iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** X **Month of publication:** October 2017

DOI: http://doi.org/10.22214/ijraset.2017.10262

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue X, October 2017- Available at www.ijraset.com

Experimental Study of Self Curing Concrete

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Abstract: With advancement in technology, concrete had been subjected to various techniques and modification. In spite of these modifications, it exhibits good mechanical properties. Curing promotes hydration of cement, controls temperature and movement of moisture from and into the concrete. To continue hydration, the relative humidity inside the concrete should be 80%. Self-curing is the process in which the water is retained in the concrete and evaporation of water is also reduced. In this paper self-curing concrete is done by using polyvinyl alcoholat a rate of 0%, 0.5%,1%,1.5% and 2%. The mechanical properties like strength and tensile. The test results were studied at normal temperature outside the lab for air curing. It is found that the optimum of 1.5% of PVA gives higher strength.
Key words: self-curing concrete. Polyvinyl alcohol, Compressive strength, Split tensile strength.

I. INTRODUCTION

A. Self-Curing concrete

Curing is the process of adding water to the concrete externally after the concrete is being finished. Proper curing of concrete allows hydration of cement and continuous gain of strength. Curing maintains the moisture movement from and into the concrete. Hydration stops when relative humidity within capillary pores drops to 80%.Self curing or internal curing is a technique by which the hydration of cement prevails with the availability of extra internal water which is not the external water. The internal water is maintained by incorporating the self-curing agent polyvinyl alcohol (PVA) which reduces the evaporation of water from the concrete, thereby increasing the water retention capacity of concrete. The advantages of internal curing are increased hydration process and strength development, reduced autogeneous shrinkage and cracking, reduced permeability and increased durability

II. MATERIALS USED

A. Cement

Cement is a good binder. The most common type of cement used is ordinary Portland cement. It usually originates from limestone. In this study, OPC of 53 grade is used.. The cementproperties were evaluated as per the IS: 4031-1996 and IS: 12269-1987

Table 1: Properties of Cement

SI NO	Properties	Result
1	Specific gravity	3.1
2	Fineness Modulus	2.99
3	Standard Consistency	31.25%
4	Initial Setting time	36 minutes
5	Final Setting time	390 minutes

B. Fine aggregate

Sand is a naturally occurring granular material composed of finely divided rock and mineral particles and having particle size less than 4.75 mm. River Sand conforming to IS 383-1970 is used in this study.

Table 2Properties of Fine aggregate

SI NO	Properties	Result
1	Specific gravity	2.47
2	Fineness Modulus	2.99
3	Bulk density(kg/m3) (loose state)	1542
4	Bulk density(kg/m3) (compacted state)	1701
5	Water absorption(%)	1

C. Coarse aggregate

Gravel is composed of unconsolidated rock fragments and havingAggregates passing through 20mm sieve and retained on 4.75mm sieve were sievedand tested as per Indian Standard Specifications IS: 383-1970.

Table 3Properties of Coarse aggregate

SI NO	Properties	Result
1	Specific gravity	2.74
2	Fineness Modulus	7.34
3	Bulk density(kg/m3) (loose state)	1426
4	Bulk density(kg/m3) (compacted state)	1706
5	Water absorption(%)	.5

D. Water

Water plays a vital role in concrete mix. It forms paste after mixing with cement that helps in binding with the aggregate. The chemical reaction between water and cement is called Hydration. Thus hydrates or hydration products are formed during hydration by the formation of chemical bond between cement and water. Hardening of concrete is caused by water during hydration.

E. Polyvinyl alcohol

Polyvinyl alcohol is formed from the chemical compound of polyvinyl acetate ,regularly by a continuous process .it is a clear and white coloured cementpowder it melt in hot water and soluble in ethyle alcohol. It has the idealized formula [CH2CH(OH)]n. ph range of a 5% solution of poly vinyl alcohol exhibit 5.0 to 6.5 ppm. It has a properties like emulsifying and gum properties . PVA is a fully degradable and dissolve quickly

F. Super plasticizer

Super plasticizer reduces the water 3 to 4 times in the concrete mixes. So they are known as high range water reducing admixture. When they are added to cement particles, they emit a strong negative charge, which helps in lowering the surface tension of the surrounding water

.By which the fluidity of the concrete mix is increased. They can be added to a certain limit of 2% of cement to the concrete mix so as to stop bleeding and segregation. The strength of concrete increases as water cement ratio decreases. Workability is greatly achieved by adding super plasticizer. In this study, Ceraplast 300 is used as super plasticizer at a dosage of 2% by weight of cement.

