American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-5, Issue-10, pp-72-75
www.ajer.org
Research Paper Open Access

Influence of Mineral Admixture (Alccofine-1203) On the Properties of Hybrid Fiber Reinforced Concrete

Manisha M. Magdum[1], Dr. V. V. Karjinni[2]
[1](Research scholar, Shivaji University, Kolhapur, India)
[2](Principal, KIT's College of Engineering, Kolhapur, India)

ABSTRACT: *The contribution of mineral admixture i.e.Alccofine-1203 to the mechanical properties of hybrid fiber reinforced concrete with high strength and workability is investigated. It reduces thermal, shrinkage cracks and increases strength as compared to conventional concrete. Fiber volume fraction (VF) 1.5% by volume of concrete was added with Alcoffine-1203 contribution of 5%, 7.5% and 10% by weight of cement. Hybrid fibers contribute to increase the flexural strength while the Alccofine-1203 boosts the compressive strength of concrete.*
Keywords: *Mineral admixture, Alccofine-1203, Compressive strength, Flexural strength, Hybridfiber reinforced concrete*

I. INTRODUCTION

It is well known that concrete is a brittle material under tensile loading. The mechanicalproperties of concretecan improved by randomly oriented discrete fibers, whichprevent or control initiation, propagation, or coalescence of cracks [6].The conventional concrete consisting hardened cement paste and aggregates has micro cracks and porosity. These are among the intrinsic factors, which can overcome by using fibers reinforcement. According to Bentur and Mindess [2], the attractive advantage of hybrid fibers system,which consists of both variety of stiffer and flexible fibers. Stronger and stiffer fibers improvesthe first crack stress and ultimate strength while flexible and ductile fibers leads to improve toughness and strain capacity in thepost-cracking.Incorporating the hybridization of two or three different types offibers in acement system, results in a composite behavior with higher engineering performance and bettermechanical properties [3].

The objective of this study was to evaluate the mechanical properties of fiber reinforced concrete, containing hybrid fibers mixture of steel fibers and non-metallic polypropylene fibers. The total dosage of fibers maintained as 1.5% by volume of concrete with Alccofine-1203 contribution of 5%, 7.5% and 10% by weight of cement to provide good workability as recommended in literature review [3]. A comparative evaluation of various hybrid fibers concretewas made based on hardened concrete properties –compressive strength and flexural strength.

II. MATERIALS AND MIX DESIGN

Several experimental works carried out to achieve the objective of the current study along with various mechanical properties such as compressive strength and flexural strength. High strength concrete (M60 – Cube strength of 60MPa) is normallyprepared for longer service life and less maintenance. Hybrid fibers (steel fibers and polypropylene fibers) used to increase the ductility, strength and makes crack resistance while the mineral admixture (Alccofine-1203) used to boostcompressive strength [9].ACI method was used to prepare high strength concrete mixture [1].

Ordinary Portland cement 53 grade was used for the concrete mixtures. Alccofine-1203 obtained from Ambuja cement, India and used for the high strength concrete mixtures [9]. River sand conforming to zone I with a specific gravity of 2.6 was used as the fine aggregate, while crushed aggregate of specific gravity 2.7 was used as coarse aggregate [8]. A super plasticizer was added to obtain the desired workability. Dramix glued hooked steel fibers and Strongcrete polypropylene fiberswere used as hybrid fibers.

Trial mixtures were prepared to obtain compressive strength of 60 MPa at 28 days, along with a workability of 50– 75 mm. In order to obtain the desired workability, super plasticizer was added. The detailed mixture proportions for the study are presented in Table 1.

Table 1: Concrete mixture proportions used in the study

Cementitious material (kg/m^3)	Alccofine-1203 (kg/m^3)	Fine aggregate (kg/m^3)	Coarse aggregate (kg/m^3)		Water (kg/m^3)	Superplasticizer (kg/m^3)
			10mm	20mm		
575	28.75 (5%)	655	392	588	190	3.45
	43.125 (7.5%)					
	57.5 (10%)					

III. EXPERIMENTAL WORK

3.1 Test for compressive strength of concrete (IS: 516-1959): Out of many testsconducted, this is the utmost important which gives an idea about all the characteristics of concrete. For this test 150mm x150mm x150mm size specimens were used. The concrete cubes were tested on compression testing machine of capacity 2000kN. The load was applied to opposite sides of specimen.The load at which concrete cube was failed, considered as ultimate load and noted.The compressive strength was obtained byCompressive strength = P/A
Where,
P = Cube compressive load causing failure in N (Newton),
A = Cross sectional area of cube in mm.
The average of no. of specimen strength is calculated and it was taken as compressive strength of one set [7].

