SELF CURING CONCRETE

A PROJECT REPORT

in partial fulfillment for the award of the degree of

MASTER OF TECHNOLOGY

IN

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Submitted by

RAHUL DEV

(11300600)

SUPERVISOR

MR. R. NAVANEETHAN

School of Civil Engineering

LOVELY PROFESSIONAL UNIVERSITY, PHAGWARA

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DECLARATION

I **RAHUL DEV**(11300600),hereby declare that this submission is my own work and that to the best of my insight and conviction, its content no material beforehand distributed or composed by other individual or office. No material which has been acknowledged for reward of some degree or certificate of the college or other organization of higher learning with the exception of where due affinitions have been made in the content. It was arranged and under the direction and supervision of **Mr. R.NAVANEETHAN**.

Date:- RAHUL DEV

Place:- 11300600

CERTIFICATE

This is to certify that **RAHUL DEV** under Ref. no. 11300600 has prepared the Pre-dessertation report titled "**SELF CURING CONCRETE**" under my direction. This is a bonafide work of the above competitor and has been submitted to me in fractional satisfaction of the prerequisite for the honour of **MASTER OF TECHNOLOGY** in **CIVIL ENGINEERING.**

SIGNATURE **SIGNATURE**

Mr. R.NAVANEETHAN

H.O.D Civil Engineering (supervisor)

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Signature of student

RAHUL DEV

ABSTRACT

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 as granite.

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.

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CHAPTER-1

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. though, good curing is not realistic in lots of cases and a amount of researchers have questioned whether it is feasible to set up self-curing concrete. It was establish that the improvement of use self-curing agent is to lessen water fading from concrete, therefore rising its water preservation capability compare with that of conservative concrete and that water-soluble polymers may have this potent.

building industry make use of bunch of water in the name of curing. The days are not far-off that all the building industry has to button over to an substitute curing system, not simply to save water for the sustainable growth of the atmosphere but also to encourage inside and open-air construction behavior even in inaccessible areas where there is shortage of water.

Cure is the method of scheming the amount of humidity loss during cement hydration.If concrete is to attain its possible strength and stability Curing may also comprise the control of the temperature since this affect the speed at which cement hydrates.

The curing era might depend on properties necessary of concrete, the reason for which it is to be used, and the ambient circumstances, i.e. the temperature and comparative dampness of nearby atmosphere. Curing is planned mainly to stay the concrete moist, by preventing the defeat of moisture from the concrete throughout the era in which it is gaining strength. Curing may be apply in a

amount of behavior and the most proper means of curing may be dictate by the location or the construction process. Curing is preservation of a acceptable moisture content in concrete for era of moment right away subsequent insertion and finishing so that the preferred property may increase. The need for sufficient curing of concrete cannot be overemphasize. Curing has a tough control on the property of hardened concrete; correct curing will enlarge durability, strength, scratch resistance, amount stability, and resistance to frozen and thaw and deicers.

bare slab surfaces are chiefly receptive to curing as strength growth. And freeze-thaw resistance of the peak face of a slab can be abridged drastically when curing is imperfect. When Portland cement is assorted with water, a chemical response known as hydration takes place. The amount to which this reaction is finished influence the strength and stability of the concrete.

newly mixed concrete usually contain more water than is mandatory for hydration of the cement; though, too much loss of water by disappearance can holdup sufficient hydration. The face is particularly vulnerable to inadequate hydration because it dry first. If temperatures are positive, hydration is comparatively fast the first few days after concrete is positioned; though, it is vital for water to be retain in the concrete throughout this era, that is, for evaporation to be banned or considerably abridged. With good curing, concrete become stronger, more impervious, and more opposed to stress, scratch, and freezing and thaw. The development is fast at early age but continues additional gradually afterward for an imprecise era.

Curing is name set to the measures used to promote hydration of cement, and consist of a power of temperature and of dampness into the concrete. Curing allows nonstop hydration of the cement and accordingly constant increase in the strength, once curing stop strength increase of the concrete also stop. correct moisture circumstances are serious because the hydration of the cement almost cease when the relative dampness within the capillaries drop underneath 80%.

A tough concrete is one that perform adequately beneath the predictable exposure state throughout its intended service time.

Definition of internal curing:-

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.'

1.1 Need of self curing:-

When mineral admixtures respond totally in blend system, their require for curing can be lot larger than that in a conservative normal cement concrete. When this water do not willingly obtainable, due to depercolation of capillary porosity.

