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Self-curing of concrete using Polyethylene Glycol 400 and Sanal fiber

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Abstract – *Self-curing is done in order to fulfill the water requirements of concrete. This investigation is aimed to utilize the benefits of reduce water for curing process to save the water. The use of self-curing agent viz., polyethylene glycol (PEG) molecular weight 400 (PEG-400) for dosage ranging between 0.5 to 1% by weight of the cement added to mixing water. Thy comparative studies were carried out for compressive strength for convention concrete to self-curing. The optimum dosage of PEG-400 for maximum strength was observed to be 1% that increase in dosage of PEG-400 show that also increase strength of self-curing. The sanal was added range between 0.5 to 1% by the overall weight of concrete by mixing before water added. This also increase to the compressive strength.*

***Key Words*: self-curing, Polyethylene Glycol, PEG 400, Internal curing, SCC, Sanal.**

1.INTRODUCTION

Today concrete is the most widely used construction material due to its good compressive strength and durability. Self-curing concrete is basically a concrete which is cable of flowing in to the formwork. Concrete is a very strong and flexible moldable construction material. It consists of cement, sand, and aggregate (e.g., gravel or crushed rock) mixed with water. The cement and water form a paste or gel which coats the sand and aggregate. When the cement has chemically reacted with the water (hydrated), it hardens and binds the whole mix together. The initial hardening reaction usually occurs within a few hours. It takes some weeks for concrete to reach full hardness and strength. Concrete can continue to harden and gain strength over many years.

1.1 PROBLEM STATEMENT

When concrete is not cured properly, its durability, strength and abrasive resistance are affected. Due to inadequate curing, concrete develops plastic shrinkage cracks, thermal cracks, along with a considerable loss in the strength of the surface layer. When the surface of the concrete is not kept moist within the first 24 hours after the casting, the evaporation from the exposed horizontal surface results in plastic shrinkage cracks and a weak and dusty surface.

An excessive temperature difference between the outer and the inner layers of the concrete results in thermal cracking due to restraint to contraction of the cooling outer layers from the warmer inner concrete. When concrete is allowed to freeze before a minimum degree of hardening is achieved after casting, the concrete gets permanently damaged due to the expansion of water within the concrete as it freezes. This results in irretrievable strength loss and makes concrete porous.

1.2 JUSTIFICATION OF THE PROJECT

Today concrete is the most generally utilized development material in the world due to its strength and sturdiness properties. To attain good strength, the curing of concrete is important so we introduce the concept of self-curing concrete rather than immersion or sprinkle curing to avoid water scarcity. It was observed that water-soluble polymers can be utilized as a self-curing agent. Polyethylene Glycol-400(PEG-400) The polymers added in the mix mainly form hydrogen bonds with water molecules and reduce the chemical potential of the molecules of water which in turn reduces the vapor pressure, thus reducing the rate of evaporation from the surface.

1.3 SCOPE OF WORK

Some specific water-soluble chemical such as polyethylene glycol 400 is added during the mixing can reduce water evaporation from and within the set concrete make it self-curing. The scope of the work to study the effect of polyethylene glycol 400 on strength characteristics of the self-curing concrete.

2. LITERATURE REVIEW

Mohammed Shafeeque Sanofar.P.B et al. (2015)

Mohammed Shafeeque Sanofar.P.B et al. has utilized PEG 600 as Self-relieving specialist in cement, M20 and M25 evaluation of cement is received for examination, he included 1.5% of PEG 600 by weight of concrete for M20 and M25 evaluation of cement. From that they underlay 1% of PEG 600 by weight of concrete was ideal for M20 and M25 evaluation of cement for accomplishing utmost quality.

M.Priya et al. (2016)

M.Priya et al. in this investigation on self-relieving concrete by including of very permeable polymer, PEG admixture with 2%-6% of wood powder, got result for 2% and 4% of wood powder contrast with ordinary cement was discovered low compressive quality yet 6% of wood powder contrast with regular cement is high compressive quality.

