EXPERIMENTAL INVESTIGATION OF CURING METHODS ON PROPERTIES OF SELF COMPACTING CONCRETE

[1]T.Sai krishna Teja, [2]K.Chandana,
[1]Assistant professor, [2] Assistant professor,,
[1]Department of civil Engineering,
[1]St.Martins engineering college, secunderabad, India

Abstract : Self compacting concrete (SCC) is highly workable concrete with high strength and high achievement characteristics, that can flow under its own mass strategy into a congested reinforced sections without segregation and bleeding. It is observed that design mix behaviour is prominently affected by varying in environmental conditions like temperature and humidity in both fresh and hardened properties. This paper presents how the fresh and compressive strength properties will change due to effect of air curing, water curing, polyethylene film curing and steam curing, water cured specimens gained high compressive strength compared to other curing methods.

Index Term:**Admixture,viscositymodifyingagent,Selfcompactingconcrete,compressivestrength**

I. INTRODUCTION

Self compacting concrete is a concrete which can be placed and compacted under its own weight without using any compaction technique, it have an ability to form without segregation or bleeding. In construction site the noise level is going to eliminate and reduces the pollution environment. The materials of SCC does not vary much compared to ordinary concrete, but commonly it consists of binder materials and chemical admixtures. These constituents along with required flow ability modify the designing mix process compared to normal vibrated concrete. SCC is achieved by reducing the volume ratio of aggregate to cementitious materials, increasing the paste volume and using various viscosity enhancing admixtures and Super plasticizers. Superplasticizer is a chemical admixture which is used in concrete to increase the flow characteristics and improves the mechanical properties also, it is likewise suggests as the high range water reducers. Conplast Sp430 is for the most part suggested SP in our whole world and its dosage is maximum up to 3% by weight of Cementitious material. Viscosity modifying agent in concrete is modifies the viscous nature of concrete and mainly improves the stability and homogeneity of SCC.
This paper mainly explains the fresh and hardened properties of Self-compacting concrete. Fresh properties are tested to know how the concrete can able to flow without segregation and bleeding.

II. LITERATURE REVIEW

A.Ferhat bingol(1) et al.(2013) It concludes that increase in silica fume percentage replacement results in increase in compressive strength and decrease in strength while the increase of fly ash content and also concludes that highest compressive strength was obtained from standard curing and less strength obtained from air curing.
Hui Zhao(3) et al. (2011) It concludes that SCC with the 7days initial water curing and SCC under condition of full room curing gains high strength.
Gritisada(2) et al.(2012) It concludes that replacement of fine aggregate in suitable levels by RHA and LS produce high compressive development at early ages due to filling impacts and pozzolanic reactions.
Raghavendra(4) Y.B et al (2013) It concludes that the self curing compound was almost as effective as the conventional curing method and this method is applicable where concrete's performance specifications are important.
Wei Sun(5) et al. (2012) It concludes that SCC with A/B proportion for 6/4 has a most extreme compressive strength, flexural strength and least porosity at all curing periods.

III. MATERIALS USED

IN THIS RESEARCH, THE DIFFERENT MATERIALS REQUIRED TO MAKE SELF COMPACTING CONCRETE ARE AS FOLLOWS

Table 1: Materials used to make SCC

cement	53 grade-Ordinary Portland cement(OPC)
Fine aggregate	River sand
Coarse aggregate	10mm and 12.5mm maximum
Superplasticizer	Conplast SP430

Mineral admixture	Fly ash, GGBFS
Viscosity modifying agent	Master matrix 2 solution

IV. MATERIAL PROPERTIES:

The material properties for each material are found out by experimental approach.

