



Behaviour of Slurry Infiltrated Hybrid Fiberreinforced Concrete Subjected to Acidic Attack

M. Guruprasad, A.Priyanka, Tipraj, N.Prabhanan, G.Swamy yadav

Abstract: In the present study attempt is made to study the slurry of cement and sand in a proportion of 1:1 was prepared with a water cement ratio of 0.35 SIFCON. Fibers were placed randomly in concrete cubes. Vibration was externally applied with vibrating table after the mould is fully filled. Specimens were kept curing for 60 days in an acidic media and characteristics were studied. Compression strength, splitting tensile strength, flexural strength, Shear strength and impact strength characteristics were studied in the present experimental investigations. It is been found that by adding fibers the characteristics of concrete are increased considerably. In this research work attempts were made to know about weight loss in slurry infiltrated hybrid fiber reinforced concrete subjected to acid attack for different combination and results here compared with respect to the monofibers and hybrid fibers. The Growth in major construction is mainly focusing on fixing problems of improving the efficiency of building industry, economy, and optimum utilization of material and power resources. Due to different property of concrete it will give a variety of new designs. Apart from its flexibility in its use it can be given any shape and other properties such as compressive strength, low thermal conductivity, stiffness etc it is best material for the construction.. To increase its tensile strength fiber are reinforced.

Keywords: Fiber reinforcement, Compression strength, Split tensile strength and impact strength test.

I. INTRODUCTION

Concrete is the widely used material in today's life. For past two decades, the research work has improved compressive strength of concrete substantially but there was no noticeable. Improvement in either of its tensile strengths or extensibility

For past two decades, the research work has improved. Compressive strength of concrete substantially but there was no noticeable improvement in either of its tensile strengths or extensibility. Development of new type of concrete with improved performance will be very important issue for the whole building industry in the near future. Reinforcement of concrete with randomly distributed short fiber improves the toughness of cementitious materials by preventing or controlling the institution, propagation and coalescence of cracks A.Siva Krishna "Design & testing of Fly-ash based Geo Polymer Concrete" International Journal of Civil Engineering & Technology[1].

The lack of strength in tensile and poor fracture toughness ill create serious issues in the cement based material these drawback not only effects the structural design but also effects the long term durability of the structure. These drawbacks can be countered by using the fiber reinforcement in the concrete which will play a vital role in improving the tensile and fracture toughness, impact resistance etc. Tipraj, et al, "Experimental Study on Strength of Concrete by Partial Replacement of Cement by Nano Silica and Fly Ash" [2]. Fiber resists the nucleation of cracks by acting as stress-transfer bridges, and once cracks originate, fiber prevent their propagations by providing crack tip plasticity and increased fracture toughness. The idea of fiber hybridization has gained much attention lately. In a hybrid fiber technology, two or more different types of fiber are rationally combined to produce a composite that derives benefits from each of the individual fiber and exhibits a synergistic response Selina Ruby.et al "Study on Performance of HFRC flexural member under cyclic loading" International Journal of Science, Engineering and Technology[3]. A hybrid fiber composite is formed by mixing of different fiber material which has got different material properties which will be present as bonding material when added in concrete & its properties, characteristics will be intact. These composite maintain an interface between different components and act in concrete which will not be done by any other genuine compounds acting individually.

SIFCON which is an acronym and stands for slurry infiltrated fiber concrete. It has been first proposed by Lankard in 1979 from the New Mexico Engineering Research Institute (NMERI) and has been further improved by others.

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Opposite to conventional fiber reinforced concrete, Usually sifcon creates problem when it is used in excess that it cannot be mixed further due to high % of fiber some time it's termed as "High volume fibrous concrete" the fiber content usually ranges in between 4 to 20 % and it depends on the shape of fibers and type of application. The matrix of sifcon consists of cement slurry or cement mortar with high workability as compared regular concrete. The method of placing the fiber and making the matrix to penetrate at the bottom of the mould is a new thing which can be optimized together with the proper type of fibers. The tests have shown that the set of a sifcon matrix or over reinforced concrete will give higher ductility value and impact strength to the concrete, it also reduces the crack width in the tensile zone of the concrete specimen at least by order when compared to the plane concrete matrix it also increases the plasticity in the compression zone but a high workability need to be provided for this a high value of water reducing admixture (Super plasticizers) may be used for improving the following characteristics of sifcon.

