# AN EXPERIMENTAL INVESTIGATION ON SELF-CURED CONCRETE: A REVIEW

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## ABSTRACT

**Today concrete is most widely used construction material due to its good compressive strength and durability. Concrete is a mixture of cement, aggregate and water with or without suitable admixtures. Concrete needs congenial atmosphere by providing moisture for a minimum period of 28 days for good hydration and to attain desired strength. Curing is the process of maintaining the proper moisture content to promote optimum cement hydration immediately after placement and to attain desirable strength and other process. 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. This paper reports an experimental study carried out to investigate the usage of sodium lignosulphonate as self curing agent. In this study slump cone, compressive strength, split tensile strength and modulus of rupture of self-curing concrete with varying percentages (0.5%, 1%, 1.5%, 2%, 2.5% and 3%) for 7, 14, 28 days are analyzed, tested and compared with conventional concrete of similar mix design were studied for M20 grade.**

**Keywords:** curing, self-curing concrete, sodium lignos ulphonate, slump cone, compressive strength, split tensile strength, modulus of rupture.

## I. INTRODUCTION

Proper curing of concrete structures is important to meet performance and durability requirements. In conventional curing this is achieved by external curing applied after mixing, placing and finishing. Self-curing or internal curing is a technique that can be used to provide additional moisture in concrete for more effective hydration of cement and reduced self-desiccation.

Curing of concrete is for maintaining satisfactory moisture content in concrete during its early stages in order to develop the desired properties. However, good curing is not always practical and often neglected in many cases. Several investigators asked the questions whether there will be self-curing concrete. Therefore, the need to develop self-curing agents attracted several researchers. The concept of self-curing agent is to reduce the water evaporation from concrete and

hence increase the water retention capacity of the concrete compared to conventional concrete. The use to view that water resources are getting valuable every day. The benefit of self-curing admixtures is more significant in desert areas where water is inadequately available.

## II. OBJECTIVE AND SCOPE OF THE INVESTIGATION

### 1. OBJECTIVE

- To improve the effectiveness of the water content of a concrete mix by using sodium Ligno sulphonate..
- To determine the characteristics of self-curing concrete such as slump, compressive strength, split tensile strength and modulus of rupture by adding self-curing agent in varying percentage.
- To compare the strength between conventional and self-curing concrete.

## III. SCOPE OF THE WORK

The major challenge in construction field nowadays is the lack of availability of water, this problem can be solved to a greater extend with the introduction of self curing concrete. Since self curing concrete controlling the rate and extend of moisture loss from concrete during hydration. The scarcity of water for curing can be compensated with the use of self curing concrete and reduce the water usage.

## IV. LITERATURE REVIEW

**Roland Tak Yong Liang, Robert Keith Sun** carried work on internal curing composition for concrete which includes a glycol and a wax. The invention provides for the first time an internal curing composition which, when added to concrete or other cementations mixes meets the required standards of curing as per Australian Standard AS 3799.

**Wen-Chen Jau** stated that self curing concrete is provided to absorb water from moisture and from air to achieve better hydration of cement in concrete. It reduces the problem when the degree of cement hydration is lowered due to no curing or improper curing by using poly-acrylic acid as a self curing agent which has strong capability of absorbing moisture from atmosphere and providing water required for curing concrete.

**Pietro Lura** The main aim of his study was to reach a better conception of autogenously shrinkage in order to be able to model it and possibly reduce it. Once the important role of self-desiccation shrinkage in autogenously shrinkage is shown, the benefits of avoiding self-desiccation through internal curing become apparent.

**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 33.9by 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 increases 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/m3 water is added by mean of 1 kg/m3 SAP.

**Basil M Joseph** Studied on self curing concrete andPEG400 were used as a self curing agent in concrete. M20 grade of concrete is adopted for investigation. He added 0-1.5% of PEG400 by weight of cement for M20 grade concrete from that he found 1% of PEG400 by weight of cement was optimum for M20 grade of concrete for achieve maximum strength. He also found that if percentage of PEG400 gets increased slump as well as compaction factor also increased.