Stella Evangeline (2017)

Stella Evangeline had to use polyvinyl liquor as a self-restoring operator in concrete in He included 0.48% by weight of concrete from that he discovered 0.48% of polyvinyl liquor by weight of concrete inventory higher compressive quality, elasticity just as flexural quality than the quality of the traditional blend. Polymers in concrete have improved the execution of cement.

Shikha Tyagi (2017)

Shikha Tyagi Studied on Self-restoring concrete and had using PEG 400 as a Self-relieving operator in concrete. M25 and M40 evaluation of cement is received for examination, she included 1-25% of PEG 400 by weight of concrete for M25 and M40 grade solid, she was inferred that the best measurements of PEG 400 for most extreme compressive quality was 1.5% for M25 and 1% for M40 evaluation of cement.

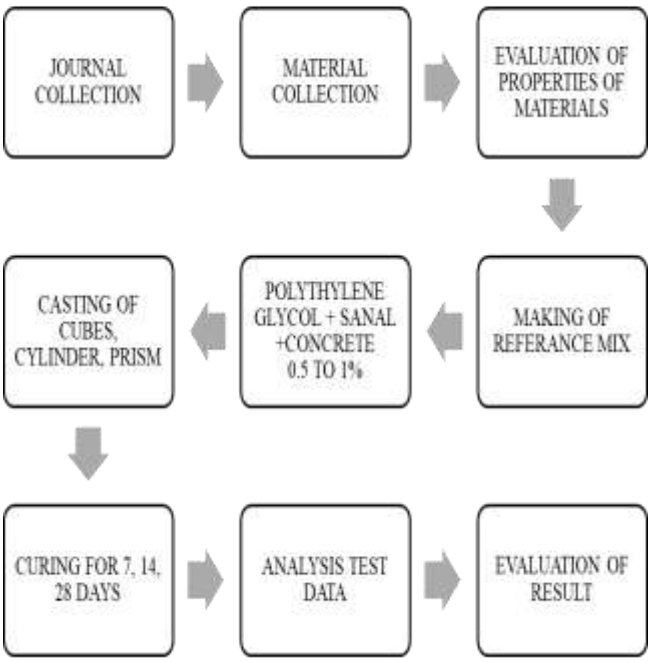
3. METHODOLOGY

4. EXPRIMENTAL DETAILS

4.1 Material used and Test

The different types of material used in the investigation are given below:

i. Cement
ii. Fine aggregate
iii. Coarse aggregate
iv. Water
v. Polyethylene Glycol 400



Cement:

Cement used 53 grade Ordinary Portland cement (OPC) IS:12269-1987.

Physical Properties of Cement		
1	Specific gravity	3.15
2	Initial setting time	30 min
3	Final setting time	600 min

Fig-1&2: Specific test and Initial setting time

Fine aggregate:

The fine aggregate conforming to zone II according to IS 383-1970 was used. The fine aggregate is a M-Sand for buying karur.

The M-Sand is almost used to construction field to replace by sand, the sand not availability from Tamil Nadu. So the M-Sand is mostly probable.

Physical Properties of M-Sand		
1	Specific gravity	2.67

Fig -3: Specific gravity test of M-Sand

Coarse aggregate:

The coarse aggregate used is procured from a load crushing unit having a 20mm nominal size. Well graded aggregate according to IS 383 is used in this investigation. The coarse aggregate used was obtaining from a Venkateshwara blue metals.

Coarse aggregates are a construction component made of rock quarried from ground deposits. Examples of these kinds of ground deposits include river gravel, crushed stone from rock quarries, and previously used concrete. Coarse aggregates are generally categorized as rock larger than a standard No.

Physical Properties of Coarse aggregate		
1	Specific gravity	2.9
2	Fineness modulus of coarse aggregate	4.86

Fig -4: Specific gravity test of Coarse aggregate

Fig -5: Fineness modulus test of Coarse aggregate

Polyethylene glycol 400:

PEG 400 is soluble in water, acetone, alcohols, benzene, glycerin, glycols, and aromatic hydrocarbons, and is slightly soluble in aliphatic hydrocarbons.

