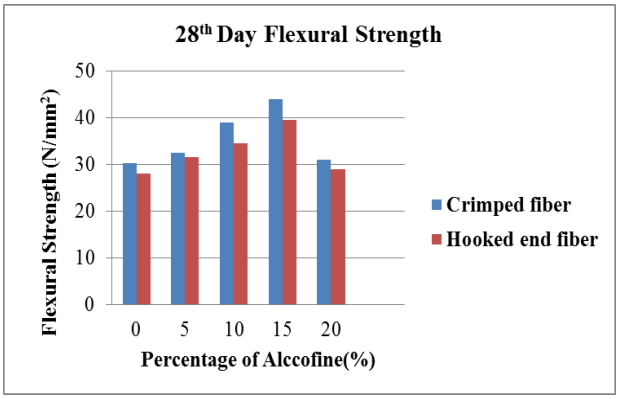

Chart 2-: Variation of Flexural Strength at 28th Day

5. CONCLUSION

This study deals with an experimental research carried out to investigate various mechanical properties of slurry infiltrated fiber concrete (SIFCON) with Alccofine. The following conclusions were derived based on the obtained results.

- The optimum replacement of alccofine in SIFCON is 15%.
- It is found that compressive strength of SIFCON with crimped roll steel fiber is 14%

more than hooked end fiber at 15% alccofine.

- SIFCON with crimped roll end fiber gives 12% more flexural strength than that of hooked end fiber at 15% alccofine.
- SIFCON with Crimped steel fiber shows better result because of its waved shape which inter-lock to each other and with mortar matrix.
- The filling effect of alccofine, particle size, and pozzolanic reaction with $Ca(OH)_2$, are main factors which affects the strength. Thus the mortar matrix become smoother thus fills the fiber network properly thereby increasing bond between fiber and mortar matrix.

REFERENCES

[1] Balaguru, P.M., and Kendzulak, J., *"Mechanical Properties of Slurry Infiltrated Fiber Concrete (SIFCON),"* Fiber Reinforced Concrete Properties and Applications, SP-105, American Concrete Institute,Detroit, Michigan, 1987, pp.247-268.

[2] Çağlar Yalçınkaya, Ahsanollah Beglarigale, Halit Yazıcı '*The effect of metakaolin and end type of steel fiber on fiber-SIFCON matrix bond characteristics* ' Usak University Journal of Material Sciences April 2014,Vol 67,PP 97 – 105

[3] Mahammed Tofik Y. Patel, Prof. A.R.Darji, Prof. B.M.Purohit' *Study on Mechanical properties of High Performance Concrete with Alccofine and Waste Glass Powder*' International Journal for Scientific Research & Development, March 2014,Vol 2,PP598-601

[4] Metin Ipek , Mecbure Aksu, Kemalettin Yilmaz, Mucteba Uysal,' *The effect of pre-setting pressure on the flexural strength and fracture toughness of SIFCON during the setting phase'* Journal of Construction and Building Materials, July 2014,Vol 66,PP 515-521.

[5] Vinaykumar M *'Behaviour of SIFCON produced with hybrid fibres under acidic attack'* International journal of Engineering Research, September 2014,Vol 4,PP 46-56

[6] Sadat Ali Khan ,Dr. K. B. Prakash *'Behaviour of SIFCON produced with hybrid fibres under sulfate attack'* International journal of Engineering Research August 2014,Vol 4,PP 154-164

[7] Suthar Sunil B , B. K. Shah *'Study on Strength Development of High Strength Concrete Containing Alccofine and Fly-Ash'* Indian Journal of Research March 2013,Vol 5,PP 103-105

[8] Ahsanollah Beglarigale, Halit Yazıcı *'The effect of alkali–silica reaction on steel fiber–matrix bond characteristics of cement based mortars'* Journal of Construction and Building Materials, march 2013,Vol 47,PP 845-850

[9] B.Abdollahi ,M. Bakhshi , Z. Mirzaee, M. Shekarchi, M. Motavalli *'SIFCON strengthening of concrete cylinders in comparison with conventional GFRP confinement method'* Journal of Construction and Building Materials February 2012,Vol 33,PP 765–778