Due to contraction happening throughout cement hydration, vacant pores are formed inside cement paste, most important to a diminish in its interior relative dampness and also to contraction which may reason early-age crack. This state is intensified in HPC due to normally advanced cement content, abridged water/cement (w/ c) percentage (fly ash, silica fume). The unfilled pores formed during self-desiccation bring contraction stresses and also control the kinetics of cement hydration procedure, restraining the last degree of hydration. The strength achieve by IC might be additional than that probable under soaked curing circumstances. frequently especially in HPC, it is not simply achievable to offer curing water from the top face at the rate necessary to gratify the current chemical contraction, due to the particularly low permeability's frequently achieved.

1.2 Significance of self curing:-

When mineral admixtures reply entirely in a combine cement structure, their order for curing water can be a lot better than that in a conservative ordinary cement concrete. When this water is not willingly obtainable, important autogenously bend and cracking may consequence. Due to chemical contraction taking place throughout cement hydration, vacant pores are created inside the

cement adhesive, chief to a decrease in its inner relative dampness and to contraction which can reason early-age cracking.

1.3 Potential material for internal curing:-

The subsequent materials can give internal water reservoir:

- Aggregate
- Fine aggregate
- OPC cement
- Polyethylene Glycol PEG

1.4 Advantages of internal curing:-

- ✓ Internal curing is a method to offer the water to hydrate the entire cement,
- ✓ eliminate mostly autogenously contraction.
- ✓ Internal curing (IC) is a technique to give the water to hydrate all the cement, accomplishing what the integration water without help cannot do. In small w/c ratio mix absorptive frivolous aggregate, replace a little of the sand, provide water that is desorbed into the mortar portion to be worn as extra curing water. The cement, not hydrated by short quantity of mixing water, will have other water existing to it.
- ✓ IC provide water to stay the comparative dampness high, keep self desiccation from happening.

- ✓ IC maintain the strength of mortar at the early on period away from the point wherever inside & on the outside induced strain can reason cracking.
- ✓ IC can build up for a few of the deficiencies of exterior curing, both human linked and hydration linked. subsequent factors found the dynamics of water progress to the unhydrated cement particles:
  - ➢ need for liquids for water via hydrating cement particle is extremely strong,
  - ➢ Capillary act of the hole in concrete is extremely tough.

CHAPTER-2

LITERATURE REVIEW

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- **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

- **M. Manoj Kumar, D. Maruthachalam** study on selfcuring. fabulous permeable polymer was used as self-curing agent. M40¬ grade of the concrete is adopt for study. Based on this new study was approved out. The subsequent conclusion were drawn. Water preservation for the concrete mix incorporate a self-curing agent is higher compare to conservative concrete mixes. As establish by the mass loss with moment. The finest quantity is 0.3 % adding up of SAP guide to a vital increase of mechanical strength. There was a balanced boost in the strength for amount from 0.2 to 0.3 % and afterward slowly abridged. Self-cured concrete using SAP was additional inexpensive than conservative cured concrete. In the study cubes were casted and reserved for curative in room temperature concerning 250 to 300 c almost viability of self-cured associate is wanted to be check in warm regions. The efficiency of inner curing by income of SAP apply to concrete was the maximum if 45 kg/m3 water is additional by mean of 1 kg/m3 SAP.
- **Basil M Joseph** study on selfcuring concrete He added 0-1.5% of PEG400 by weight of cement for M20 grade concrete he establish 1% of PEG400 by weight of cement was most favorable for M20 grade of concrete for attain utmost strength. He also establish that if proportion of PEG400 gets greater than before slump as well as compaction factor also greater than before.

- **Stella Evangeline** make use of poly vinyl alcohol as self-curing agent in concrete. He added 0.03-0.48% by mass of cement¬ from that he establish 0.48% of poly vinyl alcohol by mass of cement provide superior compressive, tensile as fine as flexural strength than the strengths of conservative mix.

- **Dayalan J** had worn great. He was added 0.0-0.48% of great¬ absorbent polymer by mass of cement for M25 grade concrete. He was establish that great absorbent polymer 0.48% by the mass of cement provide superior compressive, flexural strength than the potency of conservative mix.

CHAPTER-3

RESEARCH METHODOLOGY

The feature and the compensation of the current creation will be additional willingly understand upon a considerate reflection of the following full report of a prefer personification of present creation with reference to the associated drawings.

To make sure a straightforward as well as well-organized curing of concrete, a elevated appearance self-curing agent of the current creation, which sort high wettability and wet absorbability, shall be apply onto the concrete for self-curing cause. “Self-curing concrete” means that no manual labour work is necessary to give water for concrete, or yet no any other outside curing is necessary after insertion for self-curing reason.

, a work run of self-curing means comprises:

step **1**: “mix concrete”;

step **2**: “insertion concrete”;

step **3**: “apply first self-curing agent on concrete for initial face covering”;

step **4**: “apply second self-curing agent on concrete for second face cover” and

step **5**: “confirmation of the result of self-curing”.

