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EFFECT OF MINERAL ADMIXTURE AND PVA FIBER ON FRESH AND HARDENED PROPERTIES ON SCC

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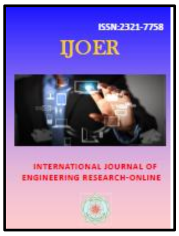

ABSTRACT

Concrete is the most frequently used material worldwide in construction industry. Conventional concrete (CC) casting relies on compaction to ensure adequate strength and durability. Inadequate compaction affects the quality and durability of concrete structures. Okamura in Japan first proposed the necessity of self compacting concrete (SCC) in 1986 to address the issues like long production times, unavailability of skilled workers, unhealthy work environment and durability of concrete that exist in cast in-situ concrete technology. The SCC can flow through the reinforcement gaps and fills the corners of moulds without any vibration and compaction during the placing process. The distinct user-friendly properties of SCC are being attracted greatly in the traditional construction industry also, but it is not yet utilized in house buildings to large extent with the conception that the use of higher fines and chemical admixtures in SCC leads to more material cost and higher strengths than the required for CC.

Besides of above stated advantages, plain self -compacting concrete has two deficiencies namely low tensile strength and low strain at fracture. These shortcomings are generally overcome by reinforcing the plain concrete by ductile materials namely fibers which has property of high tensile strength. Due to the presence of these uniformly dispersed fibers, the cracking strength of concrete is increased and the fibers acts as crack arresters. Different types of fibers, such as those used in traditional composite materials have been introduced into the self-compacting concrete mixture to increase itstoughness, or ability to resist crack growth. Such a concrete is called Fiber-Reinforced Self-Compacting Concrete (FRSCC).

The present investigation aims to study the Effect of mineral admixture and fibers on fresh and hardened properties of SCC. Nan Su mix design method has been followed to develop the SCC of M20 grade. Initially SCC mixes has been developed with GGBS as mineral admixture separately. For the initial GGBS SCC mix the Flyash is add in different % in total mineral admixture content and then fresh and hardened properties of the resultant mixes has been studied. Two different fibers like PVA fibers where added to the optimum M20 grade SCC mix which is developed by the two mineral admixtures like GGBS and Flyash.

For each mix, fresh properties of SCC such as filling and passing abilities had been studied by conducting the tests such as slump flow test, "V" Funnel test and "L" Box test and the values were tabulated. For each mix, three cubes of size 150 mm and three cylinders of diameter 100mm and height 200mm and prisms were casted to determine compressive strength, split tensile strength and Flexural strength of the mix for 7 and 28 days.

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1. INTRODUCTION

Need and Development of SCC: Concrete is a type of homogeneous mixture and one of the most widely used resources in the world because of the advantages of high compressive strength, durability, mouldability etc Current global rapid civilization shows increased construction of large and mass structures with heavy reinforcement and complicated designed shapes. For normal mix it is now very tough which is to achieve adequate workability with durable conditions. Compaction and vibration for normal concrete is essential to satisfy the required strength because the voids present in the concrete are adjusted during vibration and increases its strength and durability. It is difficult to vibrate the concrete at the place of congested reinforcement. Research is carried out on concrete such as to improve the performance of concrete in various ways through various approaches for different applications. One such advancement in concrete led to the development of Self Compacting Concrete (SCC).

Types of SCC: While designing a SCC mix, a suitable mix is selected among 1) Powder-type by increasing the powder (fines) content ranging from 550 to 650 kg/m3, 2) VMA-type by using low amount of fines ranging 350 to 450 kg/m3 and high VMA dosage and 3) Combination-type by using moderate powder content ranging from 450 to 550 kg/m3 and optimum VMA in structural conditions and applications. Powder-type of SCC is prepared by a low water-cementitious ratio (w/cm) and high powder content and can be used for heavily reinforced structures. Due to high fines content, powder-type of SCC mixes prone to have volumetric changes in constituent materials

2. SCOPE AND OBJECTIVES OF THE PROJECT

To promote SCC to large extent in the construction industry, this investigation is mainly focused on the development of normal strength SCC made with GGBS and Fly ash powder to suit for low to medium rise building constructions. Keeping in view of the savings in cost and land fill, greenhouse gas emissions, fresh, mechanical and durability properties of SCC, the replacement of GGBS and Fly ash powder for cement was taken throughout the study. As SCC has many applications and emerging as a preferred construction material, the promotion of SCC would also increase the utilization of GGBS

- Preliminary tests for mix design of concrete have to conduct on cement, sand and aggregates.
- The Self compacted concrete mix design has to be done for the M20 grade concrete by using NANSU method.
- Initially SCC mix is developed with GGBS by varying Packing Factor which satisfy the EFNARC guidelines
- The fresh properties to be studied on filling ability, passing ability, and segregation resistance for various mixes of scc

