International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 04 | Apr-2018 www.irjet.net p-ISSN: 2395-0072

A STUDY ON SILICA FUME IMPREGNATED HYBRID FIBRE REINFORCED CONCRETE

C.NAVEEN KUMAR[1], P.ESWARAMOORTHI[2]

[1] *M.E. Structural Engineering "Builders Engineering College" kangayam, Tamilnadu, India*
[2] *Assistant Professor/CIVIL "Builders Engineering College" kangayam ,Tamilnadu, India*

Abstract - *Plain concrete has low tensile strength, less ductility, destructive and brittle failure. In order to improve these properties of plain concrete, an attempt has been made to study the effect of addition of polypropylene fibre, coir fibre in the weight of Ordinary Portland Cement and also replacement of silica fume in weight of Ordinary Portland Cement for concrete. In this experimental investigation polypropylene fibre, coir fibre in different percentage from 0 to 2% additional with weight of cement and also silica fume in different percentage from 0 to 20 % replacement with weight of cement will be studied for the effect on mechanical properties like compressive strength, split tensile strength and flexural strength for M40 grade of concrete at 3, 7, 28 days.*

Key Words: **Polypropylene fibre, Coir fibre , Silica fume.**

1. INTRODUCTION

Strength and durability are often considered as the most important criteria in concrete structure designs. Concrete is recognized to be a relatively brittle material when subjected to normal stresses and impact loads, where tensile strength is approximately just one tenth of its compressive strength. As a result for these characteristics, flexural members in concrete could not support such loads that usually take place during their service life. There are a considerable number of existing concrete structures that do not meet their current design standards because of inadequate design and construction. Inadequate performance of this type of structures is a major concern from public safety point of view with an expanding population, and the increase in purchasing potentials, the need of raw materials required for structural strengthening, that would satisfy the demand in world market is rapidly growing. Concrete is relatively strong in compression but weak in tension and tends to be brittle. The weakness in tension could be overcome by the use of conventional rod reinforcement and to some extent by the addition of sufficient weight of fibres and replacement of silica fume. The introduction of fibres is brought to develop concrete with enhanced flexural and tensile strength, which is a new form of binder that enables portland cement in bonding with cement matrices.

For achieving a strong, durable concrete rests in the careful proportioning, mixing and compacting of the ingredients. Numerous tests are performed on wet concrete such as workability tests such as compaction factor test and slump test. The tests on hardened concrete are destructive test it includes compressive test on concrete cube for size (150 x 150 x 150) and split tensile strength on concrete cylinder (150 mm ø x 300mm) as per IS: 516 – 1959, IS: 5816– 1999 and IS: 516 – 1959 respectively.

2 MATERIALS

2.1 CEMENT

Ordinary Portland Cement (OPC) of 53 Grade (DECCAN) is used for the entire investigation.

Table -1 : Properties of Cement

S.NO	PROPERTY	TEST RESULTS
1	Normal Consistency	32%
2	Specific gravity	3.15
3	Setting time • Initial • Final	 35 210

2.2 WATER

Ordinary portable water available in the laboratory was used for experimental investigations and curing purpose.

2.3 FINE AGGREGATE

Locally available river sand is conformed to zone II of table 4 of IS: 383-1970.

Table- 2: Properties of Fine Aggregate

S.NO	PROPERTY	VALUE
1	Sieve analysis	Zone II
2	Specific gravity	2.68

2.4 COARSE AGGREGATE

The size of coarse aggregate depends upon the nature of work. Crushed stones passing through 20mm and retained on 10 mm sieve used as coarse aggregate.

Table- 3: Properties of Coarse Aggregate

S.NO	Property	Value
1	Specific gravity	2.72
2	Water absorption	0.5

2.5 POLYPROPYLENE FIBRE

Addition of Polypropylene fibres to concrete enhances the structure by controlling micro cracks due to shrinkage during curing. In this experimental work fibrillated fibre length is 6 mm and diameter is 0.04 is used.

