Influence of Prominent Temperature on the Compressive Strength of Self Compacting Concrete

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Abstract

In an extensive research scenario, the self-compacting concrete influence a major role in the advanced construction technology which gives the higher impact on its strength and durability of the structure, for its assessment there were various types of physical and chemical testing techniques are available. In this article the work represents the compressive strength of self-compacting concrete in various temperature testing like 200^o C and 400 ^{o} C with the consideration of 100% cement and different mix proportion of admixtures for the replaceable of cement like Fly-ash with 30% and 15% and GGBFS 30% and 15% and the addition of polypropylene fibre with 1% and 2% with all of its mix proportion. The fundamental tests of the concrete are performed as per the Indian Standard code. The results indicate that an enhancement of compressive strength at the maximum optimized temperature.

Keywords: Self Compacting Concrete, Fly-ash, GGBFS, Polypropylene fibres, Optimised Temperature

1. Introduction

Earliest research in the design of self-compacting concrete mixes began in the mid-eighties in the twentieth century in Japan. The main drive for this research are the endangered durability of reinforced concrete structures, need for easier and high-quality fresh concrete placement and lack of skilled labour force. In 1986, Okamura, University of Tokyo, Japan, is the first propose concrete that would be placed under the influence of self-weight only. The polypropylene fibre enhances the thermal stability of high strength concrete & SCC. It is also absorbed that severe fire spalling could occurs with SCC high strength concrete even at a low heating rate. Complete spalling took place when the specimens surface temperature is between 180^{0}C to 250^{0}C A. Noumowé, et al. (2006). Thermal analysis by TGA performed for samples with and without PPF at the age of 28 days. Results for 4 cement pastes without PPF, between 30 & 150 a quick weight loss is found in TGA for all samples. This corresponds to the loss of evaporable water. From 110^{0}C to 700^{0}C the weight loss indicated from TGA includes the loss of chemically bounded water from the decomposition of CSH. The weight loss of the samples made by SCCP is lower than the others for temperature up to 700^{0}C. This indicates the SCCP samples show a better stability below 700^{0}C due to the low cement content in the mixtures. Temperature is above 700^{0}C the dramatic loss of mass is observed G. Ye, et al. (2007). The normal concrete, Compressive strength at 200^{0}C is increased with 4.47%. At 400^{0}C & 600^{0}C temperature decrease in the compressive strength is about 16.15% & 49.29% respectively. The percentage of reduction of Compressive strength is 21.09, 37.44 &

63.14% of its initial compressive strength at 200^0C, 400^0C & 600^0C respectively. From the results Concluded that use of Flyash improved the performance of SCC at elevated temperatures. For SCC, at compressive strength is increased 5.7% with gradual cooling. At 400^0C & 600^0C decreasing in compressive strength is about 9.34% & 27.73% respectively. At 200^0C the percentage of reduction of compressive strength is 10.33. 24.56 & 40.78 of its initial compressive strength at 200^0C, 400^0C & 600^0C respectively M.A.Helal and Kh.M.Heiza (2010). The high strength SCCPPF specimens at 200^0C. The loss in compressive strength is 18% of the room temperature strength. At the same time temperature for normal strength is 10% after initial loss of strength. The high strength SCCPPF began to recover its strength at 400^0C. The strength of normal SCCPPF decreased rapidly at the temperature range of 200^0C to 400^0C. The strength is only 50% of that of the room temperature. Jin Tao, et al. (2010). The percentage decrease in the Compressive strength 100^0C to 600^0C is 2.91, 7.61, 14.10, 18.21, 24.13 & 30.00% respectively when temperature increased from 100^0C to 600^0C the compressive strength increases. D.B.Kulkarni and S.N. Patil (2011). SCC specimens subjected to high temperatures generally results in reduction in compressive strength. The reduction in compressive strength is due to a series of physical & chemical changes. Arabi Nawwaf Saoud, et al. (2011). At normal temperature with increase in Flyash content from 30% to 50% shows between 30.67 & 21.43MPa. Between 39.50 & 30.40 MPa at 28 & 91 days respectively. An increase of about 22.35% and 19.00% Compressive strength is observed for 28 days & 91 days respectively SCC Mixes. With increase in temperature from 100^0C to 200^0C, Compressive strength varied between 29.00 & 19.25 MPa. For 28 & 91 days' samples the compressive strength varied between 37.90 & 29.00 MPa. with decrease in Fly ash content from 50% to 30% Neelam Pathak and Rafat Siddique, (2012). It is observed that SCC specimens at high temperatures generally results in reduction in compressive strength. The strength reduction on heating is due to the serious of complex physical & chemical changes. Arabi N.S. Al Qadi, et al. (2012). compressive strength of HSSCC specimens of 28 days at room temperature varied from 84.69-82.57 N/mm^2, for 200^0C varied from 4.84-7.21 at 4hours, 8.54-10.84 at 8hours and 11.97-13.91 at 12hours. For 400^0C varied from 14.36-16.62 at 4hours, 17.86-19.04 at 8hours and 20.66-23.97 at 12hours. For 600^0C at 4. 8 & 12 hours concretes specimen are crushed. The loss of compressive strength nearly 14% & 9% at 200^0C & 400^0C for 12 hours 24% & 18% at 200^0C & 400^0C for 12hours. R.Vasusmitha and P.Srinivasa Rao (2012). When temperature raised to 200^0C to 600^0C they reported loss of compressive strength for all the mixes but up to 400^0C temperature only 70% loss of compressive strength is observed for all the mixes this is because of positive influence of Flyash & metakaolin Marija Jelcic Rukavina, et al. (2015). At 400^0C the relative compressive strength of the SCC mixture with 0% PP, SCC mixture with 0.05% PP, SCC mixture with 0.10% PP & SCC mixture with 0.15% PP mixtures show reduction in residual compressive strength at 400^0C. Residual compressive strength of 400^0C with 4hr is greater than that of concrete mixtures heated to 200^0C for 2hr. Aminuddin Jameran, et al. (2015). Plain SCC are showed small cracks on the surfaces when the temperature is maintained 200^{0}C for 2hours. Specimen of Plain SCC showed more cracks on the surfaces when the temperature is maintained 200^{0}C for 4hours. Plain SCC specimens showed small cracks no explosive spalling when temperature maintained at 400^{0}C for 4hours Mahmoud B. Alhasanat, et al. (2016). Addition of PP fibres to the concrete reduces the compressive strength of 28 days. This strength reduction is greater than in HSCC.PP6 in all the diameters except 200nm to physico-mechanical characteristics of SCC at 200^{0}C, 400^{0}C & 600^{0}C A. Saeedian , et al. (2017). After exposure to elevated temperatures there is no significance distortion of the specimens is observed. But for those specimens which are kept at 600^{0}C & 800^{0}C with a small amount of deterioration of concrete at the edges & corners is observed. The colour changes of concrete cube specimens at elevated temperature shows four distinct colour bands for each (200^{0}C, 400^{0}C, 600^{0}C & 800^{0}C). The colour of the specimen changes from grey, greyish yellow, greenish yellow & grey buff colour respectively Swapnil K. Shirsath, et al. (2017)