**Stella Evangeline** had use poly vinyl alcohol as self curing agentin 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, Gopi Krishna** has used PEG600 as a self curing agent in concrete. M20 and M25grade 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 M4O grades of concrete.

**Dayalan Jhad** 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.

## V. MATERIAL COLLECTION

1. **Cement:** OPC (53 grade).
2. **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.
3. **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.
4. **Water:** Water used was fresh, colorless, odorless and tasteless, convenient water that was free from cause early-age cracking organic matter of any type.
5. **Sodium lingo sulphonate:** It is a mixture of lingo sulphonic acid and sodium salt. Sodium lingo sulphonate are mainly for concrete mixture as water-reductive. The sodium lingo sulphonate is fit for apply to building project, dam project, thruway project etc.

## VI. EXPERIMENT LAB TEST

### 1. MATERIAL TEST

- **Sieve Analysis:**
  In this test we will use 4.75mm sieve conforming to IS: 383-1970 for fine aggregate and passing material through this sieve we will use for experiment. We will use 20mm sieve conforming to IS: 383-1970 for coarse aggregate and retaining on 4.75mm sieve, this retaining material we will use for experiment.
- **Specific Gravity:**
  An Indian standard specification IS: 2386(part III) of 1963 gives various procedures to find specific gravity of aggregate. In this study specific gravity of fine aggregate, coarse aggregate and cement are found by using pycnometer method.

## 2. SPECIMEN TEST

- **Slump Cone:** Concrete slump test is to determine the workability or consistency of concrete mix prepared at the laboratory or the construction site during the progress of the work. In this test we will find the slump value of self-curing concrete by adding sodium lingo sulphonate (chemical admixture) at 0.5%, 1%, 1.5%.2%, 2.5%, 3% and also comparing with conventional concrete for M20 grade concrete.
- **Compressive Strength:**
  The cube specimens were tested on compression testing machine of capacity 3000KN.The bearing surface of machine was wiped off clean and sand or other material removed from the surface of the specimen. The specimen was placed in machine in such a manner that the load was applied to opposite sides of the cubes as casted that is, not top and bottom. The axis of the specimen was carefully aligned at the center of loading frame. The load applied was increased continuously at a constant rate until the resistance of the specimen to the increasing load breaks down and no longer can be sustained. The maximum load applied on specimen was recorded. In this test we will find the compressive strength of self-curing concrete by adding sodium lignosulphonate (chemical admixture) at 0.5%, 1%, 1.5%.2%, 2.5%, 3% and also comparing with conventional concrete for M20 grade concrete.
- **Split Tensile Strength:**
  The cylinder specimens were tested on compression testing machine of capacity 3000KN.The bearing surface of machine was wiped off clean and looses other sand or other material removed from the surface of the specimen. The load applied was increased continuously at a constant rate until the resistance of the specimen to the increasing load breaks down and no longer can be sustained. The maximum load applied on specimen was recorded. In this test we will find the split tensile strength of self-curing concrete by adding sodium lingo sulphonate (chemical admixture) at 0.5%, 1%, 1.5%.2%, 2.5%, 3% and also comparing with conventional concrete for M20 grade concrete.
- **Modulus of Rupture:**
  The beam specimens were tested on universal testing machine for two-point loading to create a pure bending. The bearing surface of machine was wiped off clean and sand or other material is removed from the surface of the specimen. The two point bending load applied was increased continuously at a constant rate until the specimen breaks down and no longer can be sustained. The maximum load applied on specimen was recorded. In this test we will find the flexural strength of self-curing concrete by adding sodium lingo sulphonate (chemical admixture) at 0.5%, 1%, and 1.5%.2%, 2.5%, 3% and also comparing with conventional concrete for M20 grade concrete.

## VII. 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 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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