3.2 Test for flexural strength of concrete (IS: 516-1959): Flexural strength also known as modulus of rupture, a mechanical parameter for brittle material is defined as a material ability to resist deformation under load. The flexural strength represents the highest stress experienced within the material at its moment of rupture. For this test 100mm x100mm x500mm size specimens were used. The specimens were tested by using universal testing machine. The load at which control specimen ultimately fails is noted.The flexural strength is calculated by Flexural strength = $pl/bd2$(MPa)
Where,P= maximum load in N,
l=Length between the support in mm, d= Depth of specimen in mm, b = Width of specimen in mm [7].

IV. RESULTS AND DISCUSSION

Table 2: Compressive strength test results for cube specimens

Sr. no	Specimen no.	Alccofine-1203 (%) by wt. of cement	Total fiber Volume Fraction (%)	Steel fibers (%)	Polypropylene fibers (%)	Compressive strength (MPa)	Average compressive strength (MPa)
1	5C6	5	1.5	100	0	69, 67, 65	67
2	5C7			90	10	65, 63, 62	63.33
3	5C8			80	20	63, 62, 66	63.67
4	5C9			70	30	61, 59, 60	60
5	5C10			60	40	55, 54, 56	55
6	7.5C1	7.5	1.5	100	0	70,68,70	69.33
7	7.5C2			90	10	69,66,64	66.33
8	7.5C3			80	20	68,72,71	70.33
9	7.5C4			70	30	61,63,67	63.67
10	7.5C5			60	40	67,63,61	63.67
11	10C21	10	1.5	100	0	69, 70,65	68.33
12	10C22			90	10	69, 70, 66	68.33
13	10C23			80	20	69, 72, 70	70.33
14	10C24			70	30	63, 66, 64	64.33
15	10C25			60	40	66, 70, 68	68

Table 3: Flexural strength test results for beam specimen

Sr no.	Specimen no	Alccofine (%) by weight of cement	Total fiber volume fraction (%)	Steel fiber (%)	Polypropylene fiber (%)	Flexural strength (MPa)	Average flexural strength (MPa)
1	5B6	5	1.5	100	0	8.5,8.6,8.5	8.53
2	5B7			90	10	8.2, 8.1	8.15
3	5B8			80	20	7.90,7.22,7.4	7.51
4	5B9			70	30	7.1,7.6,7.8	7.5
5	5B10			60	40	7.6,7.2,7.38	7.39
6	10B21	7.5	1.5	100	0	8.42,8.23,8.3	8.31
7	10B22			90	10	7.96,7.2,7.6	7.59
8	10B23			80	20	8.4,8.6,8.91	8.64
9	10B24			70	30	7.26,7.13,6.8	7.06
10	10B25			60	40	6.72,6.1,6.2	6.34
11	10B26	10	1.5	100	0	6.9, 7.5, 7.32	7.24

12	10B27			90	10	7.2,5.8,6.7	6.56
13	10B28			80	20	7.1,5.9,6.3	6.43
14	10B29			70	30	5.78,5.9,5.7	5.79
15	10B30			60	40	5.4,5.2,5.24	5.28

Table 4: Average compressive strength test results for 1.5% hybrid fibers

For 1.5% hybrid fibers		Avg. compressive strength in MPa		
Mix number	% fibers contribution	5% Alccofine-1203	7.5% Alccofine-1203	10% Alccofine-1203
1	100-0	67	69.33	68.33
2	90-10	63.33	66.33	68.33
3	80-20	63.67	70.33	70.33
4	70-30	60	63.67	64.33
5	60-40	55	63.67	68