II. MATERIALS

A. Cement

Ordinary Portland cement (OPC) 43 grade conforming to IS: 8112 – 1989 Penna brand was used for all slurry mix. The cement used was fresh and without any lumps. The physical properties of cement are mentioned in table no. I.

Table- I: Cement Physical Properties

Type of Test	Result
Normal Consistency	30%
Initial Setting Time	35 minutes
Final Setting Time	9.45 hours
Specific gravity of cement	3.15

B. Fine Aggregates

Locally available sand of specific gravity and zone of 2.60 and Zone II respectively was used and it is conforming to IS:383:1970.

C. Fiber Reinforcement

- *Steel fibers (SF)*: Steel fiber of thickness 1 mm, length 35 mm and density of 7850 kg/m³ was used in experimental investigation.



Steel fiber

- *Polypropylene fiber (PPF)*: Polypropylene fiber of thickness 1 mm, length 35 mm and density of 90 kg/m³ was used in experimental investigation.



Polypropylene fiber

- *High density polyethylene fiber (HDPE)*: Steel fibers of thickness 1 mm, length 35 mm and density of 1189.4 kg/m³ was used in experimental investigation.



Fig. 3. HDPE fiber

- *Waste plastic fiber (WPF)*: Steel fiber of thickness 1 mm, length 35 mm and density of 1141.5 kg/m³ was used in experimental investigation.



Fig. 4. Waste Plastic fibre

III. METHODOLOGY

Slurry of cement and sand in a proportion of 1:1 was prepared with a water cement ratio of 0.35 SIFCON.



Fibers were placed randomly in concrete cubes. Vibration was externally applied with vibrating table after the mould is fully filled. Specimens were kept curing for 60 days in a acidic media and characteristics were studied. Weight loss, Compression, splitting tensile, flexural, Shear and impact strength characteristics were studied in the present experimental investigations.

IV. RESULTS AND DISCUSSIONS

A. Weight loss

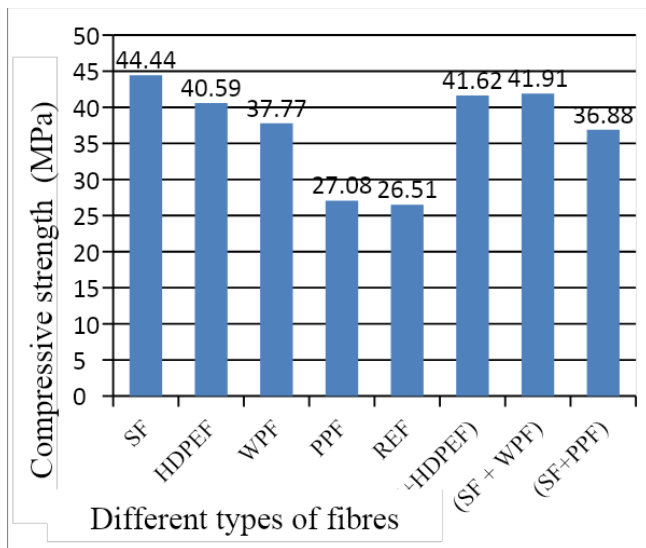
A weight loss result of slurry infiltrated hybrid fiber reinforced concrete subjected to acidic attack for various combinations is given in Table-II.

Table- II: Summary of Weight loss

Description of Concrete		Average percentage of weight loss	Percentage increases of weight loss with respect to reference mix
SIFCON with mono fibers	SF	0.86	-25.86
	HDPEF	0.95	-18.10
	WPF	0.98	-15.52
	PPF	1.02	-12.06
	REF	1.16	0.00
SIFCON with hybrid fiber	(SF+HDOEF)	0.90	-22.41
	(SF+WPF)	0.86	-25.86
	(SF+PPF)	0.82	-29.31

B. Compression strength results

The variations of compression strength results of slurry infiltrated hybrid fiber reinforced concrete subjected to acidic attack for various combinations as shown in Fig. 5.



