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SELF CURING CONCRETE

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ABSTRACT

Since we identify water shortage is mounting day by day, so 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 .Mechanical properties of concrete depend on the curing condition of concrete. The ACI-308(2010) through ACI-308(2014) Code states that "internal curing refers to the process by which the hydration of cement occurs because of the availability of additional internal water that is not part of the mixing Water", curing concrete means that water is not lost from the surface curing is taken to happen from the outside to inside. In contrast, internal curing is allowing for curing 'from the inside to outside. Internal curing' is often also referred as 'Self–curing.' Any negligence in curing will interfere in the strength and durability of concrete. Shrinkage reducing agents and lightweight aggregates such as Leca and Polyethylene-glycol, Silica fume and stone chips are used respectively to achieve effective curing results. It is observed that there is an increase in compressive strength by using polyethylene glycol (PEG) and light weight fine aggregate (LWA)

KEYWORDS: Aggregate, Fine Aggregate, OPC Cement, Polyethylene glycol PEG

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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.

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

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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.' pores are formed inside cement paste, most important to a diminish in its interior relative dampness and also to contraction which may reason early- 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.

1.1 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 capillaryporosity. Due to contraction happening throughout cement hydration, age vacant 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.

1.2 Potential material for internal curing:-

The subsequent materials can give internal water reservoir:

Aggregate, Fine aggregate ,OPC cement Polyethylene Glycol PEG

2 LITERATURE REVIEW

Magda et. al. [1] (2015)

studied the effect of two material were selected as self curing-agents has been examined in order to compare them for optimizing the performance of concrete. The first one is the Pre-soaked lightweight aggregate (lwa) with different ratios; 0.0%, up to 20% of sand volume, and the second type is a chemical agent of polyethylene-glycol with different percentages; 1%, up to 3% of cement weight. In the experimental programme performed in their study, three cement content; 300, 400 and 500 kg/m3, three different water-
cement ratios; 0.5, 0.4, and 0.3, and two amounts of silica fume as a pozzolanic additive; 0.0% and 15% of cement weight, were used. The physical properties of concrete were evaluated at different ages, up to 28 days. The concrete specimens are subjected to dry-air curing regime (25 oc). Results of their study demonstrate that a significant improvement took

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place in the physical properties studied for self-curing concrete with poly-ethylene glycol as self-curing agent. Figures 2, 3 and table 1 show the effect of using polyethylene-glycol and leca respectively on mass loss. The optimum ratio: - 4 - of self- curing agent examined in this study is 2% of the chemical agent (poly-ethylene glycol) or 10% of saturated leca. In addition, using the chemical as self-curing agent is superior to saturated leca.

Junaid et. al.[2] (2015)

Made a comparison between the conventional cured concrete and self-curing concrete by adding admixture polyethylene glycol (PEG- 4000, 1% weight of cement) in concrete (grade ratio = 1:2.23:3.08) which helps in self-curing and in better hydration and hence strength. Figure 4 shows that the Concrete cured internally using 1% PEG-4000 attained more compressive strength than conventional once.

Junaid et. al. [3] (2016)

Made a comparison between the conventional cured concrete and self-curing concrete by adding admixture polyethylene glycol (PEG-400 1%, 2% and 3% weight of cement) in concrete (grade ratio = 1:1.92:3.49) which helps in self-curing and in better hydration and hence strength. Compressive strength of concrete with 1% and 2% PEG-400 dosage gives higher compressive strength as compared to conventionally cured concrete.

Indirajith et. al.[4] (2016)

Carried out comparative experimental tests between self-curing concrete (both external self-curing and internal self-curing) by using PEG and conventional concrete for M20, M25 and M40 grade. Self-curing concrete resulted in better hydration with time under drying condition compared to conventional concrete. Slump value increases with increase in the quantity of PEG. It was studied that the strength increases at different proportions of PEG i.e, 1% is optimum for M20 and M25 grade 0.5% for M40 grade and 0.3% for high strength self curing concrete.

Stella [5] (2014)

Studied the effect of polyvinyl alcohol in self curing concrete. The tensile, Compressive and flexure strength of self-curing concrete for
28 days is found out and compared with conventional concrete of similar mix design. Use of Polyvinyl alcohol (0.48% by the weight of cement) as self curing agent Provides higher compressive, tensile as well as flexural strength than the Strengths of conventional mix. Increase in the Percentage of polyvinyl alcohol results in the reduction of weight loss.