Table – 4: Properties of polypropylene Fibre

Property	Value
Type Specific gravity (gm/cm3)	0.91
Tensile strength (MPa)	550–700
Length	6 mm
Aspect ratio	150

2.6 COIR FIBRE

Addition of Coir fibres to concrete enhances the structure resist cracking and spalling and also torsion, toughness and tensile strength.. In this experimental work fibre length is 12mm and diameter is 0.10 is used.

Table – 4: Properties of Coir Fibre

Property	Value
Type Specific gravity (gm/cm3)	0.87
Tensile strength (MPa)	210
Length	12mm
Aspect ratio	120

2.7 SILICA FUME

Addition of Micro silica fume to Concrete enhances the strength and can be very durable and also highly resistant to penetration by chloride ions.

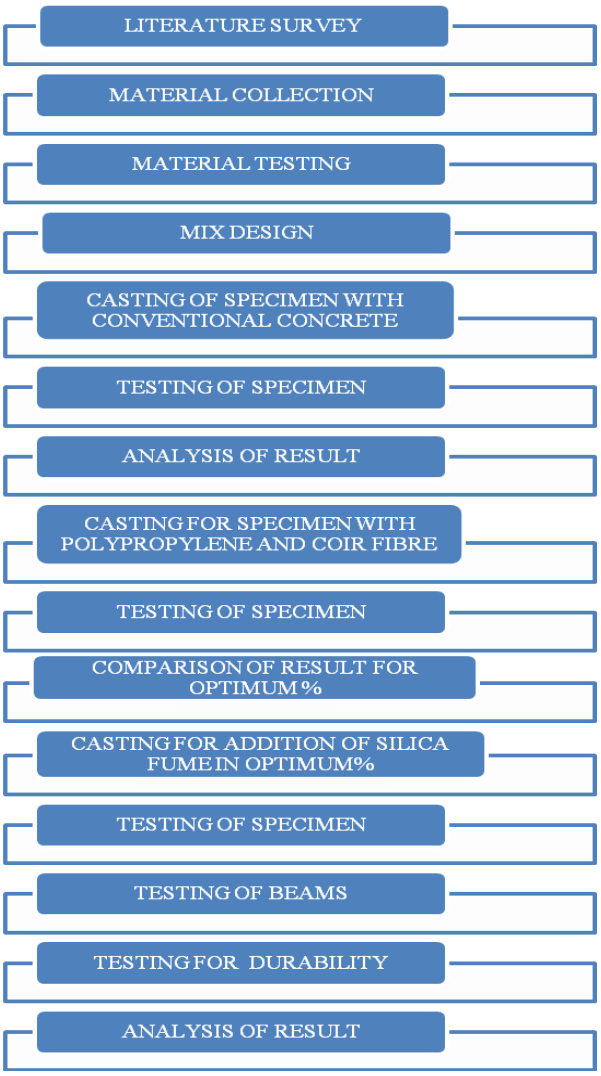
Table -5: Properties of Silica Fume

S. No.	Property	Value
1	Specific gravity	2.22
2	Size	0.1 Micron

2.8 SUPERPLASTICIZER

In this experimental study we have use conplast sp 430 at the optimum dosage level of 1% of cementious material.

3. METHODOLOGY



4. EXPERIMENTAL WORK

4.1 Mix design (As Per IS 10262-2009)

Table - 4.1 Mix Proportions For M40 Grade Of Concrete

Material	Cement	F.A	C.A	Water	SP
In kg/m³	394	683	1239	170.7	3
Ratio	1	1.73	3.14	0.43	0.007

4.2 Casting the specimen

Taking the control mix design as reference weight of materials are calculated. In all the concrete mixes polypropylene, coir fibre was varied in three different ratios (0.5,1.5),(1,1),(1.5,0.5) by addition to weight of cementitious material content and also silica fume was impregnated in the optimum ratio of fibre varies ratio from 5,10,15,20% replacement of weight of cement. Total 145

cubes (150×150×150mm) and 145 cylinders(150mm dia and 300mm length) and 145 prism (500×100×100) and also 3 beam (1200×150×150mm).

