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Study of Strength and Stability of Concrete with Water-Soluble Polyethylene Glycol as Self-Curing Agent

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Abstract: ***Curing plays a chief function in the growth of concrete properties throughout construction. Curing is often used to provide the method by which hydraulic cement concrete mature and increase hardened property more than time as a product of the constant hydration of the cement in the occurrence of enough water (ACI, 2008). The function of curing is to lessen water disappearance from concrete and keep acceptable moisture content, especially throughout early ages, for continuance of the hydration method that is essential for the growth of cement microstructure.***

Since we identify water shortage is mounting day by day, so an vital research should be needed to do the constructions without water. In early stages, water was mandatory for the curing purposes in construction. Curing of material do a chief job in rising pore structure and microstructure to increase durability and performance with water-soluble polyethylene glycol as self curing agent and light weight aggregate.

Aim of this thesis is to revise concerning the power and stability of concrete with water-soluble polyethylene glycol as self-curing agent. This agent will lessen the water disappearance from concrete.

Keywords: SCC, PEG, LWA, Self Curing Agent

I. INTRODUCTION

Curing plays a chief function in the growth of concrete properties throughout construction. Curing is often used to provide the method by which hydraulic cement concrete mature and increase hardened property more than time as a product of the constant hydration of the cement in the occurrence of enough water(ACI, 2008). The function of curing is to lessen water disappearance from concrete and keep acceptable moisture content, especially throughout early ages, for continuance of the hydration method that is essential for the growth of cement microstructure. This will lead to a improved class cement adhesive and concrete and will help to attain the preferred properties. The Code ACI-308 states “interior curing refer to procedure by which hydration of cement occur for the reason that of the accessibility of extra interior water that is not a part of integrated Water.” conservatively, curing concrete mean create circumstances that water is not absent from the exterior i.e., curing taken to go on ‘from outside to inside’. In compare, internal curing is allowing to cure ‘from within to outside’ through inner reservoirs Created. ‘Internal curing’ is regularly also referred as ‘Self–curing.’

II. LITERATURE REVIEW

Wen-Chen Jau declared selfcuring is provided to absorb water from dampness and from atmosphere to attain improved. It lessen the difficulty when the amount of cement hydration is lesser due to no curing or inappropriate curing by tough potential of fascinating moisture from environment and provide water necessary cure .

PietroLura The major aspire of his study was to attain a improved beginning of autogenous contraction in order to be capable to replica it and perhaps lessen it. Once the significant position of self-desiccation contraction in contraction is exposed, the profit of avoiding throughout inner curing turn into obvious.

Mohanraj Rajendran M strength of chop by compression test engine for Self-cured concrete is superior than of concrete cure by complete curin. The tear tensile strength of self-cured cylinder sample is superior than that of the conservatively cure sample. Self-cured concrete is establish to have fewer water absorption value compare with concrete cure by supplementary technique. thus have less quantity of absorbent. The achievement of the first study things to see the assure of extra job

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III.EXPERIMENTAL WORK

TABLE I : mix design formation.

Mean target Flexural Strength	Maximum size of Aggregate	MIX Proportion	W/C Ratio	WATER	CEMENT	FINE Aggregate	COARSE AGGREATE
(N/mm2)	(mm)	(C:S:C.A)		(Kg/m3)	(Kg/m3)	Kg/m 3	(Kg/m3)
4.5	20	1:2.17:3.5	0.4	140	350	761	1228

IV. RESULTS AND FINDINGS

This chapter deals with the presentation of test result, and discussion on compressive strength, tensile strength and flexural strength development of ordinary concrete over self curing concrete.

A. Sieve Analysis Results

Table 1: Sieve Analysis of Coarse aggregates (20mm)

S.no.	IS-Sieve	Wt. retained (gram)	%age retained	% passing	Cumulative retained
1	80	0	0	100	0
2	40	0	0	100	0
3	20	53	1.77	98.23	1.77
4	10	2938.5	97.95	.28	99.72
5	4.75	5.5	.18	.10	99.9

Table 2: Sieve Analysis of Coarse aggregates (10mm)

S.no.	IS-Sieve	Wt. retained	%age retained	%passing	Cumulative retained
1	100	0	0	100	0
2	80	0	0	100	0
3	40	0	0	100	0
4	20	0	0	100	0
5	10	201.2	67.07	32.93	0
6	4.75	958	31.93	1	67.93
7	Pan	30	1	0	99
	Total=3000gm			Sum=166.07	

Self-curing concrete is an alternative to conventional concrete in desert regions where scarcity of water is a major problem.

B. Fine Aggregate:

Table 3: Sieve Analysis of fine aggregates

S.no.	IS-Sieve	Wt. retained	%age retained	%passing	Cumulative retained
1	4.75	6	.6	99.4	.6
2	2.36	5.9	5.9	93.5	6.5
3	1.18	22.	22	71.5	28.5
4	600micron	159	15.9	55.6	44.4

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5	300micron	316.5	31.65	23.95	76.05
6	150micron	196.5	19.65	4.3	95.70
7	Pan	43	4.3	0	
Total=3000gm				Sum=251.57 FM=251.57/100=2.51	

C. Water

The drinkable water is sensible for mixing and curing of concrete. The water fit for drinking used for making concrete available in laboratories. This should be clear from any contaminants and should be of good quality.