Priya et. al. [6] (2016)

Investigated the effect of uses wood powdered concrete for various percentages (2%, 4% and 6%) in self curing concrete. The 2% and 4% of wood powdered concrete cubes are compared to conventional concrete cubes are low compressive strength but achieve the grade strength of the concrete, while the 6% of wood

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powdered concrete cubes are compared to conventional concrete cubes is high compressive strength.

Bharath et.al [7] (2016)

Made an experimental investigation involves use polyethylene glycol (PEG 200) as self-curing agent. The dosage of PEG 200 was 0.1, 1 and 2% by weight of cement. Comparative studies of workability, water retention and compressive strength were done for specimens cured under different methods of curing. The compressive strength and water retention of concrete with lower dosages of self-curing agents and low w/c ratio is beneficial.

Vishnu et. al.[8] (2016)

Studied an experimental investigation of self- curing concrete incorporated with polyethylene glycol (PEG 600) and light weight fine aggregate. In this study compressive strength, flexural strength, split tensile strength of concrete containing self-curing agent is investigated and compared to conventional concrete. There is an increase in workability, compressive strength, split tensile, flexure strength by using light weight fine aggregate and polyethylene glycol. Figures 5&6 show compressive strength of mixes A & B using in their study.

Jagannadha et. al. [9] (2012)

Investigated the strength of self curing concrete by adding polyethylene glycol PEG400 0.5%, 1%, 1.5% and 2% by weight of cement to the concrete. To study the strength characteristics mixes M20 and M40 were considered. Table 2 shows mechanical Properties of mixes M20 & M40. The optimum dosage of polyethylene glycol (PEG400) for maximum strengths (tensile, compressive and modulus of rupture) was found to be 1% for M20 and 0.5% for M40 grades of concrete. As percentage of polyethylene glycol (PEG400) increased slump increased for both M20 and M40 grades of concrete.

Ankith [10] (2014)

Studied the affect of admixture polyethylene glycol (PEG 400) and light weight aggregate (Granite) on split tensile strength, compressive strength and modulus of rupture by varying the percentage of- 6 - PEG by weight of cement from 0% to 0.2% were studied for M20.Strengths of self-curing concrete using 0.2% PEG400 and 10% granite are better than with conventional concrete.

Jabhav et.al. [11] (2017)

Carried out experiments to study the effect of PEG4000 on compressive strength and water retention by varying the percentage of PEG from 0% to 1% by weight of cement for self- compacting concrete and compare it with conventional SCC. The optimum polyethylene glycol PEG dosage at lower w/c ratio was found to be 0.1%.The weight loss increased by increasing the percentage dosage of PEG-4000. Compressive strength of self compact concrete with lower w/c ratio improves with the addition of PEG-4000.

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Gopi et.al.[12] (2016)

Studied the Fresh and hardened concrete properties of the self compacting self curing concrete (SCSCC) were measured by using Light expanded clay aggregate (LECA) and Fly ash aggregate (FAA). The spherical shape of FAA and LECA has significantly improved the properties of the fresh concrete mix. Compressive strength at 7 days of the FAA and LECA incorporated SCSCC concrete is lower than that of the control concrete. But there are improvements in compressive strength noted at 28 days. The self compact self curing concrete with FAA as self curing agent show a significantly higher compressive strength at 7 and 28 days compared to LECA as self curing agent.

Manishkumara et. Al. [13] (2014)

Investigated the effect of admixture PEG600 & PEG1500 on strength characteristics of self curing concrete by varying percentage 0.5% up to 2% by weight of cement. The compressive strength increased by 33.9% by adding 1.0% of PEG1500 and 37% by adding 1.0% of PEG600 as compared to the conventional concrete. The optimum dosage of polyethylene glycol (PEG600&PEG1500) is 1% of weight of cement for maximum compressive strengths for M25 grades of concrete

Mohammed mousa. [14] (2015)

Examined the mechanical properties and durability of self curing concrete by using self curing agents such as 2% polyethylene glycol (PEG200), 15% lightweight aggregate (leca) and addition of 15% silica fume, curing in normal temperature (25 oC) and elevated temperature (50 oC). Generally, there are improvements in all considered concrete properties due- 7 - to the addition of 15% silica fume (SF) with self- curing agents, especially with 2% polyethylene glycol.