2. Material Properties

The constituent materials used for the making of SCC are the same as those for conventional concrete except that SCC contains lesser aggregates and greater powder content (cement and filler particles). Fly ash, ground granulated blast furnace slag, glass filler, limestone powder, silica fume, etc. are used as the filler materials. To improve the self-compact ability of SCC, many types of chemical admixtures are used as Super plasticiser. The materials considered for the present investigation are cement, fine aggregate, coarse aggregate, GGBFS, Fly ash and Polypropylene fibres. Ordinary Portland cement (OPC) of 53 grade Birla Super is used for casting all the specimens. As per IS:269-2015, In Table 1 and Table 2, Physical and Chemical Properties of Ordinary Portland Cement are tabulated.

Table 1. Chemical Composition of Ordinary Portland Cement

Ingredient	Composition	Percentage (%)
Lime	CaO	62
Silica	SiO2	22
Alumina	Al2 O3	05
Calcium Sulphate	CaSO4	04
Iron Oxide	Fe2O3	03
Magnesia	MgO	02
Sulphur	S	01
Alkalies	---	01

Table 2. Physical properties of Ordinary Portland cement

Sl. No.	Properties	Test Results	As per IS 269-2015
1	Normal Consistency (in %)	32	-
2	Specific Gravity	3.09	-

3	Setting Time (in Minutes) a) Initial Setting Time b)Final Setting time	80 360	Not less than 30mins Not more than 600mins
4	Compressive Strength(MPa) (70.6*70.6*70.6mm Cubes) 3 days strength 7 days strength 28 days strength	28.2MPa 38.5 MPa 58.8MPa	Not less than 27Mpa Not less than 37Mpa Not less than 53Mpa

The coarse aggregate used is brought from a local supplier in Magadi road, Bangalore, Karnataka. The C.A of 12.5mm passing is used. The sieve analysis of coarse aggregates confirms to the specifications of IS 383: 2016 for graded aggregates and specific gravity. Table. 3 explain Physical properties of Coarse Aggregate respectively.

Table 3. Physical properties of Coarse Aggregate

Sl No	Physical properties	Coarse aggregate
1	Size	12.5mm
2	Specific gravity	2.63
3	Fineness modulus	7.24
4	Loose Bulk density (kg/m3)	1360
5	Rodded Bulk density (kg/m3)	1499

M- SAND is used as fine aggregate from Tavara Mines &Minerals, Jigani Industrial area, Anekal Taluk, Bangalore, Karnataka. The sieve analysis and physical Properties results are presented in Table. 4 respectively. The sieve analysis results indicate that the sand confirms to Zone-II as per IS: 383-2016.

Table 4. Physical properties of fine aggregates

Sl No	Physical properties	Fine aggregate
1	Size	4.75mm
2	Specific gravity	2.52
3	Fineness modulus	2.94
4	Loose Bulk density (kg/m3)	1444.72
5	Rodded Bulk density (kg/m3)	1555.69

As per IS:456-2000, Portable water is used for concreting. Ordinary portable water available in the college campus is used throughout the project work. The fly-ash used is from BTPS KPCL, Kudathini, Bellary (Dist), Karnataka. As per IS:3812 - 2013, It is pozzolanic fly-ash belonging to ASTM classification “F”. The fly-ash is collected directly from open dry dumps, Its physical and chemical properties are presented in Table 5 & 6.

