By Using Mineral Admixture Polypropylene As A Partial Replacement For Cement In Self-Compacting Concrete

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Abstract- *Self Compacting Concrete (SCC) was created especially for usage in conditions where access from below is not allowed. When the weight of its own body is applied, it can flow. It may be used when confronted with considerable reinforcement and complex structural designs. The problems of segregation and bleeding are disregarded, and vibration is not necessary for compaction. Strong compression strength and poor tension strength characterise concrete. To make it sturdy under tension, discontinuous High Dispersion Anti-Crack Glass Fibers are added. Glass fibre reinforced self-compacting concrete (SCC) is self-compacting concrete (SCC) that has been made by adding irregular glass fibres (GFRSCC). Because self-compacting concrete can flow under its own weight, it can be employed in areas with substantial reinforcement. By adding the required superplasticizers, self-compacting concrete can be created. Cost-cutting is one of the key justifications for adding mineral admixtures to concrete. This research primarily focuses on establishing the strength properties of SCC, where cement is largely substituted by mineral admixtures including GGBS, Fly Ash, and Alccofine together with polypropylene. These properties include compressive strength, split tensile strength, and flexural strength. The addition of polypropylene lowered shrinkage values significantly and somewhat increased strength. Additionally, the microstructure of the concrete samples was also examined.*

Keywords- Self Compacting Concrete, Strength, Mineral Admixtures, Superplasticizers, Microstructure .

I. INTRODUCTION

Due to a dearth of qualified labourers, self-compacting concrete was first adopted by Japan in the 1990s. Since self-compacting concrete has the ability to flow under its own weight, it doesn't require vibration or compaction. For the same slope, self-compacting concrete is stronger than traditional concrete. The use of superplasticizers and the increased quantity of cement and fine aggregate in SCC compared to conventional concrete are two major differences between the two types of concrete. Concrete was strengthened slightly by the use of polypropylene fibres in order to boost properties including compressive strength, split tensile strength, and flexural strength. Concrete is made more affordable by the addition of mineral admixtures such Ground Granulated Blast Furnace Slag (GGBS), Fly Ash, and Alccofine.

II. LITRATURE REVIEW

DFDGG J. K. Su et al. [7] suggested SCC mix by varying sand ratio (S/A) in increasing order from 0.3, 0.4, 0.45, 0.475, 0.5, 0.525, and 0.55. It showed increase in workability upon increase in S/A ratio. Also rheological properties were enhanced. Optimum S/A ratio recommended were upto 47.5 %. Investigation also revealed that S/A ratio has negligible effect on elastic modulus of SCC.

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T. Suresh Babu et al. [8] prepared glass fibre reinforced self compacting concrete (GFRSCC) by adding 600 gm/m3 of Cem-FIL Anti-Crack High Dispersion glass fibers along with suitable admixtures. SSC mix was prepared as per Nan-Su method mix design steps and Okamura's guidelines. By adding fibers, prepared GFRSCC showed increase in compressive strength, split tensile strength and flexural strength by 2.0 to 5.5%, 3.0 to 7.0 % and 11.0 to 20.0 % respectively. Review Concept and inception of SCC was done in 1986 by Okamura in Japan. Since then number of researchers has contributed in enhancing properties of SCC. Noticeable amongst them were studied and their findings are considering for improving workability as well as strength properties. Addition of fibers also contributed in increasing the compressive, split tensile strength and flexural strength of SCC. Nan Su et al. [5] developed mix design method which

was found to be more economical and easy to use as compared to conventional Japanese mix design method. The Packing Factor (PF) parameter was adopted which has influenced workability, durability and strength of SCC mix. Author adopted PF values in gradual decreasing order from 1.18, 1.16, 1.14 and 1.12. On reducing PF value in SCC mix compressive strength was found to be enhanced from 27.5 to 48 MPa. Requirement of cement binder was reduced upto 424 kg/m3 as compared to previous requirement of 500 kg/m3 . Even workability and durability was improved by using optimum content of Packing Factor

III. OBJECTIVE OF THE STUDY

The main objective of this resarch work is to find the strength charecterstics such as Compressive strength, split tensile strength and flexural strength of self compacting concrete with and without polypropylene fibers separately for different mixes where cement is partially replaced by various mineral admixtures

IV. MATERIALS USED

In this section details regarding materials used for the project work is mentioned below

Cement: OPC 53 Grade
Fine Aggregates: River sand
Coarse Aggregates: 12.5 mm size
Mineral Admixtures: GGBS, Class F
Fly Ash and Alccofine
Superplasticizer: MasterGlenium SKY 8233 .

V. FRESH CONCRETE PROPERTIES

FreshconcretepropertiesincludesSlumpflowtest,VFunneltest,UboxTestandLBoxtest

Table1 -WithoutPolypropylene

Property	Mix 1	Mix2	Mix3	Mix4	EFNARC
Slump	726	689	707	693	640 -800
V funnel	8	11	9	10	6 – 12
UBox	15	11	13	12	0-30
LBox	0.83	0.95	0.85	0.92	0.8 –1

Table2 -WithPolypropylene

Property	Mix 5	Mix6	Mix7	Mix8	EFNARC
Slump	680	661	674	659	650 -800
V funnel	11	12	10	12	6 – 12
UBox	16	13	15	16	0-30
LBox	0.90	0.92	0.92	0.96	0.7 –1

HARDENEDCONCRETEPROPERTIES

HardenedpropertiesofconcreteincludeCompressivestrength, splittensilestrengthand Flexuralstrength.