M. joseph [15] (2016)

Evaluated the use of water-soluble polyethylene glycol (PEG400) as self-curing agents with different doses from 0% up to 1.5% on strength characteristics of self-curing concrete and compared with conventional concrete. The optimum dosage of polyethylene glycol (PEG400) for maximum strengths (tensile, compressive and modulus of rupture) was found to be 1%. If the dosage exceeds 1% there is a slight decrease in the strength. Self-curing concrete (SCC) is an alternative to conventional concrete in desert regions.

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 wetabsorbability, shall be apply onto the concrete for self-curing cause. “Self-curing concrete”

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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. 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:

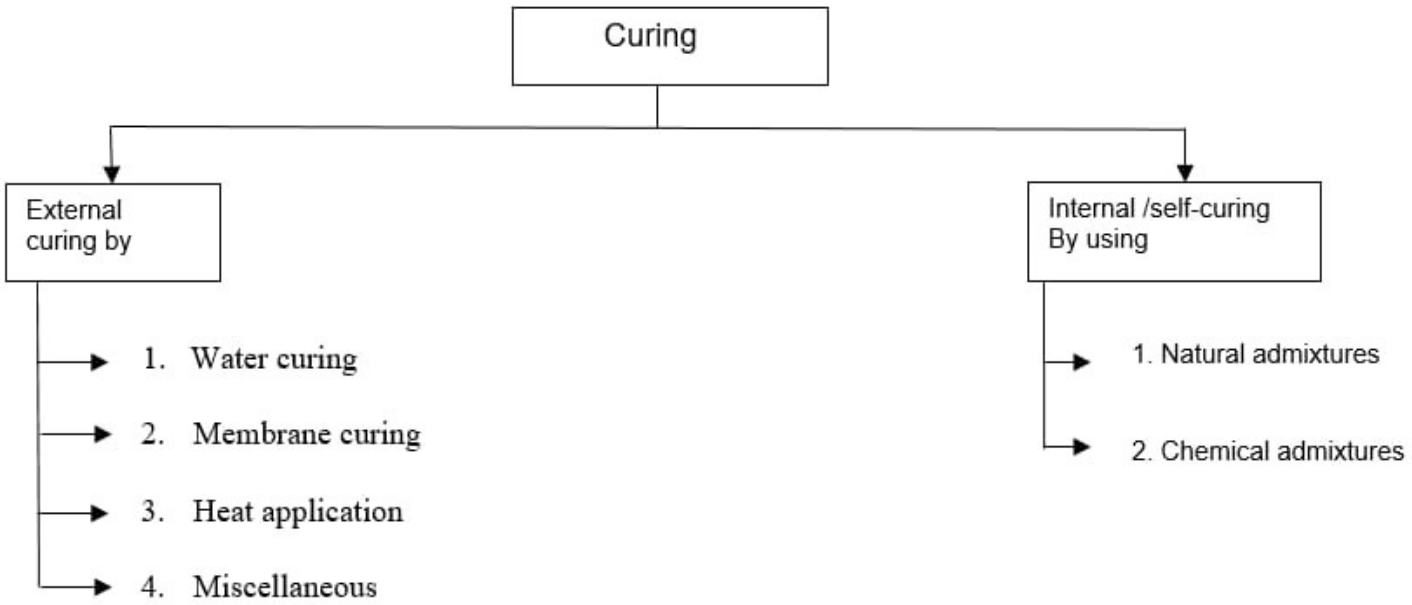
Step 1: "mix concrete";

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



RESULT AND DISCUSSION

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.

Test Methods

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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%

Sieve Analysis Results:-

Table 4.1: Sieve Analysis of Coarse aggregates (20mm)

S.no.	IS-Sieve	Wt. retained	%age re-taine d	% 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	0.1	0	
				SUM=201.38	
	Total=3000 gm			FM=(201.38+500)/	
				100=7.01	

Fine Aggregate

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

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Table 4.3: Sieve Analysis of fine aggregate

S.no	IS-Sieve	Wt. retained	%age re-tained	%passing	Cumulativ e re-tained
1	4.75	6	0.6	99.4	0.6
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	95.7
7	Pan	43	4.3	0	
	Total=3000g m				
				Sum=251.57 FM=251.57/100=2.51	

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=1

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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