Polyethylene Glycol-400(PEG-400) The polymers added in the mix mainly form hydrogen bonds with water molecules and reduce the chemical potential of the molecules of water which in turn reduces the vapor pressure, thus reducing the rate of evaporation from the surface.

Appearance	Clear Liquid or White Solid
Odor	Mild odor
Solubility	Soluble in water
Density range	1.1 to 1.2 (increases as molecular weight increases)

Mix proportion:

	Material used	
1	Cement	438.2 kg/m^3
2	Coarse aggregate	1194 kg/m^3
3	Fine aggregate	673.7 kg/m^3
4	Water	197.2 lit/m^3
5	PEG 400 1% of Cement weight	4.3 kg/m^3
6	Sanal 0.5 % of Cement weight	2.2 kg/m^3

M30 mix design ratio = 1:1.5:2.7

Workability test:

Slump test

The slump flow test, using the traditional slump cone is the most common field test. The slump cone is completely filled without consolidation, the cone lifted, and the spread concrete measured. The slump floe test, the viscosity of the SCC mixture can be estimated by measuring the time taken for the concrete to reach a spread diameter of 300 mm from the moment the slump cone is lifted up.

The slump flow value is = 110 mm.

Fig -6: Slump flow test

5. Test for hardened concrete

Compressive strength of concrete

The compressive strength of samples was tested after 7 days. The chart shows the variation in strength with is as we have used 1% of PEG-400 and 0.5% sanal to the concrete, the strength increased to the conventional concrete. We are increase the strength of the concrete for 7 days. Tested for cube and Cylinder compressive strength.

Fig -7: Compressive strength for Cube

Compressive strength for Cube

unit=N/mm^2

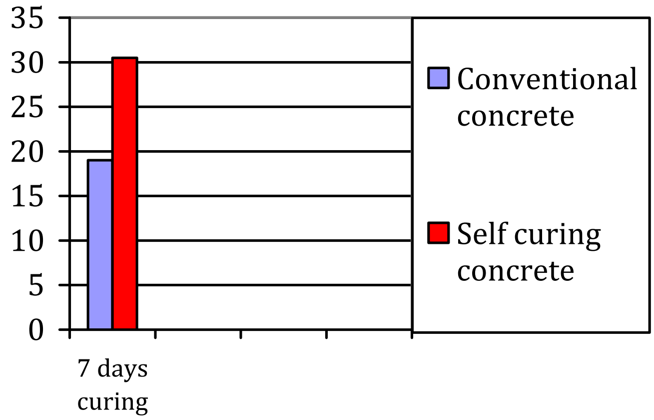


chart-1: compressive strength of 7 days curing

Compressive strength for Cylinder

unit=N/mm^2

Fig -8: Compressive strength for Cylinder

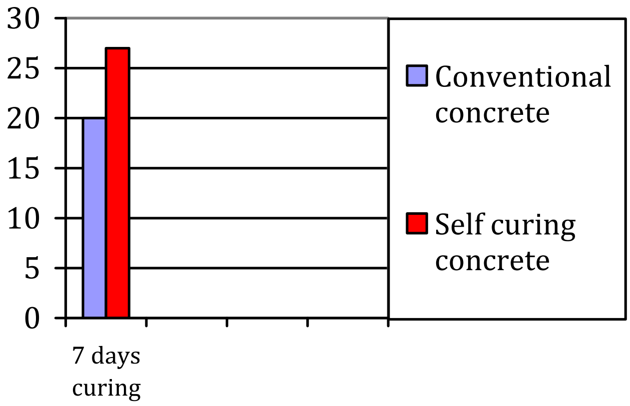


chart-2: Compressive strength for Cylinder

6. CONCLUSION

The use of PEG 400 is reducing the use of external water to the concrete. Its fully controls the water evaporation during the hydration of concrete. It gives more strength when it is compared to conventional concrete. To Save the water and to save the world.

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