Table. 5 Physical Properties of fly-ash obtained

SL.NO	Property	value
1	Colour	Light grey
2	Specific gravity	2.1
3	Surface area	310 m2/kg

Table. 6 Chemical Properties of fly-ash

SL.NO	Parameter	Percentage (%)
1	Silicon Dioxide(Sio2)	62.63
2	Alumina(Al2o3)	23.55
3	Iron oxide(Fe2o3)	3.93
4	Calcium oxide(cao)	2.04
5	Magnesium oxide(Mgo)	0.46
6	Sulfur tri oxide(So3)	1.34
7	Sodium oxide(Na2o)	0.032
8	Potassium oxide(K2o)	0.030
9	Loss on ignition% by mass	0.39

Ground-granulated blast furnace slag is highly cementitious and high in CSH (calcium silicate hydrates) which is a strength enhancing compound which improves the strength, durability and appearance of the concrete. Use of GGBS significantly reduces the risk of damages caused by alkali–silica reaction (ASR), provides higher resistance to chloride ingress reducing the risk of reinforcement corrosion and provides higher resistance to attacks by sulphate and other chemicals. The GGBFS used in the Present investigation is from RMC Ready mix (India), Kumbalagodu Industrial Area, Bangalore, Karnataka. As per IS:16714-2018 physical properties are presented in Table 7 and Chemical properties are presented Table 8

Table. 7 Physical Properties of GGBFS obtained

Sl.no	Characteristics (physical requirements)	Requirement as Per IS:16714-2018	Test Results
1	Fineness (M2/kg)	275 (Min)	395
2	Specific gravity	------	2.51
3	45 micron (residue) (%)	------	6.10

Table. 8 Chemical Properties of GGBFS

Sl. NO	Characteristics (Chemical requirements)	Requirement as Per BS EN15167-1:2006	Test Results
1	Magnesia content (%)	18.0 (Max)	7.95
2	Sulphide Sulphur (%/)	2.00 (Max)	0.50
3	Sulphite content (%)	2.50 (Max)	0.29
4	Loss of ignition (%)	3.00 (Max)	0.22
5	Chloride content (%)	0.10 (Max)	0.008
6	Glass content (%)	------	93
7	Moisture content (%)	1.0 (Max)	0.13

Polypropylene fibres is used in the experimental work and is that uniform dispersion in is obtained concrete. In this study, polypropylene fibres of 12 mm length are used. Properties of fibres are shown in Table 9.

Fig. 1 Polypropylene fibres

Table. 9 Properties of Polypropylene fibres

SI.NO	Properties	Polypropylene Fibres
1	Length	12mm
2	Diameter	30 µ
3	Slenderness ratio	400
4	Specific gravity	0.91
5	Melting point	1650c
6	Acid resistance	High
7	Salt resistance	High
8	Aspect ratio	2.5 µ or 0.0025mm
9	Specific gravity of Polypropylene fibres	0.91

3. Testing Methods

The workability tests conducted on SCC mixes are according to the **EFNARC-2002** guidelines.

Table. 10 Acceptance criteria for SCC as per EFNARC guidelines

SL.No	Method	Unit	Typical range of Values	
			Minimum	Maximum
1	Slump flow by Abram's cone	mm	650	800
2	J-ring	mm	0	10
3	V-funnel	s	6	12
4	L-box (h2/h1)	(h2/h1)	0.8	1.0
5	U-box (h2-h1)	mm	0	30

3.1 Fresh Properties of Final Mix Proportions

Table. 11 Fresh properties of final mix proportions 70% Cement + 30% Fly ash with 1%& 2%PP fibres

MIX	SF	SF1	SF2	EFNARC(2005) GUIDELINES
Slump flow(mm)	720	690	650	650-800
J-ring(mm)	9	8	5	0-10
V-funnel(sec)	7	8.5	11	6-12
L-box(H1/H2 mm)	0.92	0.88	0.83	0.8-1.0
U-box(H1-H2 mm)	23	27	29	0-30

Table. 12 Fresh properties of final mix proportions 70% Cement + 30% GGBFS with 1%& 2% PP fibres

MIX	SG	SG1	SG2	EFNARC(2005) GUIDELINES
Slump flow(mm)	740	700	670	650-800
J-ring(mm)	9	7	4	0-10
V-funnel(sec)	8	9	11	6-12
L-box(H1/H2 mm)	0.90	0.88	0.82	0.8-1.0
U-box(H1-H2 mm)	23	27	29	0-30

Fig. 2 Casting of Samples

4. Strength and Durability Tests

4.1 Compressive Strength Test

4.1.1 Casting of Cube Specimens for Compression Test

The steel cube moulds are coated with mould oil on their inner surfaces and are placed on Plate. Concrete is poured in to the moulds. The top surface is finished using trowel. After 48 hours concrete cubes are demoulded and the specimens are kept for curing under water. The test results are tabulated.

4.1.2 Testing of cube specimens for Compressive Strength of concrete

The compression strength of concrete i.e., ultimate strength of concrete is defined as the load which causes failure of the specimen divided by the area of the cross section in uniaxial compression, under a given rate of loading. To avoid large variation in the results of compression test, a great care is taken during the casting of the test specimens and the loading as well. However, it is realized that, in an actual structure, the concrete at any point is in a complex stress condition and not in uniaxial compression. However, it is customary to conduct the test in uniaxial compression only. Concrete under Triaxial state can offer more resistance and will fail only after considerably large deformations. The use of 150mm cubes have been made as per I.S:516-1959 & IS 456-2000. The advantage of selection of IS 516 – 1959 cube as the standard test specimen is that two plane and parallel surfaces can always be found between which the load can be applied.
The failure of concrete under compression is due to shear stress occurring on planes inclined at an angle of $(45^o – \Phi/2)$ with the axis of loading, since the resistance of concrete is a function of both the internal friction of Φ of concrete is generally about 20^o, such that failure occurs by the formation of a cone failure. Typical failures of standard concrete specimens in compression as shown below.