III. MIX PROPORTION FOR SCC

There is no standard mix design for self-compacting concrete (SCC).Using IS: 10262 (2009) the mix design for M30 grade is achieved. SCC is achieved by taking 55% of total aggregate as fine aggregate as per EFNARC specification. In this design water to powder ratio is taken as 0.35 and super plasticizer is added at dosage of 2% by weight of cement.

Table 4Mix proportion for M30 grade of concrete for $1m^3$

Cement (kg/m^3)	Fine Aggregate (kg/m^3)	Coarse Aggregate (kg/m^3)	Water (lit/m^3)	Super Plasticizer (%)
520	912	776	182	2

IV. TEST RESULTS

A. Compressive strength and split tensile strength result

Compression test and tensile strength is carried out in the cube of size 150mmx150mmx150mm and cylinder of size 150mmx300mm. The specimen with self-curing agent PVA at a dosage of 0%,0.5%,1%,1.5%,2% by weight of cement is added. The test results are taken for 7days, 14 days, 28 days. The test results of the specimen are observed for both water curing at normal temperature.Compression test and tensile strength was carried out by 400 tonne universal testing mcompressing testing machine.

Table 5Compressive strength test results

Specimen Details		Compressive strength(N/mm^2)		
		7 Days	14 Days	28 Days
PVA 0%	Conventional (WC)	20.7	27.54	31.45
PVA 0% AC	SCC	19.45	26.76	30.21
PVA 0.5% AC	SCC	20.51	27.45	31.55
PVA 1.0% AC	SCC	20.73	27.98	31.78
PVA 1.5% AC	SCC	21.23	28.78	32.42
PVA 2.0% AC	SCC	20.54	27.13	31.13

Figure 1Graphical representation for Compressive strength test results

Table 6Split tensile strength test results

Specimen Details		Split tensile strength(N/mm^2)	
		7 Days	28 Days
PVA 0% WC	Conventional(WC)	2.51	3.50
PVA 0% AC	SCC	2.21	3.23
PVA 0.5% AC	SCC	2.53	3.52
PVA 1.0 % AC	SCC	2.74	3.76
PVA 1.5% AC	SCC	2.98	3.97
PVA 2.0% AC	SCC	2.43	3.32

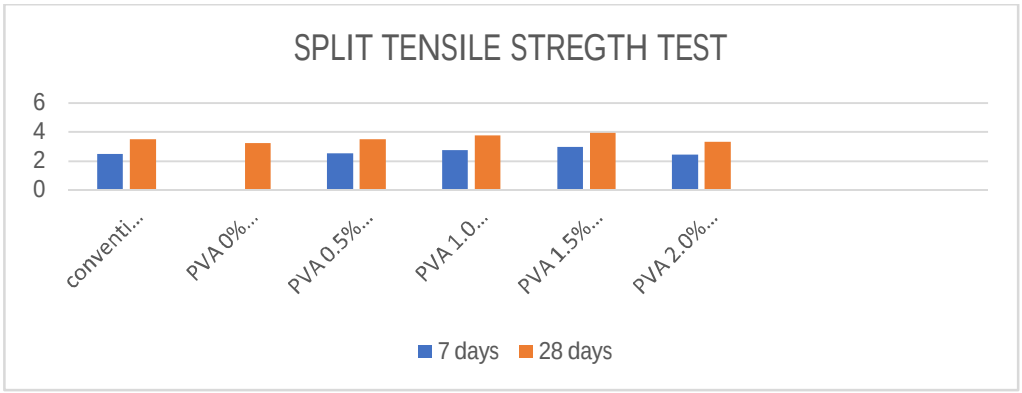

Figure 1Graphical representation for Split tensile strength test results

V. CONCLUSION

The following conclusion was drawn from this study

A. It was observed that 2% PVA gives lower compressive strength and spilt tensile strength compared to 1.5% PVA. Thus it is found that addition of PVA in high dose over 1.5% of cement would not give expected results in strength and those cannot be used practically.1.5% gives higher compressive strength and spilt tensile strength compared to the normally used water cured specimens without self-curing chemicals.