Firstly, an not obligatory concrete combination ratio is certain for step **1**, which contain coarse aggregates, fine aggregates, cement, pozzolans, superplasticizer and addition water of good mix amount.

In step **2**, the assorted concrete is located into formworks. After first setting of concrete, execute step **3** to apply initial self-curing agent on concrete face by means of consistent spraying. throughout the face cover in step **3**, the water state first self-curing agent can soak up dampness from environment and then discharge it into concrete. The necessary quantity of first self-curing agent is approx. 10 to 500 gw/m^2, or practically about 150 gw/m^2.

To develop the self-curing consequence of self-curing agent, after the initial self-curing agent has infiltrate into concrete, carry out step **4** for second-time face covering past 5-10 minutes of step **3**, such that the second self-curing agent is apply to the face of the first self-curing agent.

After performing a check in an environment of RH 85%, where self-curing process of the current creation is apply to OPC of a water to cement proportion 0.6, it's establish that the water defeat in mass of OPC with self-curing cause has abridged by 32% as compare to OPC with no curing, and the compressive strength has enlarged by 15%. If applying self-curing process of the current creation to SCC of a water to binder ratio 0.37, it's establish that, after at least one face covering by self-curing agent, the water defeat in mass of SCC with self-curing agent was abridged by 46% as compare to SCC with no curing, and the compressive strength has improved by 30%. Therefore, the current creation features easy operation and acceptable curing of a variety of concretes with no external curing work. In addition, the following experiment results illustrate that the self-curing technique of the current creation has an superior curing effect, a higher compressive strength and lower volume contraction.

The current creation can decrease water evaporation and develop curing effect after taking away of formworks, as illustrate in the subsequent test:

In the subsequent tables, RH represent air humidity, and ordinary covering is commercially obtainable liquid membrane-forming compound for curing concrete in compliance to ASTM C309. The self-curing agent of the current creation is polyethylene glycol (PEG) in the first chosen personification, and propylene glycol in the second favoured personification. In above particular

work run, the self-curing agent apply to OPC and SCC (50 gw/m^2, 100 gw/m^2, 150 gw/m^2) is represent by “small quantity”, “moderate quantity” and “large quantity”.

TABLE 1

Water loss for OPC	Water loss (unit gw)				Weight loss
No curing	0	78.2	98.8	114.3	1
The first embodiment small quantity	0	65.5	94.6	106	0.927
The first embodiment moderate quantity	0	47.3	80.3	100.1	0.876
The first embodiment large quantity	0	30.2	63.5	84.5	0.739
The second embodiment small quantity	0	69.1	65.4	112.6	0.985

TABLE 2

Water loss for OPC Curing	Water loss				Weight loss ratio
No curing	0	62.7	98.7	112.2	1
Membrane	0	56	93.3	107.6	0.958
The first embodiment small quantity	0	50.2	85.8	100.2	0.893
The first embodiment moderate quantity	0	44.2	74.6	89.2	0.795

The first embodimentlarge quantity	0	32.2	61.3	76.8	0.684

Water loss SCC Curing	Water loss				Weight loss ratio
No curing	0	65.1	83.1	97.3	1
The first embodiment small quantity	0	58.6	74.9	88	0.904
The first embodiment moderate quantity	0	50.2	67.2	79.1	0.812
The first embodiment large quantity	0	35.5	52.5	69.1	0.710
The second embodiment small quantity	0	51.7	72.3	85	0.873
The second embodiment moderate quantity	0	42.5	63.6	77.2	0.793

so, the self-curing process of the present creation is optimally right for OPC and SCC, established by its minor water defeat than OPC and SCC with no curing or by covering. The self-curing agent of the current creation can soak up dampness from environment and then discharge it into concrete. frequently used commercially accessible covering usually can only in some measure avoid water loss from concrete to environment.

The better compressive strength of the current creation is described with the subsequent test and diagrams:

OPCs are use for curing in dissimilar circumstances, and then the compressive strength are compared.the compressive strength of first preferred personification (polyethylene glycol) in the atmosphere of RH 50% is 231, 254, 271 kgf/cm^2 correspondingly, according to the categorization of "small quantity", "moderate quantity" and "large quantity" (A**1**, A**2**, A**3**); the compressive strength of next favoured personification (propylene glycol) is 230, 237, 247 kgf/cm^2 correspondingly. on the other hand, the compressive strength of ordinary concrete with no curing (C**0**) is 233 kgf/cm^2 (1 MPa=10.1972 kgf/cm^2), and that with damp curing (C**1**) is 306 kgf/cm^2. The compressive strength of self-curing process of the current creation is superior than that with no curing (C**0**), but lesser than that with damp curing (C**1**). in the environment of RH 67.5% and 85%, the compressive strength of self-curing procedure of the present formation (A**1**, A**2**, A**3**, B**1**, B**2**, B**3**) is superior than that with no curing (C**0**), and close to or equivalent to that with criterion moist curing (C**1**) and usually used process of covering (C**2**). The self-curing process of the current creation can develop the compressive strength of OPC in the case of RH superior than 67.5%.