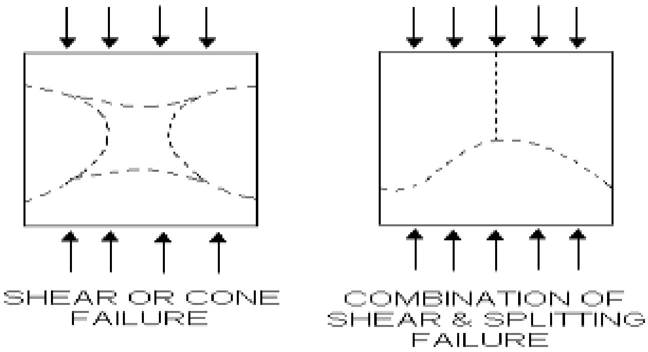

Figure. 3 Failure pattern of Specimen subjected to Compression

The failure in actual test deviates from this theoretical value of 35°, because of the restraint to internal expansion under the compressive load produced due to friction exercised by the bearing plates at the ends of the specimen. If this friction is reduced by applying lubricant at the bearing surfaces and especially in case of high strength concrete, failure occur by splitting of concrete into a series of vertical columns. This failure called 'Columnar Failure' or splitting failure occurs due to the fact that the compressive load along the axis produces tensile strains along the perpendicular direction. Since concrete is weak in tension and friction is eliminated from the bearing surfaces, the failure is by splitting of concrete as shown in the Figure 3. At each desired curing periods specimens are taken out of water and kept for surface drying. The cubes are tested in 2000kN capacity compressive testing machine loaded at constant rate of loading at 145kg/cm^2/min as per standard procedure explained in IS: 516-1959(1999) to get the compression strength of concrete.

5. Temperature Tests

Fig. 4 (a) **Fig. 4 (b)**

Fig. 4(a) Placing of specimens in the temperature analysing box.

Fig. 4 (b) Monitoring the Temperature

6. Mineral Admixtures Mixes Considered for Experimental Work

After procuring the required quantity of materials, the materials are tested for their physical properties. Trials mixes using Okamura method of mix design are carried out for the following mix proportions to achieve the final mixes, which satisfies all the workability properties. **(i)** MIX –S: SCC containing 100% cement. **(ii)** MIX –S1: SCC containing 100% cement with 1% fibres **(iii)** MIX –S2: SCC containing 100% cement with 2% fibres **(iv)** MIX-SFG: SCC containing 70% cement, 15% fly ash and 15% GGBFS, **(v)** MIX-SFG1: SCC containing 70% cement, 15% fly ash and 15% GGBFS with 1% fibres, **(vi)** MIX -SFG2: SCC containing 70% cement, 15% fly ash and 15% GGBFS with 2% fibres, **(vii)** MIX –SF: SCC containing 70% cement and 30% fly ash. **(viii)** MIX –SF1: SCC containing 70% cement and 30% fly ash with 1% fibres. **(ix)**MIX –SF2: SCC containing 70% cement and 30% fly ash with 2% fibres**.** **(x)** MIX -SG: SCC containing 70% cement and 30% GGBFS. **(xi)** MIX –SG1: SCC containing 70% cement and 30% GGBFS with 1% fibres. **(xii)** MIX –SG2: SCC containing 70% cement and 30% GGBFS with 2% fibres Table. 13 gives the details of all the mixes.

Table 13. Mix Proportions Details.

Mix	**Cement%**	**Fly ash %**	**GGBFS %**	**SP %**	**PPF %**
S	100	--	--	1	--
S1	100	--	--	1	1
S2	100	--	--	1	2
SF	70	30	--	1	--
SF1	70	30	--	1	1
SF2	70	30	--	1	2
SG	70	--	30	1	--
SG1	70	--	30	1	1
SG2	70	--	30	1	2
SFG	70	15	15	1	--
SFG1	70	15	15	1	1
SFG2	70	15	15	1	2

7. RESULTS AND DISCUSSIONS

The results are shown in the following figures, it represents the compressive strength influence in the different mix proportion and various optimized temperature. In this present investigation, the cured specimens are exposed to the two different temperatures i.e. 200°C & 400°C. Once the specimens are subjected to temperature, it was checked for its compression strength. The results of each mix are analyzed, compared and plotted graphs.

Table 14. Compressive strength for 100% cement with fibres when subjected to temperature of 200°C

Mix	Average Compressive strength (N/mm^2) when subjected to 200°C		
	28 days	**56 days**	**90 days**
S	74.54	91.99	92.98
S1	58.36	61.20	80.68
S2	33.67	38.05	57.21