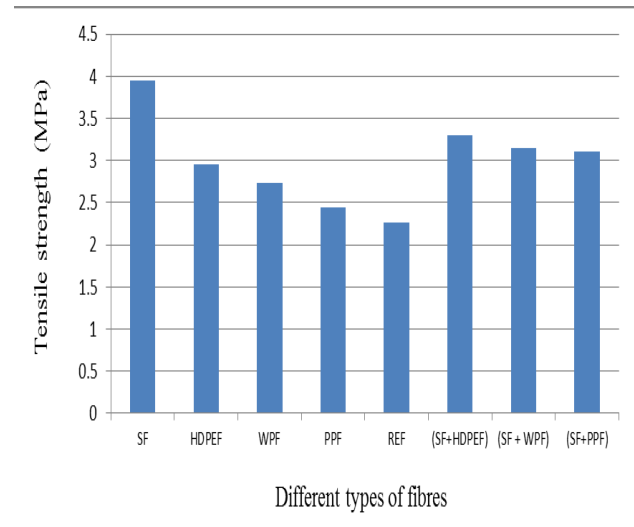
Graph. 5. Compressive strength results

1. It is observed that the compressive / tensile / shear / flexural / impact strength of slurry infiltrated mono fiber reinforced concrete and slurry infiltrated hybrid fiber reinforced concrete are higher as compared to the reference concrete without fibers when subjected to acidic attack. This distinctly indicates that slurry infiltrated mono fiber reinforced concrete and slurry infiltrated hybrid fiber reinforced concert have better resistances to acidic attack.

2. It is observed that the compressive strength of slurry infiltrated hybrid fiber reinforced concrete are higher as compared to slurry infiltrated mono fiber reinforced concrete when subjected to acidic attack. Slurry infiltrated hybrid fiber reinforced concrete with combination (SF+HDPEF), (SF+WPF), (SF+PPF) show 56.99%, 58.09%, and 39.11% increase in the compressive strength respectively as compared to their corresponding mono fiber reinforced concrete.

C. Tensile strength results

The variations of Tensile strength results of slurry infiltrated hybrid fiber reinforced concrete subjected to acidic attack for various combinations as shown in Fig. 6.



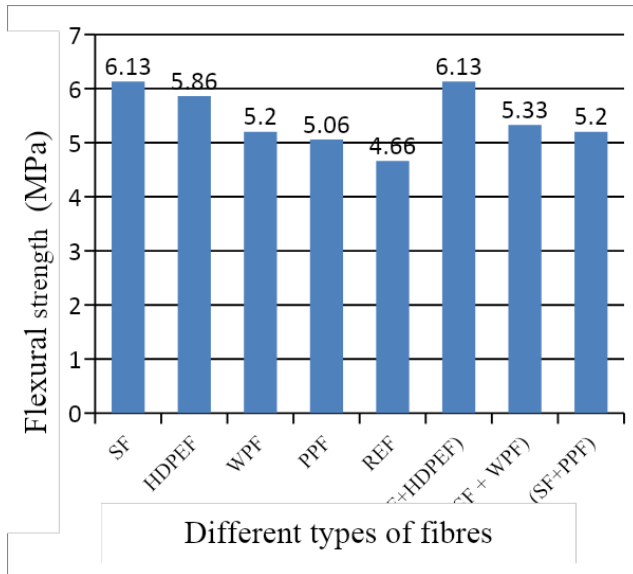
Graph 6. Tensile strength results

1. It is observed that the tensile strength of slurry infiltrated hybrid fiber reinforced concrete are higher as compared to slurry infiltrated mono fiber reinforced concrete when subjected to acidic attack. Slurry infiltrated hybrid fiber reinforced concrete with combination (SF+HDPEF), (SF+WPF), (SF+PPF) show 46.01%, 39.38%, and 37.61% increase in the tensile strength respectively as compared to their corresponding mono fiber reinforced concrete.

D. Flexural strength results

The variations of Flexural strength results of slurry infiltrated hybrid fiber reinforced concrete subjected to acidic attack for various combinations as shown in Fig. 7.

