

# Study of self curing concrete with LWPA: A Review

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**Abstract:** Use of self-curing concrete is done according to different needs and goals; it helps if water is not available near places of construction area or with expensive spending of money can provide water for curing; Self-curing concrete help for speed in construction work and having an economical project. As it is very important topic, many researchers have trying to develop it with different methods and techniques and after many studies and investigations It has been found that they used different material for having good results, some important materials which had acceptable results is super absorbent polymer, light weight aggregate, wood powder, polyethylene or 600 and other shrinkage reducing admixtures. Self-curing concrete is one of the special concretes in mitigating insufficient curing due to human negligence paucity of water in arid areas, inaccessibility of structures in difficult terrains and in areas where the presence of fluorides in water will badly affect the characteristics of concrete. The present study involves the use of shrinkage reducing admixture polyethylene glycol (PEG 400) in concrete which helps in self curing and helps in better hydration and hence strength. In the present study, the affect of admixture (PEG 400) on compressive strength, split tensile strength and modulus of rupture by varying the percentage of PEG by weight of cement from 0% to 2% were studied for M20.M30 and M40 mixes. It was found that PEG 400 could help in self curing by giving strength on par with conventional curing. It was also found that 1% of PEG 400 by weight of cement was optimum for M30 without compromising workability.

**Index Terms:** Self curing concrete, poly ethylene glycol, internal curing, light weight porous aggregate

## 1. Introduction

For good performance and durability of concrete, curing is essential. Conventional curing also called external curing and internal curing is often referred to as “self-curing concrete”. Internal curing has attracted more attentions because after casting concrete it brings very facility to construction work. Self-curing provides additional moisture in concrete for having good performance and durability. By comparing with conventional concrete the self-curing concrete reduce the water evaporation from concrete and increase the retention capacity of concrete and also it prevents early age cracking. Self-curing is vital for desert area where the availability of water is very less or not available so it can help to have an economical construction. There are different chemical and mineral admixtures with different properties are added in self-curing for minimizing the using of water in concrete.

## 2. Materials

As per studying and review of many research papers, here will explain some important materials that had efficient result for utilizing in self curing concrete.

### 2.1 Cement

Cement is manufactured through a closely controlled chemical combination of calcium, silicon, aluminum, iron and other ingredients.

### 2.2 Polyethylene glycol (PEG)

Polyethylene glycol is a polyether compound with many applications from industrial manufacturing to medicine. PEG is also known as polyethylene oxide (PEO) or poly oxy ethylene (POE), depending on its molecular weight. The structure of PEG is commonly expressed as  $H-(O-CH_2-CH_2)_n-OH$ .

### 2.3 Super absorbent polymers

Super absorbent polymers are cross-linked hydrophilic polymers which can retain absorbed water under pressure due to an equilibrium balance of dissolution and thermodynamically favoured expansion of polymer chains constrained by cross-linking structure.

### 2.4 Light weight porous aggregate

Light weight aggregate is the generic name of a group of aggregates having a relative density lower than normal density aggregates (natural sand, gravel and crushed stone), sometimes and is referred to as low density aggregate.

### 2.5 Shrinkage reducing admixtures

Shrinkage reducing admixtures are added during batching can significantly decrease both the early and long-term during shrinkage. This is achieved by treating the cause of drying shrinkage within the capillaries and pores of the cement paste.

### 3. Mechanism of Internal Curing:

Continuous evaporation of moisture takes place from an exposed surface due to the difference in chemical potentials (free energy) between the vapour and liquid phases. The polymers added in the mix mainly form hydrogen bonds with water molecules and the chemical potential of the molecules which in turn reduces the vapour pressure, thus reducing the rate of evaporation from the surface.

### 4. Potential Materials for Internal Curing (IC):

- **Cement:** OPC (53 grade).
- **Fine aggregate:** Locally available natural river sand passing through 4.75mm sieve was used for all of the mixes of self-curing concrete. The fine aggregate was free from organic impurities.
- **Coarse aggregate:** Crushed stone was used as a coarse aggregate passing through 20 mm and retaining on 4.75mm was used for all of the mixes of self-curing concrete.
- **Water:** Water used was fresh, colourless, odourless and tasteless, convenient water that was free from cause early-age cracking organic matter of any type.
- **Polyethylene-Glycol(PEG):** Polyethylene glycol is produced by the interaction of ethylene oxide with water, ethylene glycol, The reaction is catalyzed by acidic or basic catalysts. It is used as water reducing agent.