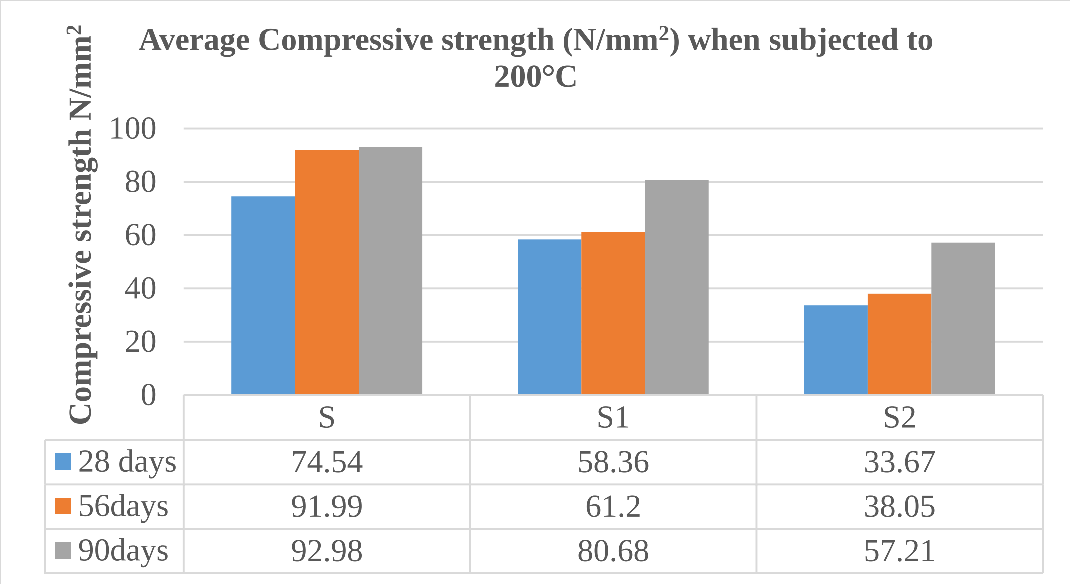

Fig. 5 Graph represents the compressive strength for 100% cement with fibres when subjected to temperature of 200°C

From the above graph it has been observed that S (100% Cement) has shown more strength when compared to S1 (100% cement with 1% PPF) & S2 (100% cement with 2% PPF), when specimens were exposed to 200°C temperature.

Table 15. Compressive strength for 100% cement with fibres when subjected to temperature of 400°C

Mix	Average Compressive strength (N/mm^2) when subjected to 400°C		
	28 days	**56 days**	**90 days**
S	88.07	89.87	93.76
S1	58.28	72.38	74.54
S2	37.76	42.27	44.27

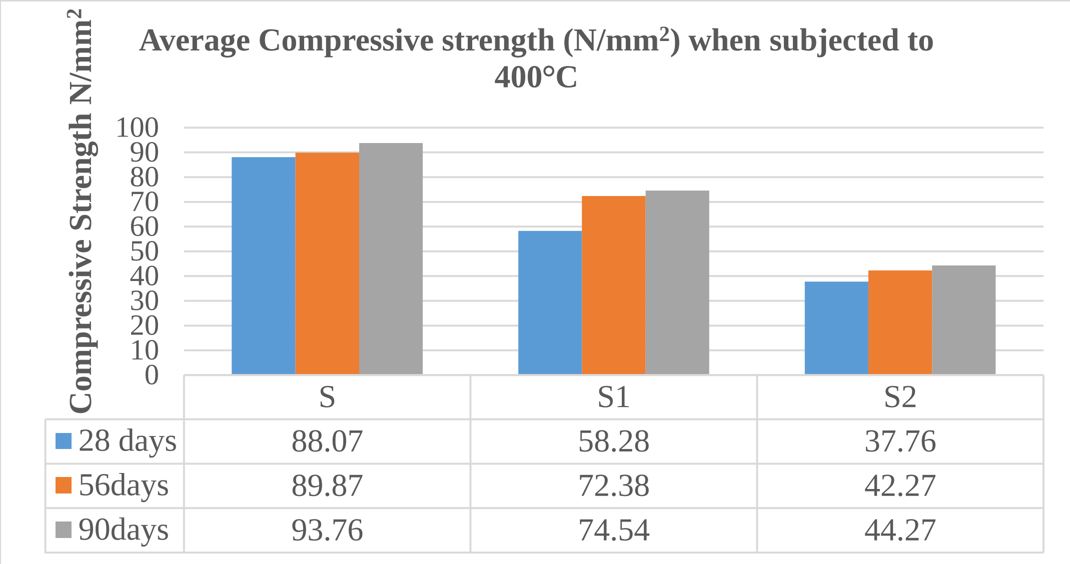

Fig. 6 Graph represents the Compressive strength for 100% cement with fibres when subjected to temperature of 400°C

From the above graph it has been observed that S (100% Cement) has shown more strength when compared to S1 (100% cement with 1%PPF) & S2 (100% cement with 2%PPF), when specimens were exposed to 400°C temperature. Also it has been observed that when the specimens were exposed to temperature of 400° C, the compressive strength of specimens were decreased when compared to 200°C temperature.

Table 16. Compressive strength for 70% cement + 30% Fly ash with fibres when subjected to temperature of 200°C

Mix	Average Compressive strength (N/mm^2) when subjected to 200°C		
	28 days	56 days	90 days
SF	65.19	71.65	78.25
SF1	34.48	41.65	64.03
SF2	27.21	38.24	41.74