D. Test Methods

The methods used to test the materials like cement, sand, aggregates (coarse) and concrete are given below:

1) Specific Gravity

It is define as the proportion of the weight of particular volume of a material to the weight of an equal volume of some mention substance, or consistently the ratio of the masses of equal volumes of 2(two) substances.

Coarse and Fine Aggregates Sieve Analysis as per IS: 2386 (Part I) – 1963 The sieve analysis is used to distribute particle size and find the fineness modulus of aggregates.

Specific gravity of Coarse aggregates is 2.65 and that of fine is 2.68

2) LOS Angles Abrasion test for Coarse Aggregates

Weight of sample (w1) =5000gm

Weight of sample retained after rolling in machine for 500 times (W2) =4020gm Weight of sample passing through 1.7mm sieve=W1-W2=880gm

L.O.A= (W1-W2)/W1=19.75%

E. Mix Proportion of Concrete M40

TABLE.4. Mix of M40 with different percentage of peg per CUM of M40 grade.

TYPE OF MIX	concrete grade	Cement (kg)	fine aggregate(kg)	coarse aggregate (Kg)	water IN (L)	PEG in %
LOW	M40	390.7	776	1019.7	164	1
MED	M40	390.7	776	1019.7	164	1.5
HIGH	M40	390.7	776	1019.7	164	2

F. Polyethylene Glycol

Table 5. Properties of PEG

Property Name	Property Value
Specific gravity	1.12 at 27 oC
pH	>6
Molecular weight (gm/mol)	400
Appearance	Clear liquid
Colour	White
Hydroxyl value (mg KOH/gm)	300
Nature	Water soluble
Molecular formula	H(OCH2CH2)n OH
Density g/cm3	1.125

Table 6 : Concentration of PEG dosage with slump Values:

Polyethylene Glycol (PEG) Dosage	
(Percentage by weight of cement) Replaced	slump in mm
Low	66
medium	69
High	77

G. Compressive Strength

Table 7. Compressive strength values of external and self curing specimen of 150x150x150 mm

Curing type	(Percentage by weight of cement)	7D	14D	28D
external	0 % (external curing)	26.9	33.78	48.25
self curing	1%	27.4	33.88	48.4
self curing	1.50%	31.18	33.32	47.6
self curing	2%	26.4	33.18	47.4

H. Flexural Strength

Table 8. Flexural strength values of external and self curing specimen of 100x100x300 mm

Curing type	(Percentage by weight of cement)	7D	14D	28D
external	0 % (external curing)	4.30	5.74	8.68
self curing	1%	4.38	5.75	8.71
self curing	1.50%	4.98	5.66	8.56
self curing	2%	4.20	5.64	8.53

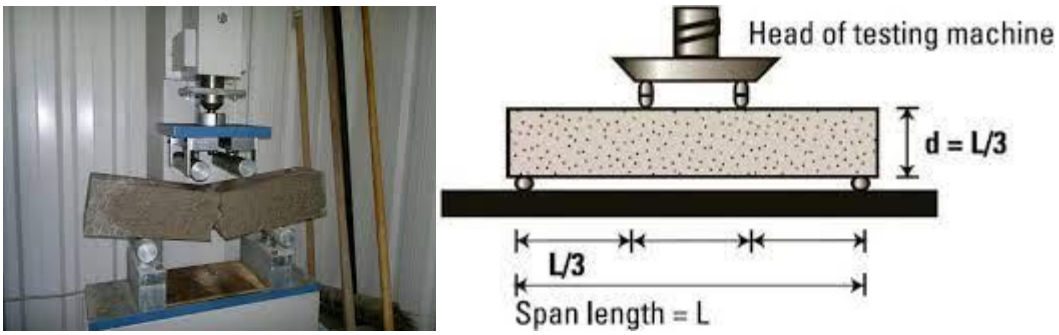


Fig1. Flexural strength test of sample.

I. Cost Analysis

Table 8.1. Manifacturing cost of normal concrete mix (Rs. Per cum)

Manifacturing cost of normal concrete mix (Rs. Per cum)					
grade	Cement (a)	FA (b)	CA ©	W (d)	Cost/ Cum= a+b+c+d
M40	390 x Rs6	776xRs1.8	1019xRs0.7	164 x Rs 0.5	Rs. 4536

Table 8.2. Cost of concrete with Appling water externally to Concrete for curing in INR:

grade	cost per cum	cost of water required per cum of concrete	cost of extra labour	total cost
M40	4536	1500	2800	8836

Cost of PEG for Self curing Concrete
= 1.95 X Rs 544 = Rs. 1060.80

Table 5.8.3. Variation of Cost of Externally and internally cured concrete in INR:

cost of nominal concrete per cum	cost of SCC per cum	cost saving
8836	5597	3239

V. CONCLUSION

From the results obtained in this study the following conclusions can be noted:

1) The use of self-curing agent (polyethylene glycol) in concrete mixes improves the strength properties of concretes under air curing regime which may be attributed to a better water retention and causes continuation of the hydration process of cement past resulting in less voids and pores, and greater bond force between the cement paste and aggregate.