B. It is observed that the specimen with PVA when placed outside the lab gives same result as that of normal water cured specimen. The usage of PVA gives better strength than the water cured conventional concrete when stored inside the lab.

C. So self-curing agent (PVA) works well in a normal environment

D. Curing Chemical Admixture (SCCA) ie. PVA can promote effective hydration of cement without any externally applied curing procedure

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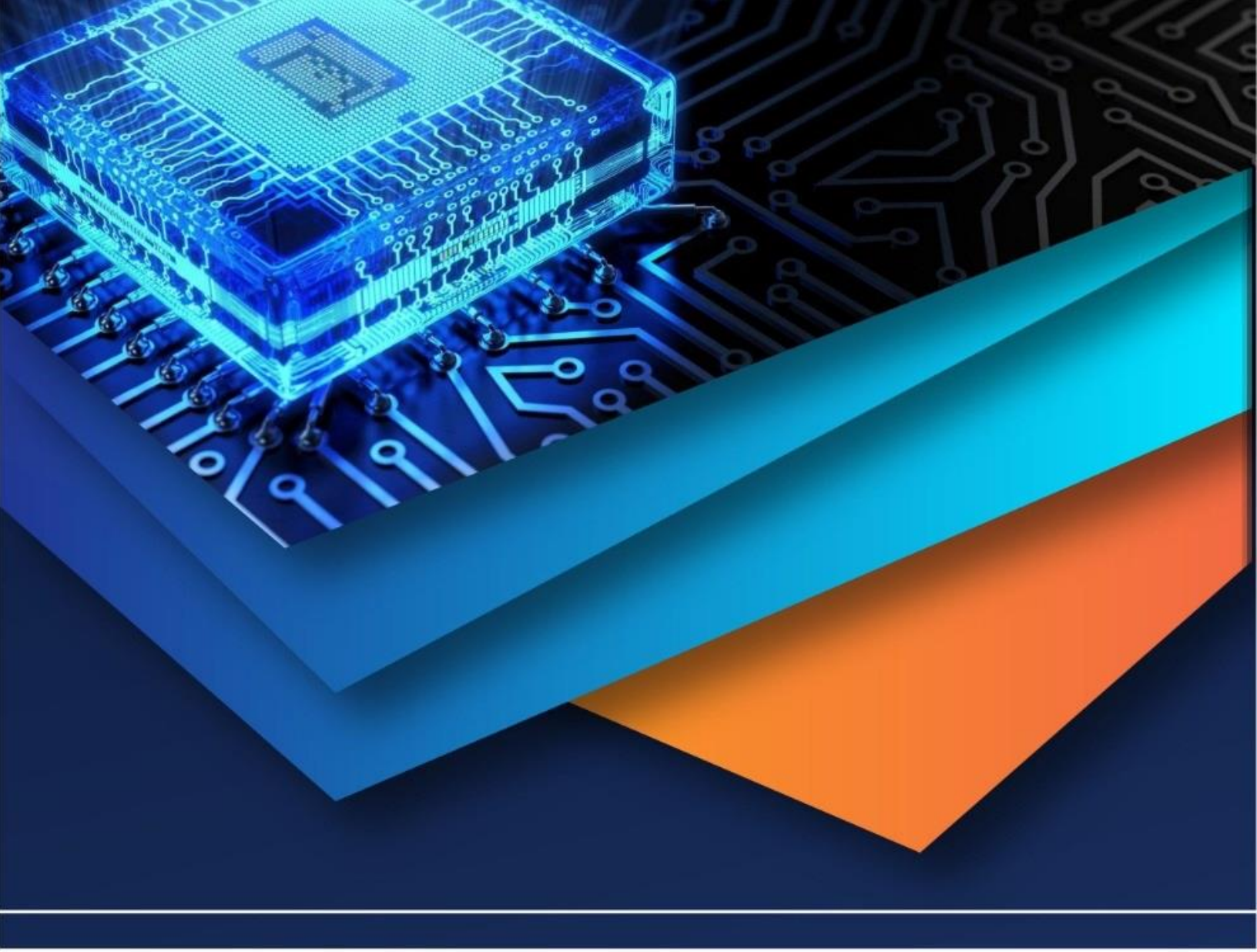

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