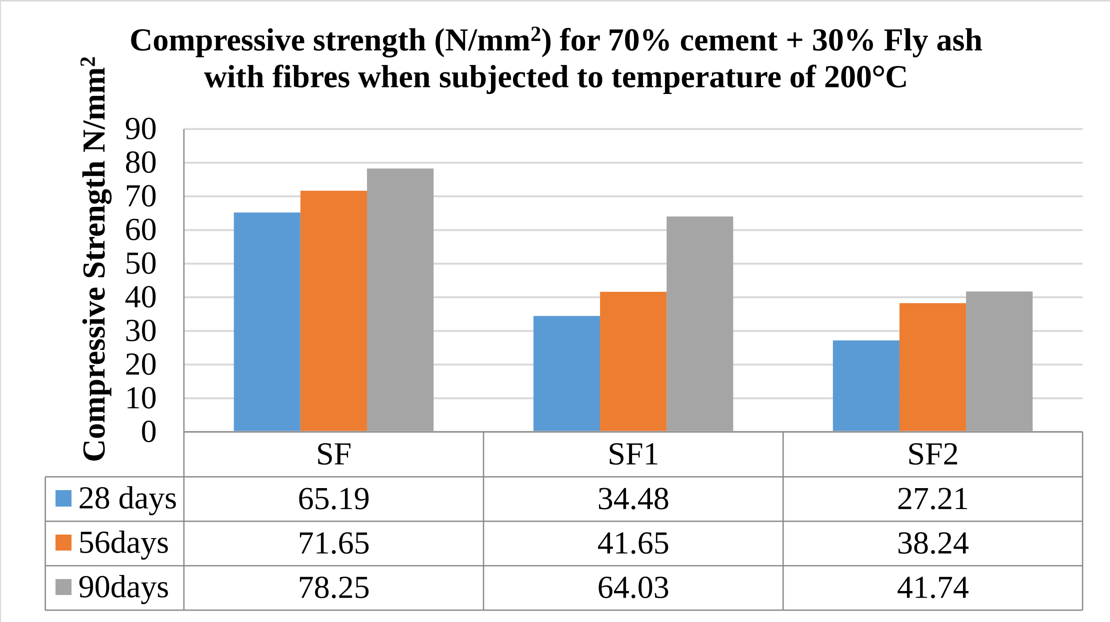

Fig. 7 Graph represents compressive strength for 70% cement + 30% Fly ash with fibres when subjected to temperature of 200°C

From the above graph it has been observed that the mix containing 70% cement + 30% fly ash shows greater strength when compared to the mix containing PP fibres, when specimens were exposed to 200°C temperature.

Table 17. Compressive strength for 70% cement+ 30% Flyash with fibres when subjected to temperature of 400°C

Mix	Average Compressive strength (N/mm^2) when subjected to 400°C		
	28 days	**56 days**	**90 days**
SF	73.63	74.15	81.94
SF1	37.11	37.59	45.04
SF2	26.94	36.66	37.50

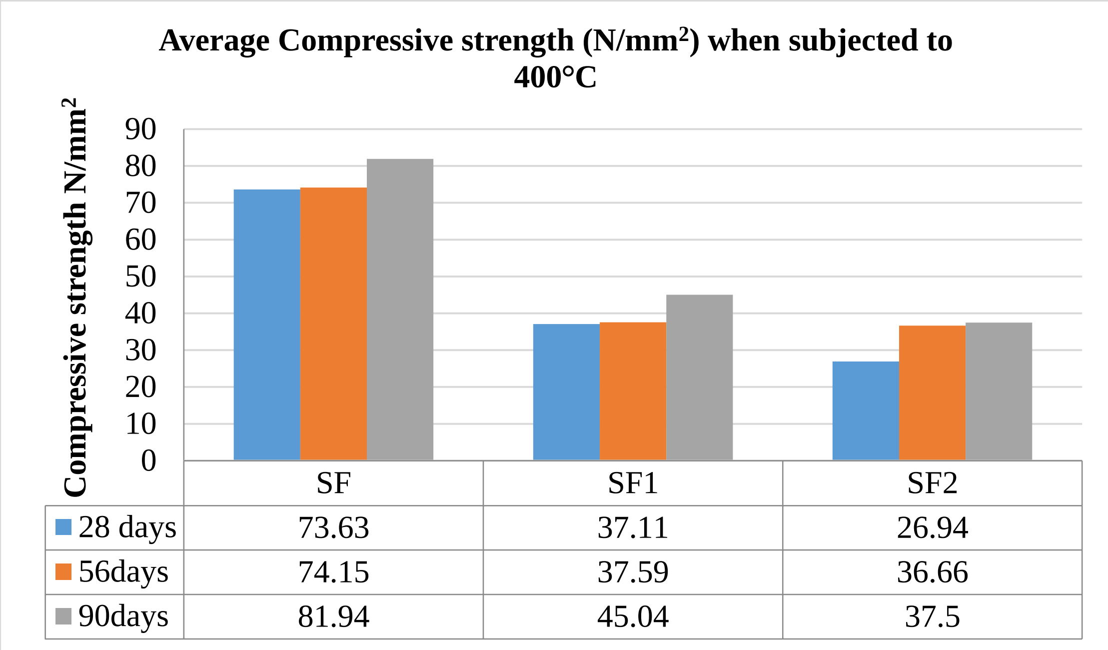

Fig. 8 Compressive strength for 70% cement+ 30% Fly ash with fibres when subjected to temperature of 400°C

From the above graph it has been observed that the mix containing 70% cement+30% fly ash has shown greater strength when compared to the other mix contain PP fibres when exposed to 400°C

Table. 18 Compressive strength for 70% cement+ 30% GGBS with fibres when subjected to temperature of 200°C

Mix	Average Compressive strength (N/mm^2) when subjected to 200°C		
	28 days	**56 days**	**90 days**
SG	83.71	91.65	97.54
SG1	53.24	58.41	73.62
SG2	36.04	45.61	47.48

