

## **A Review on to Investigate Self Curing Concrete using PEG-400**

*N.S.Deshmukh<sup>1</sup>, Ravikant Y. Swami<sup>2\*</sup>, Faiz L.Lukade<sup>3</sup>, Tejas B. Kothimbire<sup>4</sup>*

*<sup>1</sup>Assistant Professor, <sup>2,3,4</sup>Student*

*Department of Civil Engineering, Anantrao Pawar College of Engineering and Research,  
Pune, Maharashtra, India.*

*\*Corresponding Author E-mail: ravikant8983257179@gmail.com*

### **ABSTRACT**

*Concrete is the most rapidly used material in the construction industry. It comprise of cement, sand and aggregate which hardens when mixed with water within certain time. It is most important to gain structural strength. To attain its properties sufficient curing is required if curing need in not met it lacks durability resulting in shrinkage cracks. During curing a lot of water is wasted and since we are identifying water shortage is mounting day by day. On an average 12000litres of water is needed to cure 1000sqft concrete surface one time. So a research should be needed to do the constructions with minimum use of water. The use of self curing admixtures may be very crucial as saving of water is a need of the hour. An approach is taken to reduce the water requirement during curing and at the same time to increase its strength as compared to the conventional concrete. To meet this requirement self curing agent polyethyleneglycol-400 is been used as 0.5%, 1% & 2% by the weight of the cement. As it is water soluble it can be used with water in mixing process. This agent will lessen the water disappearance from concrete by locking water content forming a thin layer of film over it thus maintaining internal hydration of concrete. The goal of this investigation is to study the mechanical properties of the self curing concrete over conventional concrete.*

**Keywords-** *Curing, Self Curing, Water shortage, Self curing admixtures, Polyethylene glycol-400, Hydration, Mechanical Properties*

### **INTRODUCTION**

Curing elevates hydration of the cement and helps in controlling of the temperature and moisture in the concrete. Proper curing of the concrete is necessary to achieve all the properties and to increase the durability of the structure. In conventional concrete this condition is achieved by external curing of the concrete.

The traditional way of curing often fails due to lack of resources or due to lack of supervision. It mostly helps in evaporation loss for flat surface but curing of vertical member is still a major problem. Curing of members includes a lot of cost and wastage of natural resources. The high strength concrete was mostly used for vertical members. Due to a very low water

cement ratio in combination with high cement content show early strength development which makes an early form stripping possible. But when exposed to air considerable evaporation loss leading to develop of micro cracks therefore the effect of curing cannot be neglected. Saving curing time will indirectly result in saving of construction cost. Self-curing or internal curing is a technique that can be used to provide additional moisture in concrete for more effective hydration of cement.

Currently there are three methods of self curing using of light weight aggregate, using of polyethylene glycol and using of shrinkage reducing admixture. Polyethylene glycol reduces water evaporation from the surface of concrete

and also helps in water retention. It is also important with respect to saving water and it has attracted a lot of researchers because of its benefit over normally cured concrete.

## LITERATURE REVIEW

### **1) Chunpeng Zhang, Chaoming Pang , Yunrui Mao and Zhiyuan Tang -Effect and Mechanism of Polyethylene Glycol (PEG) Used as a Phase Change Composite on Cement Paste –MDPI -8 April 2022**

In this paper Author studied that PEG significantly improved the cement matrix's fluidity. When the content reached 10%, the fluidity increased by 35% at a water–cement ratio of 0.4 and exceeded the measurement limit at a water–cement ratio of 0.5. The strength of cement paste decreased as the PEG dosage increased, PEG can significantly slow down the process of cement hydration.

### **2) V. Athiyamaan, PhD, Assistant Professor -Admixture-based self-compacted concrete with self-curing concrete techniques a state of art of review –Elsevier Ltd,25 August 2021**

In this paper Author identified that the variables such as binders, fine aggregate, coarse aggregate, W/C ratio, Packing density factor were the key parameters in influencing the rheological and mechanical properties of SCC. He also studied strength development of Fly ash and kaolin based SCC had high performance and better durability when compared with conventional OPC concrete. Self-curing concrete improves the strength and efficiency of upto 20%. It is possible to produce concrete having the tensile strength and elastic modulus varied from 2 MPa to 4.9 MPa. The structural efficiencies of these concretes are much higher than the conventional normal density concretes.

### **3) Vedant P. Chavan -Self-Curing Concrete with Polyethylene Glycol -**

### **International Journal of Engineering Research & Technology (IJERT) -Vol-09, Issue09, September-2020**

This paper represents the methods of self curing concrete and past work carried out on self curing concrete. Most commonly used materials for self curing concrete are lightweight aggregates, super absorbent polymers, shrinkage reducing admixtures etc .He also studied about the variation in strength with variation of chemical of M20 grade of concrete and focuses on the need of self curing concrete as a need of era.