1. **Cement** :The ordinary Portland cement (OPC) of 53 Grade was used to conduct experimental study and their specific gravity can be calculated by using density bottle method as 3.15.
2. **Fine aggregate** :The fine aggregates chosen for this investigation are obtained after sieving through the 4.75mm IS sieve and their specific gravity were found to be as 2.74 by Pycnometer apparatus.
3. **Coarse aggregate :**The Coarse aggregates are taken into two proportions as 40% of 10 mm and 60% of 12.5 mm after calculating the specific gravity of CA as 2.67.
4. **Water :** The portable water which is available in the lab is utilized in this investigation should have the pH in the limit 6-8.
5. **Superplasticizer :** It is a chemical or synthetic admixture used to build the flow characteristics of the concrete and reduce the water requirement for cement particles. Superplasticizer used in this study is Conplast SP430.

Table 2: Physical and chemical or compound properties of superplasticizer

Appearance	Brown colored fluid
Relative density	At 20^0C,value found to be 1.02-1.05 g/cm^3
pH	Less than or equivalent to 6
Compatible	For all sorts of cement
Chloride ion (%)	Less than 0.25%

Viscosity Modifying Agent(VMA) :

It is a consistency adjusting chemical material and helpful to alter the thick nature and strength of the concrete The VMA utilized as a part of this examination paper is Master Matrix 2 solution.

Table 3: Physical and chemical properties of Master Matrix2 solution.

Appearance	Clear fluid
Relative density	At 20^0c,value found to be 1.00-1.02 g/cm^3
pH	Less than or equivalent to 6.5
Chloride ion (%)	Less than or equivalent to 0.1

MIX PROPORTION OF SCC AND PREPARATION OF SPECIMEN

There is no any standard system for SCC mix design. Many research organisations, blended plants; precast companies have created their own mix proportioning techniques. Numbers of trails were carried out with 0.01m^3 of concrete using locally available materials and checked the fresh properties. According to European Guidelines finalised the mix proportion of M30 Grade of SCC. Once the mix proportion is achieved, concrete cubes were cast. All trail batches were arranged in rotating drum mixture. First the aggregate are added and then half quantity of mixing water was added and rotated for approximately two minutes. Next the cement, flyash and GGBS were introduced with measured amount. Later superplasticizer and viscosity modifying agent are introduced into the concrete mixture.

Table 4: Trail mix proportions

Trail mix	cement kg/m^3	CA, kg/m^3	FA kg/m^3	Fly ash kg/m^3	GGBFS kg/m^3	Water kg/m^3	SP %	VMA %
1	374	814	918	115	87	173	2	0.1
2	374	814	918	115	87	173	2	0.2

RESULTS AND DISCUSSIONS :

From the review of literature we can concluded that how the admixture influences greatly on SCC and also the viscous nature of it. The fresh and hardened properties of SCC are studied briefly and obtained results are dicussed below.

a. TESTS CONDUCTED ON FRESH SCC:

Fresh concrete tests were carried to know the workability property of SCC. Below Fig.1 shows the different tests conducted. The test results and EFNARC limits are listed in Table5.

J-ring apparatus

L-box apparatus

Slump flow apparatus

Table 5: Fresh properties results

SLNO	Type of test	Trail mix 1	Trail mix 2	Acceptance criteria
1	Slump flow, mm	665	690	650-800
2	J-ring, mm	6	8	0-10
3	V-Funnel, seconds	8.5	8	8-12
4	L-box	0.89	0.95	0.8-1.0
5	U-box, mm	10	10	30(max)

A. CURING CONDITIONS USED :

After achieving the proper mix and acceptance fresh properties the cubes were casted and kept under different curing condtions. The type of curing conditions used as shown below :

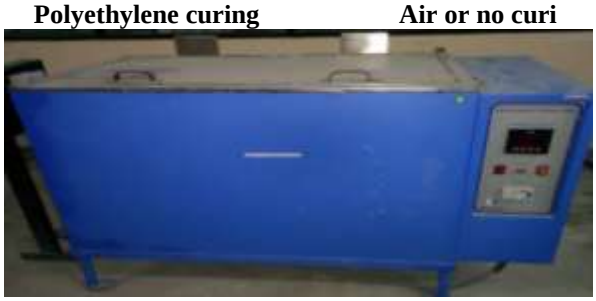
6.b.1 **water curing** :After demoulding the specimen, it should be kept in normal water at the standard room temperature till at the date of testing.