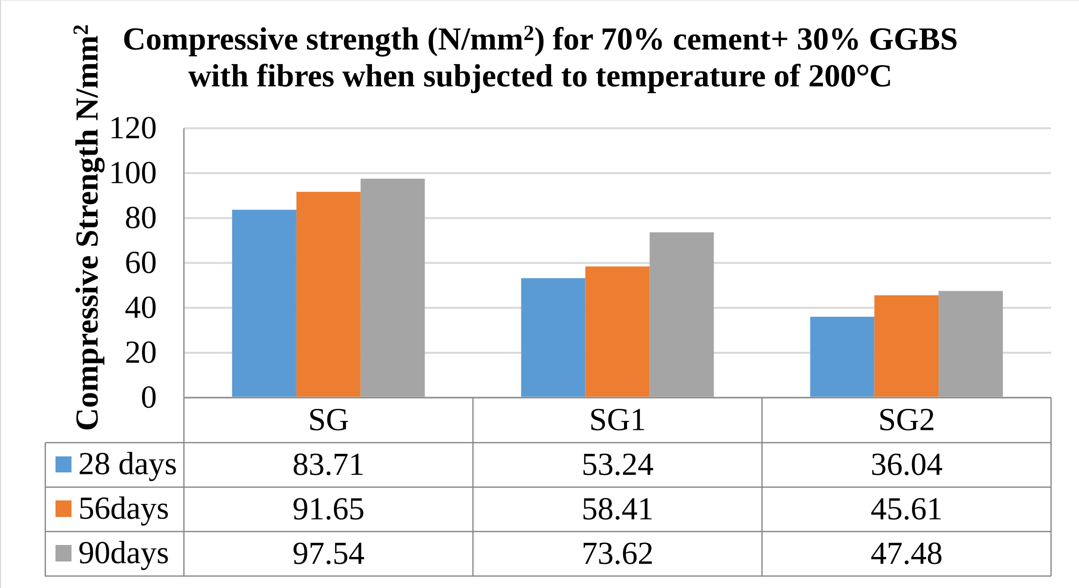

Fig. 9 Compressive strength for 70% cement+ 30% GGBS with fibres when subjected to temperature of 200°C

From the above graph it has been observed that the mix containing 70% cement + 30% GGBS shows greater strength when compared to all other mixes, when specimens exposed to 200°C. When the same mix added with PP fibre, strength was reduced.

Table .19 Compressive strength for 70% cement+ 30% GGBS with fibres when subjected to temperature of 400°C

Mix	Average Compressive strength (N/mm^2) when subjected to 400°C		
	28 days	**56 days**	**90 days**
SG	81.88	92.11	94.59
SG1	45.78	61.82	67.46
SG2	35.65	39.27	45.27

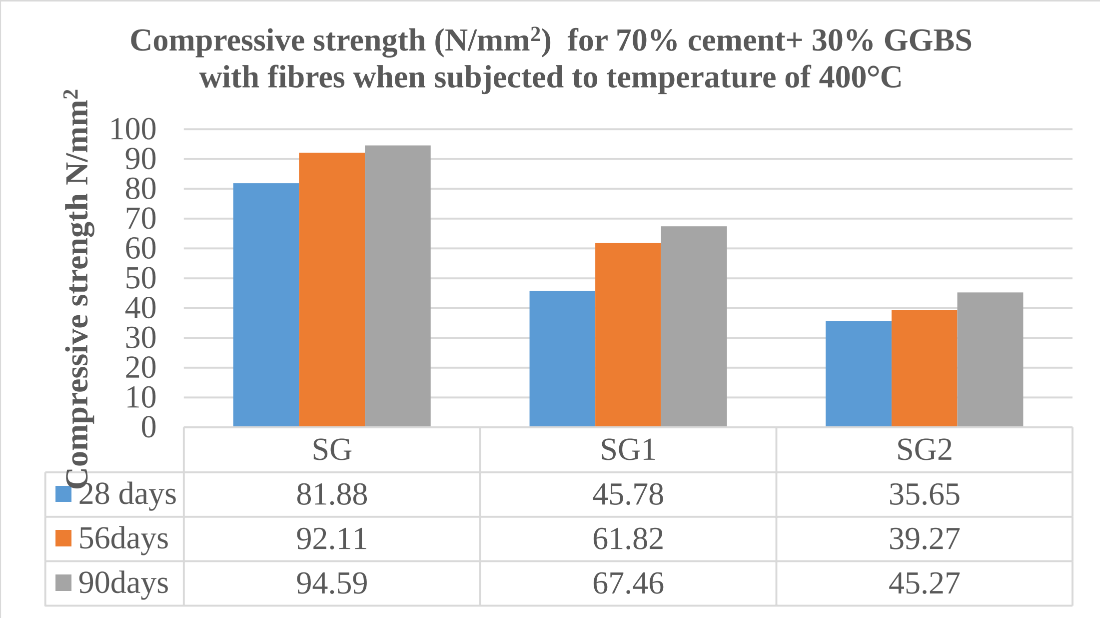

Fig. 10 Compressive strength for 70% cement+ 30% GGBS with fibres when subjected to temperature of 400°C

From the above graph it has been observed that the specimens were exposed to 400°C, the compressive strength of specimens was decreased. Increase in temperature will cause the reduction of CSH gel. Hence compressive strength of the specimens was decreased.

Table. 20 Compressive strength for 70% cement+ 15% fly ash + 15% GGBS with fibres when subjected to temperature of 200°C

Mix	Average Compressive strength (N/mm^2) when subjected to 200°C		
	28 days	**56days**	**90days**
SFG	59.67	74.45	83.09
SFG1	44.26	69.55	82.13
SFG2	29.71	38.06	40.91