4.3 Process of mixing

Weight of all the materials were measured and taken. Measured plasticizer was mixed in water thoroughly. This mixture was added to dry aggregates in step manner and mixed those thoroughly by hand mixing.

4.4 Workability

To determine workability of fresh concrete the following tests were conducted.

- Slump cone test
- Vee-Bee consistometer test
- Compaction factor test

4.5 Casting

The specimen were kept clean and oiled. Ensured that, there should be no gaps in the moulds to avoid the leakage of slurry. Concrete was poured in the mould in three layers and tamping was done thoroughly at every layer. Finally, leveling to the top surfaces of specimens was done. These moulds were kept for drying for 24 hours, after that those were de-moulded and concrete specimens are kept in fresh concrete for curing.

5. RESULT AND DISCUSSTION

5.1 Compressive strength

The Compressive strength of concrete is determined by testing the cubes under compressive testing machine. The result of compressive strength are shown in table 5.1. Maximum compressive strength occurred at Mix 2(coir fibre 1.5, polypropylene fibre 0.5 addition to weight of cement and also replacement of silica fume 10% in weight of cement) and it is results shows higher strength than control mix .

Table -5.1 Results of compressive strength

S.No	Mix No.	Compressive strength(N/mm²)		
		3 days	7 days	28 days
1	Control	24	32	44.12
2	Mix -1	22	32.15	43.55
3	Mix -2	23	33.44	45.88
4	Mix -3	21	31.99	45.33
5	Mix -4	20	29.10	40.99

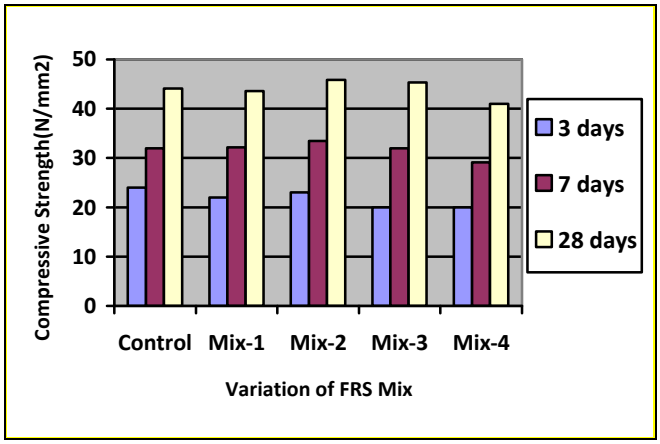


Fig.1. Variation of FRS Mix Vs Compressive strength

5.2 Split Tensile Strength

Split tensile strength was conducted for the cylinders of 150mm dia and 300mm length. The obtained values are tabulated in table 5.2.

Table- 5.2 Results of split tensile strength

S.No	Mix No.	Split Tensile strength(N/mm²)		
		3 days	7 days	28 days
1	Control	1.22	2.33	2.80
2	Mix -1	1.23	2.68	2.82
3	Mix -2	1.25	2.71	2.95
4	Mix- 3	1.21	2.63	2.79
5	Mix- 4	1.19	2.50	2.60

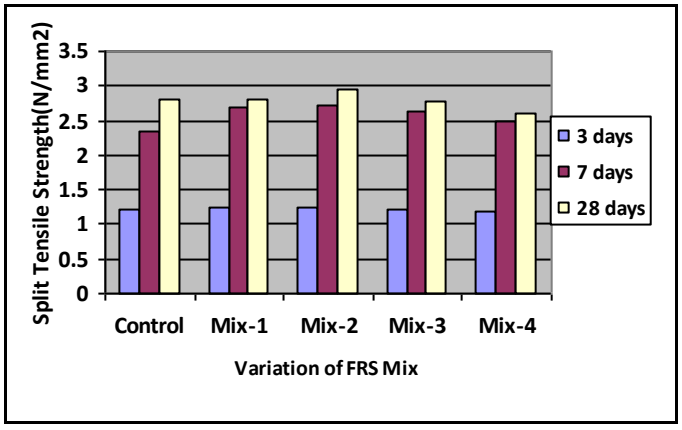


Fig.2.Variation of FRS Mix Vs Split tensile Strength

5.3 Flexural Strength

Flexural strength test was conducted for the prism of 500 length and 150mm height, width. The obtained values are tabulated in table 5.3