Table3 – Mould Size

Moulds	Mould Size
Cubes	150mm×150mm×150mm
Cylinder	150mm×300mm
Prism	100mm×100mm×500mm

MIX PROPORTION.

Cement–562.893kg/m^3
Fine Aggregates – 865.327 kg/m^3
Coarse Aggregates – 680.379 kg/m^3
Water – 223.677 kg/m^3
Superplasticizer–5.62lit/m^3

VI. RESULTS

CompressiveStrength

Table4–Compressivestrength

Mixes	WithoutPolypropylene		WithPolypropylene	
Curing	7days	28 days	7days	28 days
Mix1	43.35	51.72	48.70	56.53
Mix2	31.20	44.11	33.31	49.82
Mix3	36.45	46.70	37.22	50.55
Mix4	31.66	40.03	39.45	48.74

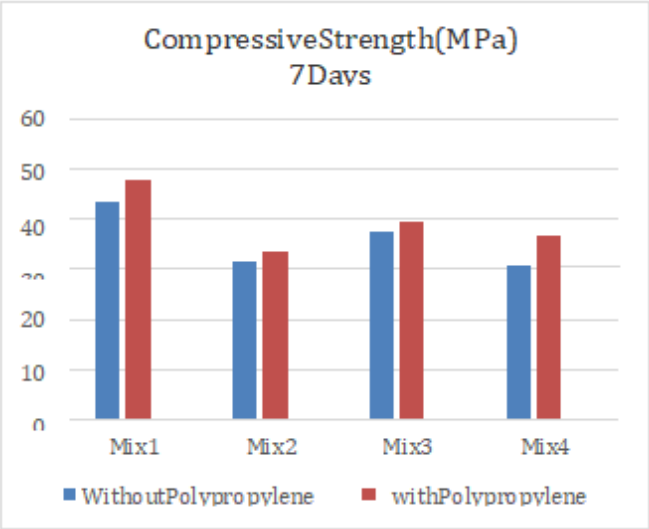

Chart1:compressive strength for 7 days

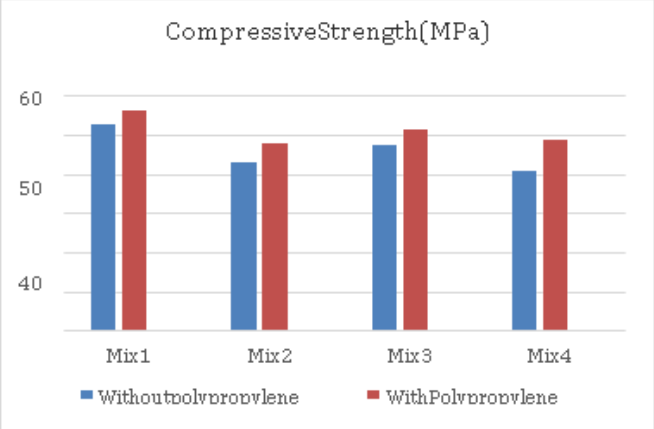

Chart-2:compressivestrengthfor28days

FlexuralStrength

Table5 – FlexuralStrength

Mixes	WithoutPolypropylene		WithPolypropylene	
Curing	7days	28 days	7days	28 days
Mix1	8	11.5	9.5	10.25
Mix2	5	6.5	6	9.25
Mix3	6	9.15	7.25	11.5
Mix4	5.5	7.15	6.5	9.5

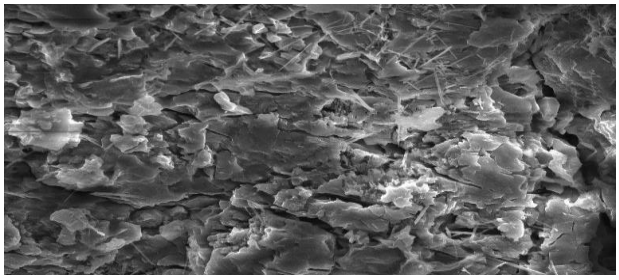

Fig-1:Mix1(28days)

ThisSEMpictureshowsmicrocracksaswellasettringite particles in it and CSH gel is also presentand dark spots indicates pores in hydrated cementpaste

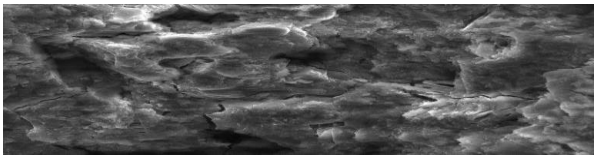

Fig-2: Mix2(28days)

Here in this we can see the formation of Dense CSHgel and also bright spots which indicates unhydratedcementparticlesandwecanalsoobservemicrocracksin it.

VII. CONCLUSION

Basedontheexperimentalprogramthefollowingconclusioncanbe made

- For making self compacting concrete NanSuMethodofmixdesigncanbeused.
- AllthemixproportionchosenfallswithintheEFNARCguidelines.
- Compressive strength, Split tensile strengthand flexural strength of concrete specimenswhichhaspolypropylenefibresshowshighers trength than specimens which doesn't havePolypropylene.
- By this study one can say that increasing thedosageofsuperplasticizersincreasestheworkabilityofconcrete.

The strength of all the mixes are increasedwhenfibreare added.

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