Casting the cubes of size 150mmx150mmx150mm, cylinder's of size 150mmx300mm and prism of size 750mmx100mmx100mm and testing for compressive strength, Split tensile strength and Flexural strength of SCC for different percentages of the Fly ash 0%,10%,20%,30%,40%,50% 60%,70%,80%,90% and 100% after 7, 28 days of curing

3. RESULTS AND DISCUSSIONS

Table 1. Fresh properties of Binary Blended SCC

S.NO	MIX	Slump (mm) (650-800 mm)	V-Funnel(sec) (6-12 sec)	L-box (0.8-1.0)
1	M0	660	11	0.75*
2	M1	680	11	0.77*
3	M2	685	11	0.77*
4	M3	692	10.6	0.8
5	M4	720	8	0.84
6	M5	756	8	0.86
7	M6	761	7.5	0.86
8	M7	780	7.4	0.89
9	M8	796	6.5	0.91
10	M9	820(NA)	4*	0.93

Table 2. Hardened properties of Binary Blended SCC (7&28 days)

SNO	MIX	Compressive strength (Mpa)		Split tensile strength (Mpa)		Flexural strength (Mpa)	
		7 days	28 days	7 days	28 days	7 days	28 days
1	M0	16.48	26.36	1.76	2.82	2.23	3.56
2	M1	17.58	27.8	1.79	2.86	2.26	3.62

3	M2	17.88	28.6	1.81	2.89	2.38	3.81
4	M3	18.38	29.4	1.91	3.06	2.63	4.2
5	M4	18.88	30.2	2.03	3.25	2.91	4.65
6	M5	18	28.8	1.95	3.12	2.57	4.11
7	M6	17.25	27.6	1.93	3.08	2.51	4.02
8	M7	16.88	27	1.88	3.01	2.45	3.92
9	M8	15.75	25.2	1.8	2.88	2.4	3.84
10	M9	13.75	22	1.79	2.87	2.38	3.81
11	M10	11.25	18	1.79	2.87	2.36	3.78

Table 3. Fresh properties of Binary Blended SCC with PVA fibers

	MIX	Slump (mm) (650-800 mm)	V-Funnel(sec) (6-12 sec)	L-box (0.8-1.0)
1	PVM_0	720	8	0.84
2	PVM_1	710	8	0.84
3	PVM_2	694	8.7	0.83
4	PVM_3	682	10	0.81
5	PVM_4	665	11	0.81
6	PVM_5	642*	13.2*	0.76*

Table 4. Hardened properties of Binary Blended SCC with PVA fibers

SNO	MIX	Compressive strength (Mpa)		Split tensile strength (Mpa)		Flexural strength (Mpa)	
		7 days	28 days	7 days	28 days	7 days	28 days
1	PVM_0	18.88	30.2	2.03	3.25	2.91	4.65
2	PVM_1	19.13	30.61	2.06	3.29	2.96	4.73
3	PVM_2	19.5	31.2	2.1	3.36	3.08	4.92
4	PVM_3	19.74	31.59	2.18	3.49	3.2	5.12
5	PVM_4	20.54	32.86	2.26	3.61	3.28	5.24
6	PVM_5	19.28	30.84	2.14	3.42	3.03	4.84