6. b. 2 **polyethylene film curing**:After demoulding the specimen, it should be wrapped with 0.01mm thick polyethylene transparent film and kept under ambient room temperature.

6. b. 3 **Air curing** :After demoulding the specimen it should be kept in open air to cure till the date of testing.

6. b. 4 **Steam curing**:After demoulding the specimen, it should keep in steam chamber for about 24hours maximum at 60^0c maximum temperature

Polyethylene curing **Air or no curi**



Curing in steam chamber

B.**COMPRESSIVE STRENGTH TEST RESULTS**

The hardened property like compressive strength is calculated for cubes under different curing methods. The cubes used for casting and testing of size 150X150mm. After cured at specified days the specimens should remove from the required cured conditions, it will test under UTM(Universal testing machine) . The following figure 3 and figure 4 shows the compressive strength test results for various curing methods.

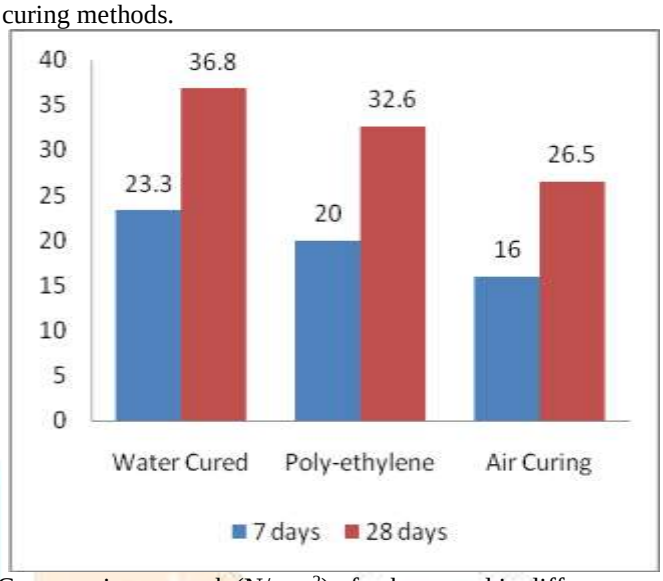


Figure 1. Compressive strength (N/mm^2) of cubes cured in different conditions

C.CONCLUSION:

1) From the research it concluded that water cured specimens gained higher compressive strength compared to other methods of curing.
2) It also concludes that air or no curing method cured specimen obtained a least compressive strength because of scarcity of water for hydration reaction and weak hydrated products formed. Hydrated products are the main contributors for strength gaining rate.
3) Steam cured specimens at 24hours compressive strength is almost nearer to the water cured specimens at 28days strength, but quality of hydrated products formed under steam curing is not much efficient as compared to water cured hydrated products.

D.REFERENCES:

[1] A Ferhat Bingol, Ilhan Tohumcu. (2013) explained "Effect of different curing regimes on the compressive strength properties of self compacting concrete incorporating fly ash and silica fume ".

[2] Gritsada, Sua-iam a, Natt Makul b (2012) explained "Utilization of limestone powder to improve the properties of self-compacting concrete incorporating high volumes of untreated rice husk ash(RHA) as fine aggregate".

[3] Hui Zhao, WeiSun, Xiaoming Wub, Bo Gao(2011) explained "Effect of initial water-curing period and curing condition on the properties of self-compacting concrete".

[4] Raghavendra Y.B. and Aswath M.U(2013) explained "Effect of self curing compound on strength of high performance self compacting concrete".

[5] Hui Zhao, Wei Sun, Xiaoming Wu and Bo Gao(2012) explained "The effect of coarse aggregate gradation on the properties of self-compacting concrete".