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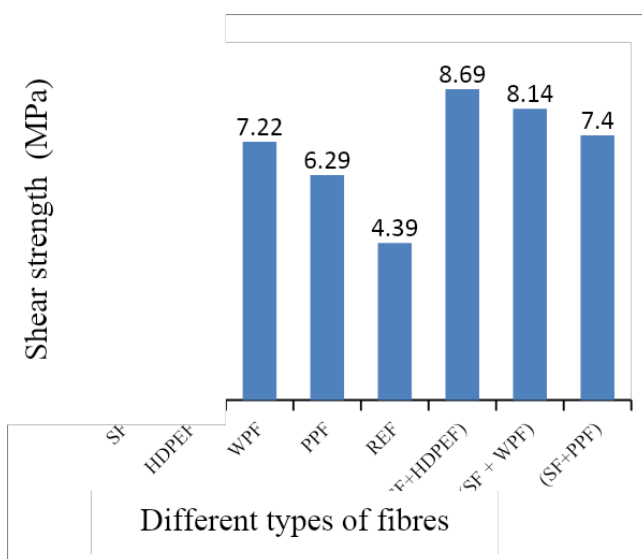


Graph 7. Flexural strength results

- It is observed that the flexural strength of slurry infiltrated hybrid fiber reinforced concrete are higher as compared to slurry infiltrated mono fiber reinforced concrete when subjected to acidic attack. Slurry infiltrated hybrid fiber reinforced concrete with combination (SF+HDPEF), (SF+WPF), (SF+PPF) show 31.54%, 14.37%, and 11.58% increase in the flexural strength respectively as compared to their corresponding mono fiber reinforced concrete.
- It is observed that the compressive / tensile / shear / flexural / impact strength of slurry infiltrated hybrid fiber reinforced concrete made up of (SF+HDPEF) is higher as compared to (SF+WPF) and (SF+PPF) when subjected to acidic attack.

E. Shear strength results

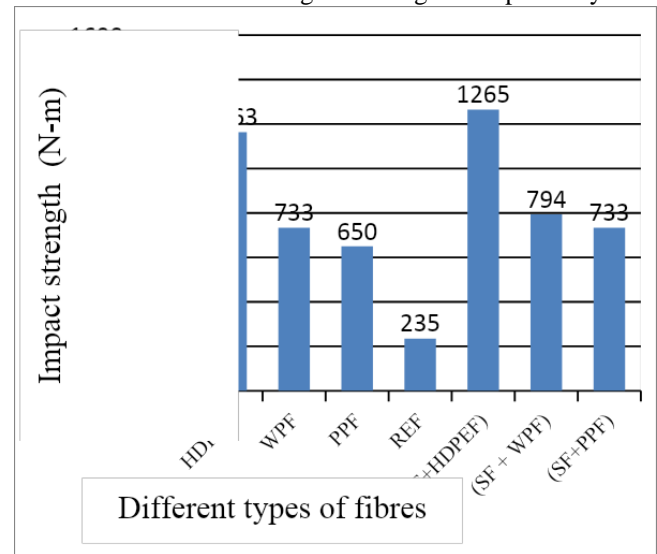
The variations of Shear strength results of slurry infiltrated hybrid fiber reinforced concrete subjected to acidic attack for various combinations as shown in Fig. 8.



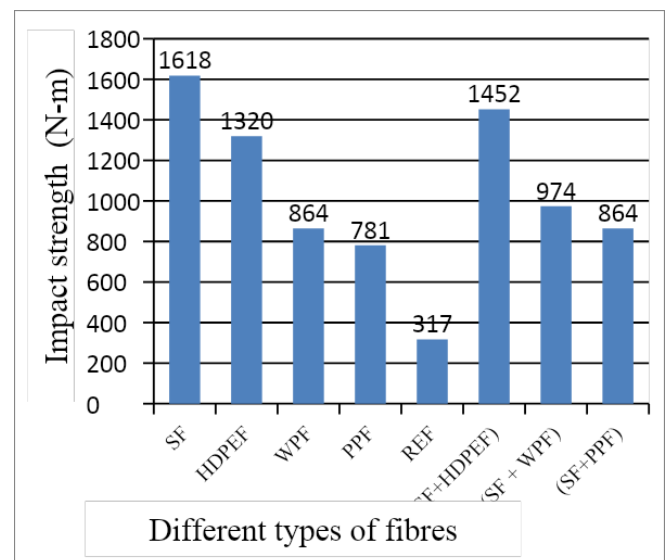
Graph 8. Shear strength results

F. Impact strength results

The variations of impact strength results of slurry infiltrated hybrid fiber reinforced concrete subjected to acidic attack for various combinations for first crack and final failure as shown in Fig. 9 and Fig. 10 respectively.