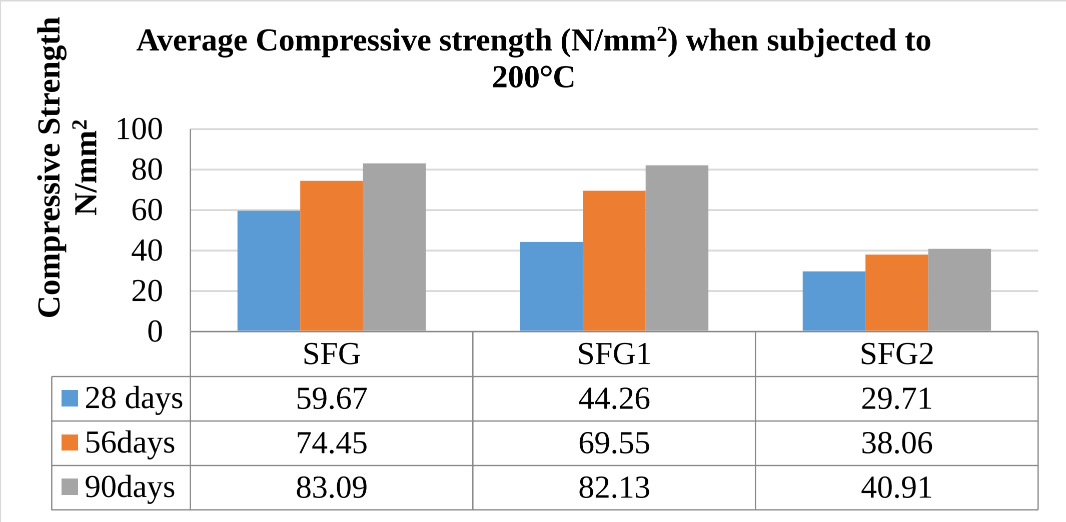

Fig. 11 Compressive strength for 70% cement+ 15% fly ash + 15% GGBS with fibres when subjected to temperature of 200°C

From the above graph it has been observed that the mix containing 70% cement +15% fly ash + 15% GGBS with 1% of PP fiber shows the greater strength when compared to the mix 70% cement +15% fly ash + 15% GGBS and 70% cement +15% fly ash + 15% GGBS with 2% PP fiber when subjected 200°C.

Table. 21 Compressive strength for 70% cement+ 15% fly ash + 15% GGBS with fibres when subjected to temperature of 400°C

Mix	Average Compressive strength (N/mm^2) when subjected to 400°C		
	28 days	**56 days**	**90 days**
SFG	57.88	59.01	82.60
SFG1	35.50	47.77	81.97
SFG2	41.59	42.28	53.92

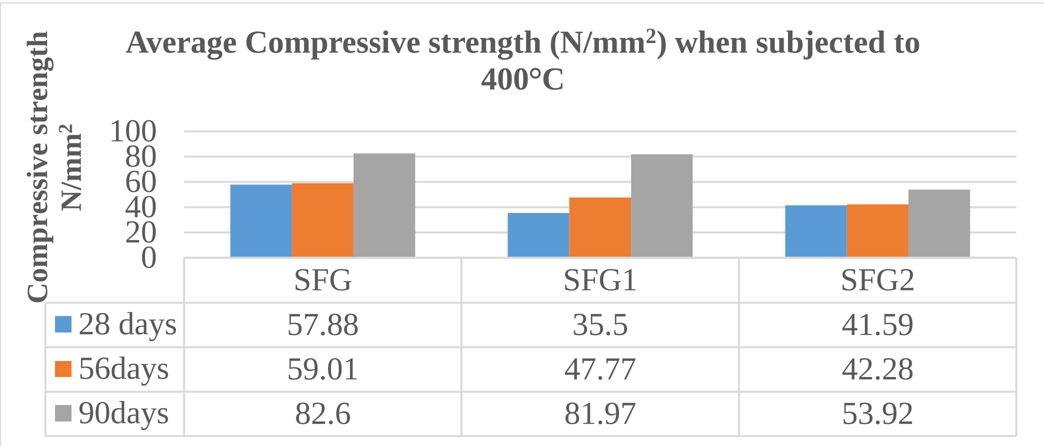

Fig. 12 Compressive strength for 70% cement+ 15% fly ash + 15% GGBS with fibres when subjected to temperature of 400°C

From the above graph it has been observed that the mix containing 70% cement +15% fly ash + 15% GGBS with 1% of PP fiber shows the greater strength when compared to the mix 70% cement +15% fly ash + 15% GGBS and 70% cement +15% fly ash + 15% GGBS with 2% PP fiber when subjected 400°C.

8. Conclusions

The samples mix proportions with different admixtures are tested with the two variant temperature is 200°C and 400°C. The samples were cured up to 90 days and tested under the temperature of 200°C and 400°C. The sample with 100% cement (S, S1(1% fibre),S2(2% fibre)) shows that, without fibre the compressive strength is high compared with the addition of fibres .

- It is observed that S (100% Cement) has shown more strength when compared to S1 (100% cement with 1% Poly Propylene Fiber) & S2 (100% cement with 2% PPF), when specimens were exposed to elevated temperature of 200°C. It has also observed that S (100% Cement) has shown more strength when compared to S1 (100% cement with 1%PPF) & S2 (100% cement with 2%PPF). Also it has been observed that when the specimens were exposed to temperature of 400° C, the compressive strength of specimens was decreased when compared to 200°C temperature.

- The mix containing 70% cement + 30% fly ash shows greater strength when compared to the mix containing Poly Propylene Fiber, when specimens were exposed to 200°C temperature while in the other hand the mix containing 70% cement+30% fly ash has shown greater strength when compared to the other mix contain Poly Propylene Fiber when exposed to 400°C

- The mix containing 70% cement + 30% GGBS shows greater strength when compared to all other mixes, when specimens exposed to 200°C. When the same mix added with Poly Propylene Fiber, strength was reduced while the specimens were exposed to 400°C; the compressive strength of specimens was decreased. Increase in temperature will cause the reduction of CSH gel. Hence compressive strength of the specimens was decreased.

- It has been observed that the mix containing 70% cement +15% fly ash + 15% GGBS with 1% of PP fiber shows the greater strength when compared to the mix 70% cement +15% fly ash + 15% GGBS and 70% cement +15% fly ash + 15% GGBS with 2% PP fiber when subjected 200°C and the strength is higher when it is exposed to 400°C.

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