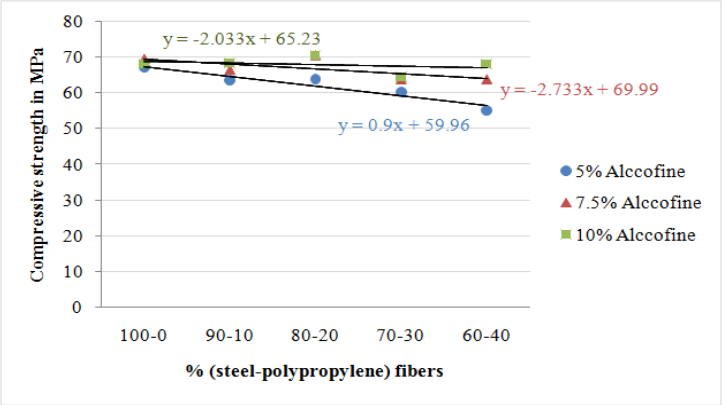

Fig 1: Variation of compressive strength for 1.5% hybrid fibers

Table 5: Average flexural strength test results for 1.5% hybrid fibers

For 1.5% hybrid fibers		Avg. flexural strength in MPa		
Mix number	% fibers	5% Alccofine-1203	7.5% Alccofine-1203	10% Alccofine-1203
1	100-0	8.53	8.31	7.24
2	90-10	8.15	7.59	6.56
3	80-20	7.51	8.64	6.43
4	70-30	7.5	7.06	5.79
5	60-40	7.39	6.34	5.28

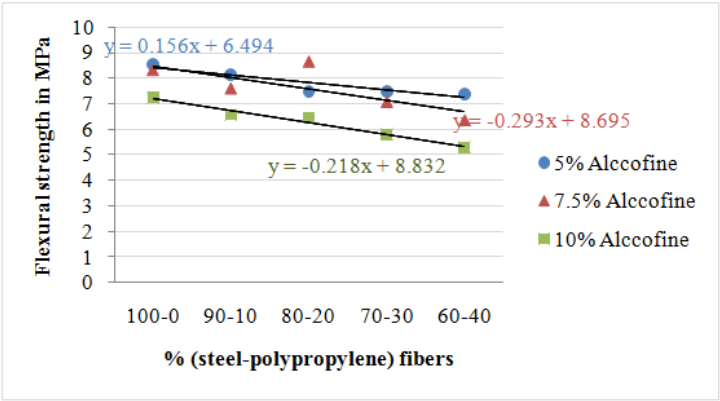

Fig 2: Variation of flexural strength for 1.5% hybrid fibers

The primary objective of this study was to evaluate the action of hybrid fibers at different volume fractions to obtain a good post-peak behavior of high strength concrete. Results from the study indicate following observations:

- Compressive strength was found to be increasedwith increase in percentage of mineral admixture alccofine-1203 and noted maximum in case of 10%.
- Flexural strength of concrete was found maximum when we used 1.5% of fiber volume fraction (80% steel fiber and 20% polypropylene fiber) by weight of cement.

V. CONCLUSION

This paper presents influence of mineral admixture (Alccofine-1203) on mechanical properties of hybrid fiber reinforced concrete. The mechanical properties of the concrete mixtures were evaluated based on compressive and flexural strength.The following conclusions were drawn from the study:

- Experiments with M60 grade of concrete suggest that 7.5% replacement of cement with Alccofine-1203 and 1.5% hybrid fibers(80% steel fiber and 20% polypropylene fiber) resulted in best concrete compressive strength. Compressive strength was increased with increase in percentage ofAlccofine-1203.
- The flexural strength of concrete with 7.5% replacement of cement with Alccofine-1203and 1.5% hybrid fibers (80% steel fiber and 20% polypropylene fiber)resulted in maximum.
- It isrecommended to use Alccofine-1203in concrete as replacement for cement is possible.
- The results indicated that the use of hybrid fibers with Alccofine-1203 enhance the mechanical properties of concrete.

REFERENCES

Journal Papers:

[1]. ACI 211.4R:1993, *Method for mix design of high strength concrete*

[2]. Bentur A. andMindess S., *Fibers Reinforced Cementitious Composites*, 2nd ed. 2007, Taylor & Francis.

[3]. Bing Chena and Juanyu Liub, *Contribution of hybrid fibers on the properties of the high-strength lightweight concrete having good workability*, Cement and Concrete Research, 2005,Vol. 35, pp.913–917

[4]. Burcu Akcay and Mehmet Ali Tasdemir, *Mechanical behaviour and fibre dispersion of hybrid steel fibre reinforced self-compacting concrete*, Construction and Building Materials,2012,Vol. 28, pp.287–293

[5]. F. Burak, S. Turkel& Y. Altuntas, *Hybird fibers reinforced self-compacting concrete with high-volume coarse fly ash*, Const. & Build. Material. **21**, 150-156, 2007.

[6]. IS: 516-1959 Indian standard code for methods of tests for strength of concrete. Bureau of Indian Standards, New Delhi.

[7]. IS 383:1970,*Indian Standard Specification for Coarse and Fine aggregates from natural source for concrete*, Bureau of Indian standards, New Delhi

[8]. IS 12089:1987,Indian Standard Specification for granulated slag for manufacture of Portlandslag cement., Bureau of Indian standards, New Delhi.