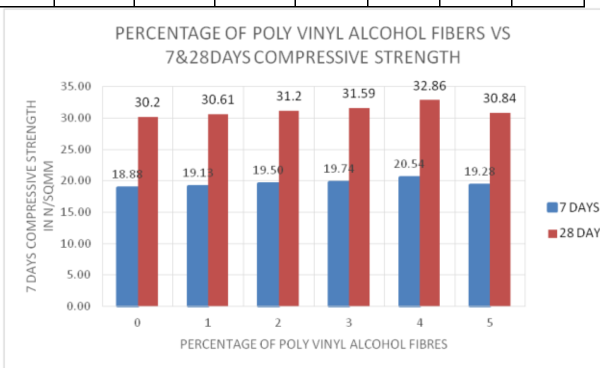

Fig 1: COMPRESSIVE STRENGTH FOR VARIOUS % OF PVA FIBERS

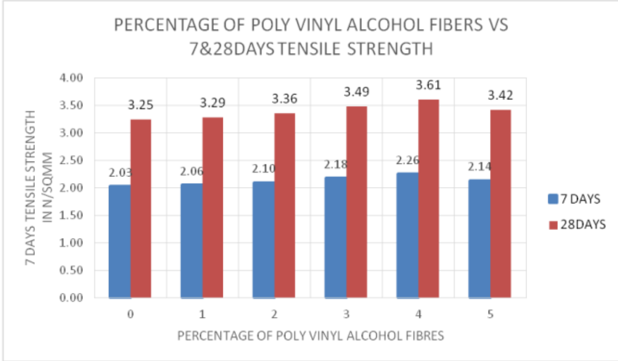

Fig 2: TENSILE STRENGTH FOR VARIOUS % OF PVA FIBERS

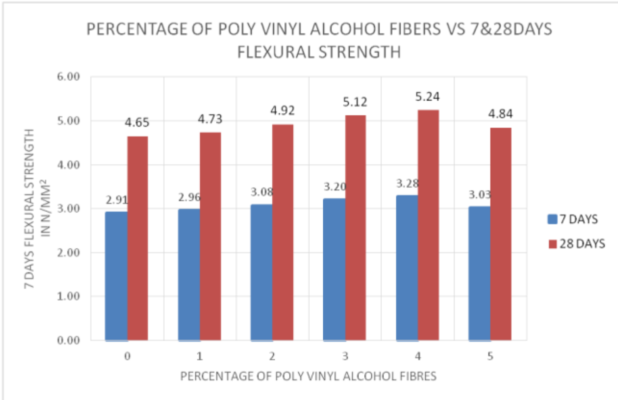

Fig 3: FLEXURAL STRENGTH FOR VARIOUS % OF PVA FIBERS

4. CONCLUSION

1. Self-compacting concrete with partial replacement of GGBS by fly ash shows better workability characteristics and good mechanical properties.
2. When Ground Granulated Blast furnace slag is replaced by fly ash in percentages like 10, 20, 30, 40, 50 results of fresh properties were proved to be satisfactory upto 40% replacement.
3. There is an increase in the strength of SCC when the GGBS is replaced by fly ash up to 40%. Beyond 40% strength properties were tend to decrease.
4. 4.Maximum compressive strength of 30.2 MPa was obtained for the mix M4(60%GGBS, 40% fly ash) and the percentage increase in compressive strength compared to control mix is 14%
5. Maximum Split tensile strength and Flexural strength were obtained are 3.25 MPa and 4.65 MPa for the mix M4
6. In Binary blended self-compacted concrete PVA fibers are adding in different % within

the powder content and shows better harden properties than the Fresh properties

7. With increase in the % of PVA Fibers the compression strength increased 8% up to 4% PVA fibers.
8. Maximum Split tensile strength and Flexural strength were obtained are 3.42 MPa and 5.24 MPa for the mix PVM_4
9. From the above experimental investigation, industrial waste products are made use of to produce self-compacting concrete of required strength using the method called **NANSU.**
10. Indirectly this leads to saving of large amounts of cement, and also inclusion of waste materials leads to the reduction of stress on the environment

REFERENCES

[1]. Aarre T, Domone PLJ. Testing-SCC: Summary report on work package 2: Development of mix designs and material selection. 2004.

[2]. AASHTO LRFD Bridge Design Specifications. 3rd edition. American Association of Highway and Transportation Officials, Washington, D.C. 2004.

[3]. AASHTO LRFD Bridge Design Specifications. American Association of Highway and Transportation Officials, Washington, D.C. 2006.

[4]. ACI 209R. Prediction of Creep, Shrinkage, and Temperature Effects in Concrete Structures, ACI 209R-92. American Concrete Institute, Farmington Hills, Mich., 1997.

[5]. ACI 301. Specifications for Structural Concrete. 2010.

[6]. ACI 237R-07. Self-Consolidating Concrete. 2007.

[7]. ACI 318-95. Building code requirements for structural concrete. Detroit. 1995.

[8]. ACI 363R. State-of-the-art report on high-strength concrete. American Concrete Institute, Detroit. 1992.

[9]. Aiad I. Influence of time addition of superplasticizers on the rheological properties of fresh cement pastes. Cement and Concrete Research, Vol. 33, No. 8, 2003, pp1229-1234.

[10]. ASTM C157/C157M-08 Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete. ASTM International, West Conshohocken, PA, 2008.

[11]. ASTM C 618. Standard specification for coal fly ash and raw or calcined natural pozzolan for use in concrete. 2003.

[12]. Atis CD. High-volume fly ash concrete with high strength and low drying shrinkage. Journal of Materials in Civil Engineering, Vol. 15, No. 2, 2003, pp153-156.

[13]. Ayano T, Wittman FH. Drying, moisture distribution, and shrinkage of cement based materials. Mater Struct, Vol. 35, No. 237, 2002, pp134-40.

[14]. Ahmaruzzaman M. A review on the utilization of fly ash", Progress in Energy and Combustion Science J., Vol. 36, No. 3, 2010, pp327–363.

[15]. Bapat SG, Kulkarni SB, Bandekar KS. Using SCC in Nuclear power plants – Laboratory and Mock-up Trials at Kaiga. Indian Concrete Journal, Vol. 78, No. 6, 2004, pp51-57.

[16]. Bazant Z, Baweja S. Creep and shrinkage prediction model for analysis and design of concrete structures. The Adam Neville Symposium: Creep and Shrinkage-Structural Design Effects, SP-194, American Concrete Institute, 2000, pp1-100.

[17]. Bentz DP, Stutzman PE. Evolution of porosity and calcium hydroxide in laboratory concretes containing silica fume, Cement Concrete Research, Vol. 24, 1994, pp1044–1050.