Table- 5.3 Results of Flexural strength

S.NO.	Mix No.	Flexural Strength (N/mm²)		
		3 days	7 days	28 days
1	Control	2.5	3.7	5.5
2	Mix -1	2.2	3.9	5.62
3	Mix- 2	2.4	4.1	5.75
4	Mix -3	2.1	3.45	4.62
5	Mix -4	2	3.37	4.25

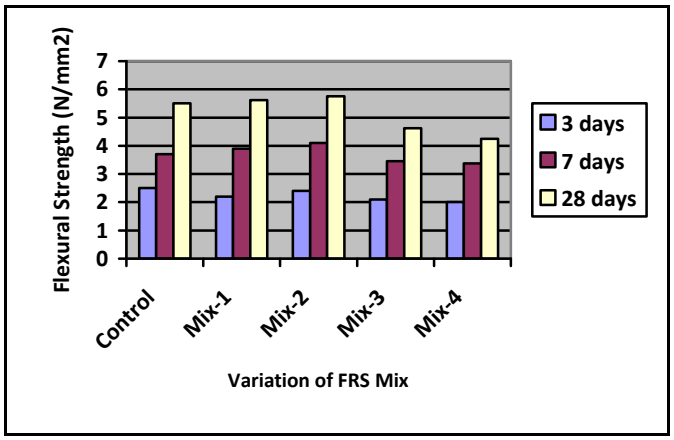


Fig.3.Variation of FRS Mix Vs Flexural Strength

6. CONCLUSION

From the present experimental study the following conclusions are arrived.

1. Compressive strength: At mix 2 slightly increased than control mix. 28 days compressive strength is maximum at mix 2(coir fibre 1.5, polypropylene fibre 0.5 addition to weight of cement and also replacement of silica fume 10% in weight of cement) and the increment of 1.5%.

2. Split Tensile Strength and also flexural strength is same gain at mix 2

3. In that fibre mix 2 optimum value is now 3 beam should be cast and after 28 days ductility can be check.

4. And also Durability process is going on.

7. REFERENCE

1. Anthony Nkem Ede , Adebodun Oluwaseyi Aina (2015) " Effect of Coconut Fibre and Polypropylene Fibre on Fire Resistance of Concrete" International Journal of Engineering Science and Management, Vol. 5, Issue 1:Jan-Mar: 2015,PP. 171-179

2. Amalu Wilson , Navaneetha. B(2016) "Experimental Study On Hybrid Fibre Reinforced Concrete Property Using Silica Fume And Steel Slag" International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, Issue 3, March 2016, PP. 2849-2854

3. Arivudamai.V, R.Velkennedy.R. (2017) "Acid Attack On Hybrid Fiber Reinforced High Strength Concrete With Manufactured Sand and Coconut Shell" Journal Of Advance In Chemistry, ISSN 2321 -807X, Vol.12, No. 27, January 2017, PP. 5825-5828

4. Bhuvana Vijaya.T, Ajitha.B. (2017) "Inclusion of Coir Fibre In High Strength Concrete Blended With Silica Fume" International Journal of Advanced Technology in Engineering and Science, Vol. No.5, Issue No.4, April 2017, PP. 719-730

5. Jasira Bashir, Khushpreet Singh (2017) "Experimental Inquest for Improving the Fire Resistance of Concrete by the Addition of Polypropylene Fibre" International Journal of Civil Engineering and Technology, Vol.8, Issue No.8, August2017,PP.129-1

BIOGRAPHIES

Pursuing M.E- Structural Engineering in Builders Engineering College, Kangayam, Tamilnadu, India.

Assistant Professor/CIVIL, Builders Engineering College, kangayam, Tamilnadu, India.