2) It is observed that as grade increases workability decreases in self-curing concrete mixes. Similarly as dosage of polyethylene glycol (PEG) increases, workability increased.

3) The optimum dosage of polyethylene glycol (PEG) (expressed in percentage by weight of cement) for M40 grades self-curing concrete is 1% respectively.

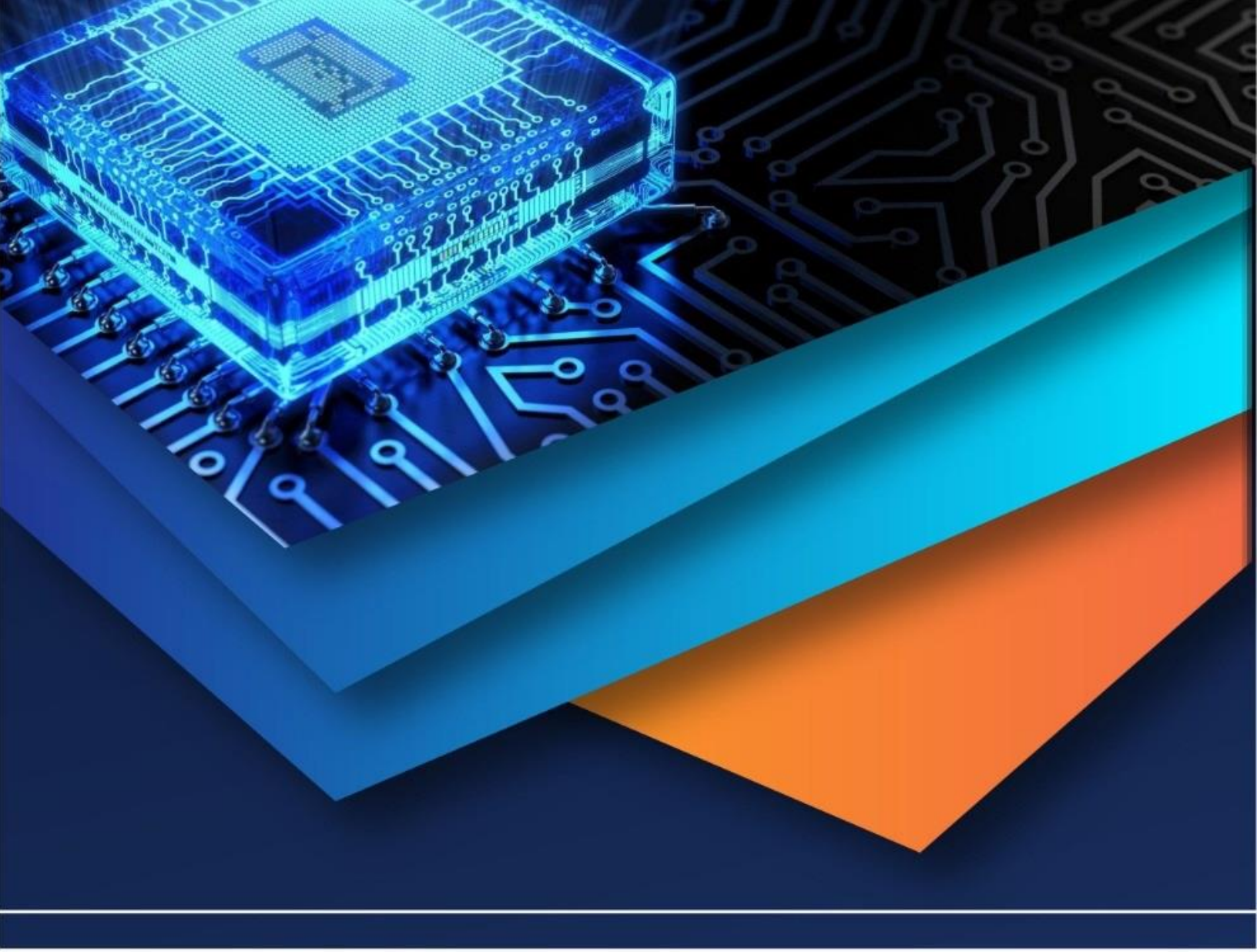
4) There is a significant increase in the compressive, split-tensile and flexural strength properties self-curing concrete mixes at all ages of curing when compared to normal externally cured concrete mixes.

5) It was found that there is significant cost saving ranging from Rs. 2500 -3000 per cubic metre of concrete if concrete is internally cured.

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