Graph 9. Impact strength for first crack results



Graph 10. Impact strength for strength final crack results

V. CONCLUSIONS

Following conclusions may be drawn based on experimental results obtained on the behavior of slurry infiltrated hybrid fiber reinforced concrete subjected to acidic attack.

- Slurry infiltrated mono fiber reinforced concrete and slurry infiltrated hybrid fiber reinforced concrete show better resistances to acidic attack.
- The slurry infiltrated hybrid fiber reinforced concrete show better resistance to acidic attack than that of slurry infiltrated mono fiber reinforced concrete.

3. Slurry infiltrated hybrid fiber reinforced concrete made up of (SF+HDPEF), shows higher resistances to acidic attack. The order of preference with respective acidic attack may be written as (SF+HDPEF), (SF+WPF), (SF+PPF).
4. The slurry infiltrated hybrid fiber reinforced concrete may be recommended in the construction of structures which are likely to be attacked by acidic media.

REFERENCES

1. A.Siva Krishna "Design & testing of Fly-ash based Geo Polymer Concrete" International Journal of Civil Engineering & Technology (IJCIET) Volume 8 Issue 5 May, 2017.
2. Tipraj, E. Laxmi Prasanna, N. Prabhanjan, A. Shiva Krishna, M. Guru Prasad, "Experimental Study on Strength of Concrete by Partial Replacement of Cement by Nano Silica and Fly Ash", International Journal of Civil Engineering and Technology (IJCIET) 9(11), 2018, pp. 1763-1771.
3. Selina Ruby.G Muthu Priya.P Venkatasubramani.R "Study on Performance of HFRC flexural member under cyclic loading" International Journal of Science, Engineering and Technology Research (IJSETR), Volume 3, Issue 5, May 2014.
4. Selina Ruby G Geethanjali C Jaison Varghese Muthu Priya P "Influence of Hybrid Fiber on Reinforced Concrete". International Journal of Advanced Structures and Geotechnical Engineering ISSN 2319-5347, Vol. 03, No. 01, January 2014.
5. MD Ikramullah Khan, M Sravanthi, E LaxmiPrasanna, "An experimental study of the mechanical properties of s glass fiber reinforced high strength concrete partially replacing cement with nano silica", Volume 9, Issue 4, April 2018, pp. 1398-1409.
6. Shaik khader vali baba and Sandela hariPriya, 2017. performance analysis of black cotton soil treated with granite dust and lime. International Journal of Civil Engineering and Technology (IJCIET), Volume:8, Issue:10, Pages:1341-1350.
7. Priti. A.Patela, Atul K.Desai, Jatin. Desai. A "An investigation on properties of various fiberreinforced concretes" International Journal of Advanced Engineering Research and Studies (IAERS), Vol. II, Issue I Oct.-Dec., 2012 PP.36-38.
8. Sadat Ali Khan Prakash.K.B "Behaviour of SIFCON produced with hybrid fiber under sulfate attack" International Journal of Engineering Research-online vol.2., issue.4, 2014.
9. Tamil Selvi.M, Thandavamoorthy.T.S "Studies on the Properties of Steel and Polypropylene FiberReinforced Concrete without any Admixture" International Journal of Engineering and Innovative Technology (JEIT) Volume 3, Issue 1, July 2013.
10. Ahsana Fathima. K.M, Shibi Varghese "Behavioural study of steel fiber and polypropylene fiber reinforced concrete" International Journal of Research in Engineering & Technology (IJRET) Vol. 2, Issue 10, Oct 2014, PP. 17-24.



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