SCCs are worn for curing in dissimilar circumstances, and then the compressive strengths are compare. the compressive strength of first and second favoured personification (polyethylene glycol) (A**1**, A**2**, A**3**, B**1**, B**2**, B**3**) in the atmosphere of RH 50% is somewhat superior than that with no curing (C**0**), and lesser than that with damp curing (C**1**), according to the categorization of "small quantity", "moderate quantity" and "large quantity". in the atmosphere of RH 67.5%, the compressive strength of self-curing process of the current creation (A**1**, A**2**, A**3**, B**1**, B**2**, B**3**) is much superior than that with no curing (C**0**), and superior than or equivalent to that with damp curing (C**1**). the compressive strength of self-curing process (A**1**, A**2**, A**3**) in the atmosphere of RH 85% is 302, 319, 319 kgf/cm^2 (1 MPa=10.1972 kgf/cm^2), correspondingly, much superior than that of no curing (C**0**) (234 kgf/cm^2), with moist curing (C**1**) (278 kgf/cm^2) and of ordinary covering curing (C**2**) (255 kgf/cm^2). It's thus proved that, the self-curing process of the current creation can develop the compressive strength of SCC in the case of RH superior than 50%, specially at 85%.

Therefore, the self-curing process of the current creation ensures a acceptable self-curing with no any measure curing after placing. in addition, it can lessen water disappearance after taking away of concrete formworks and concrete

contraction arising from water disappearance while recovering compressive strength.

though the creation has been explain in relation to its chosen personification, it is to be understood that various other probable modification and variation can be prepared with no retiring from the spirit and possibility of the creation as hereinafter claim.

Cement

In this study OPC 43 grade cement for design mix as per IS 269-2015.The various properties of cement are found out i.e. compressive strength after 3, 7 and 28 days, specific gravity, consistency and initial and final setting of cement as shown in Table 1.

Table 3.5: Properties of OPC 43 grade Cement

S .no.	**Characteristics**	**Value obtained Experimentally**
1.	Specific Gravity	3.15
2.	Standard Consistency	30.5%
3.	Initial Setting Time	150 minutes
4.	Final Setting Time	255minutes
5.	Compressive Strength	
	3 days	32.9 N/mm^2
	7 days	42.6 N/mm^2

	28 days	-

Coarse Aggregate

Coarse aggregate used in the experiment are mainly obtained from crashed stone with 20 mm and 10 mm size in 50:50 fraction respectively.

Table 3.5: Properties of Coarse aggregate

Characteristics	Description
Color of aggregates	GREY
Shape of aggregates	ANGULAR
Maximum Size of aggregates	20mm

CHAPTER-4

RESULT AND DISCUSSION

Sieve Analysis Results:-

Table 4.1: 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

6	Pan	3	.10	0	
	Total=3000 gm			SUM=201.38 FM=(201.38+500)/ 100=7.01	

Table 4.2: Sieve Analysis of Coarse aggregate (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	

			FM=(166.07+500)/100= 6.66

Fine Aggregate

Fine aggregate worn for experimental job is of Zone II. The specific gravity examine is 2.68.

Table 4.3: Sieve Analysis of fine aggregate

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
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=3000g m			Sum=251.57 FM=251.57/100=2.5 1	

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 goodquality.

Test Methods

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

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

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%**

Table 4.4: Mix design for M40

MEAN TARGET FLEXURAL STRENGTH (N/mm2)	**MAXIMUM SIZE OF AGGREGATE (mm)**	**MIX PROPORTION (C:S:C.A)**	**W/C RATIO**	**WATER (Kg/m3)**	**CEMENT (Kg/m3)**	**FINE Kg/m3**	**COARSE AGGREAGTE (Kg/m3)**
4.5	20	1:2.17:3.5	0.4	140	350	761	1228

CHAPTER-5

CONCLUSION

The optimum dosage of PEG400 for maximum strength (compressive, tensile and modulus of rupture) was found to be 1% for the M20

. • As percentage of PEG400 increased slump increased for M20 grade of concrete

. • Strength of self-curing concrete is on par with conventional concrete.

• Self-curing concrete is the answer to many problems faced due to lack of proper curing.

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

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