### 5. Literature Review

➤ Patel Manishkumar Dahyabhai, Prof. Jayeshkumar Pitroda studied on “introducing the self-curing concrete in construction industry”. Compressive strength of self-curing concrete is increased by applying self-curing admixtures. The compressive strength of concrete mix increased by 37% by adding 1.0% of PEG600 and 33.9% by adding 1.0% of PEG1500 as compared to the conventional concrete. The optimum dosage of PEG600 for maximum compressive strength was found to be 1% of weight of cement for M25 grade of concrete. The optimum dosage of PEG1500 of maximum compressive strength was found to be 1% of weight of cement for M25 grade of concrete. Self-curing concrete is the best solution to the problem faced in the desert region and faced due to lack of proper curing.

➤ Mohanraj Rajendran M Studied on “self-curing concrete incorporated with polyethylene glycol”. The compressive strength of cube by compression testing machine for Self-cured concrete is higher than of concrete cured by full curing and sprinkler curing. The split tensile strength of self-cured cylinder specimen is higher than that of the conventionally cured specimen. Self-cured concrete is found to have less water absorption values compared with concrete cured by other methods. Self-cured concrete thus have a fewer amount of porous. The success of the initial studies highlights the promise of additional work. In planned studies the mix design will be optimized for self-curing agent in concrete mix.

➤ M. Manoj Kumar, D. Maruthachalam Studied on self-curing. Super absorbent polymer was used as self-curing agent. M40 grade of concrete is adopted for investigation. Based on this experimental investigation was carried out. The following conclusions were drawn. Water retention for the concrete mixes incorporating a self-curing agent is higher compared to conventional concrete mixes. As found by the weight loss with time. The optimum dosage is 0.3 % addition of SAP leads to a significant increase of mechanical strength. Compressive strength of self-cured concrete for the dosage of 0.3% was higher than water cured concrete. Split tensile strength of self-cured concrete for dosage of 0.3% is higher than water cured concrete. Flexural strength of self-cured concrete for dosage of 0.3% is lower than water cured concrete. Performance of the self-curing agent will be effected by the mix proportions mainly the cement content and w/c ratio. There was a gradual increase in the strength for dosage from 0.2 to 0.3 % and later gradually reduced. Self-cured concrete using SAP was more economical than conventional cured concrete. In the study cubes were casted and kept for curing in room temperature about 250 to 300 c practically feasibility of self-cured member is needed to be checked in hot regions. The effectiveness of internal curing by means of SAP applied to concrete was the highest if 45 kg/m<sup>3</sup> water is added by mean of 1 kg/m<sup>3</sup> SAP.

➤ Stella Evangeline had use poly vinyl alcohol as self-curing agent in concrete. He added 0.03-0.48% by weight of cement from that he found 0.48% of poly vinyl alcohol by weight of cement provides higher compressive, tensile as well as flexural strength than the strengths of conventional mix.

➤ Mohammed Shafeeque Sanofar.P.B, Praveen.K.P., Jitin Raj, Nikhil.V.P, Gopikrishna has used PEG600 as a self-curing agent in concrete. M20 and M25 grade of concrete are adopted for investigation. They added 0-2% of PEG600 by weight of cement for M20 and M25 grade concrete. From that they found 1% of PEG600 by weight of cement was optimum for M20 and M25 grade of concrete for achieve maximum strength.

➤ Shikha Tyagi Studied on self-curing concrete and had use PEG400 as a self-curing agent in concrete. M25 and M40 grade of concrete are adopted for investigation. She added 1-2% of PEG400 by weight of cement for M25 and M40 grade concrete. She was concluded that the optimum dosage of PEG400 for maximum Compressive strength was to be 1% for M25 and 0.5% for M40 grades of concrete

➤ Dayalan J had used super absorbent polymers as a self-curing agent in concrete. He was added 0.0-0.48% of super absorbent polymer by weight of cement for M25 grade concrete. He was found that super absorbent polymer 0.48% by the weight of cement provides higher compressive, tensile as well as flexural strength than the strength of conventional mix.

## 6. Conclusion:

Based on literature review, following conclusions are obtained:

- The optimum dosage of PEG400 for maximum strength (compressive, tensile and modulus of rupture) was found to be 1% for the M30.
- As percentage of PEG400 increased slump increased for M30 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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