### **4) Rayees Ali Khan, Chhavi Gupta -A REVIEW ON THE STUDY OF SELF CURING CONCRETE–Journal of Engineering Sciences - Vol 11,Issue 2, Jan-2020**

In this paper Author studied that the Durability and workability of the concrete are enhanced by the use of self-curing admixtures. Mostly in all the cases, the strength of self-curing concrete is higher than conventional concrete with the same mix design. For maximum strength (compressive; tensile and flexural strength) the optimum dosages of PEG and PVA for different grades of concrete were found to be 0.5% to 1% Water-soluble chemical sodiumlignosulphonate is probably to use as a self-curing agent and the optimum strength of concrete was found to use 0.5% of sodium-lignosulphonate when compared with normal concrete. In different grades of concrete, the use of SAP increased the compressive strength and the most favorable of SAP is 0.5 to 1% weight of cement.

### **5) Vikant Dixit<sup>1</sup>, Vivek Viswakarma<sup>2</sup> , Rajeev Chandak<sup>3</sup> -Study of self curing concrete with LWPA: A Review, International Journal for Research Trends and Innovation (IJRTI)-Volume 5, Issue 1 -2020**

In this paper Author studied that the optimum dosage of PEG400 for maximum strength (compressive, tensile and modulus of rupture) and 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.

**6) S.P.Raju.V , Martha Saikumar , T.Srinivas , G.V.D.N. SaiVamsi , A. Vijaya Srinivas Srikar -Experimental Study on Compressive Strength, Water Retention And Water Absorption of self-curing Concrete With Different Curing Conditions -ICMED 2020**

In this paper author studied that Compressive strength of self-curing concrete after 28 days curing period is more than the compressive strength of water cured concrete by 16.5% and 17.5% without and with replacement fly ash and quarry dust respectively. Compressive strength of air dried concrete cubes is low because lack of curing. The amount water retained in self cured concrete is more. Because self-curing compound forms a thin layer and it restrict the evaporation of water from the concrete

**7) N. Y. ELWakkad, KH. M. Heiza, Prof Dr Aqial eladly3- Review on Self-Curing Concrete-MONO UNI EGYPT - 2019**

In this paper author studied all the mechanical and physical properties of the concrete using self curing agent .There is rise un slump value with increase in the quantity of PEG. It was observed that there was an increase in compressive strength by using PEG and light weight fine aggregate.

**8) Prof.Rahul Dev ,Prof.R.Navaneethan-Self Curing Concrete-International Journal of advance research,ideas and innovation in technology-Vol-4,Issue3, 2018**

In this paper Author studied that the superior cost of PEG 200 for M30 and M40 mixes are acquired as 0.5% by weight of cement. The result determined out for specimen incorporates PEG-200 suggests better energy than traditional mixes in compressive, split tensile, and flexural strengths. The compressive

energy changed into accelerated up to 9.5% at zero.5% PEG for M30 mix and 6.57% for M40 mix. The splitting tensile electricity became multiplied up to 14.28% at 0.5%PEG for M30 mix and 10% for M40 mix. The flexural strength changed into elevated up to 5.Thirteen% at 0.5% PEG for M30 mix and five.76% for M40 blend. The usage of PEG 200 helped to conquer the scarcity of water. By the use of optimum stage of PEG 200, the power of concrete has expanded.PEG two hundred affords the water to hydrate all of the cement, undertaking what the combination water on my own cannot do and that's why there may be a boom in electricity properties of self-curing concrete. Normally a large amount of water is needed for curing purpose. Here that may be stored via using PEG 200

**9) David O. Nduka 1, John O. Ameh 2 , Opeyemi Joshua 1 and Rapheal Ojelabi-Awareness and Benefits of Self-Curing Concrete in Construction Projects: Builders and Civil Engineers Perception- Received: 28 June 2018; Accepted: 6 August 2018; Published: 14 August 2018**

In this paper a cross-sectional survey design method was accepted by giving out 115 questionnaires to selected builders and engineers in Lagos. The results showed that about 21% of selected builders and civil engineers practicing in Lagos are not aware with the concept of self-curing technology while about 43.1% of the professionals who have the knowledge of SCT have never used it in their professional practice. In addition, lower permeability, reduced coefficients of thermal expansion, and improved microstructures of cementitious paste were considered as the benefits of the self-curing concrete method.

**10) T.Udaya Banu M.E.,(Ph.D.) , Fredy.A , Ditto Bensiger. C M "Study of Self Curing Concrete Using Peg-400 in PPC", International Journal of Innovative Research in Science,**

**Engineering and Technology  
(IJIRSET), Volume 7, Special Issue 5,  
April 2018**

In this paper author studied the strength of self-curing concrete with optimum dosage of PEG 400 the maximum strength was found to be 1.5% for M20 grade concrete. The strength and durability properties of internally cured concrete with PEG 400 gives better result compared with external cured concrete. The cost requirement is also low in internal curing when compared with external curing.

**11) M.Vidhya, S. Gobhiga & K. Rubini -  
Experimental study on self curing  
concrete using biomaterials as  
admixtures -International Journal of  
Engineering Research and Modern  
Education -Impact Factor 6.525, Special  
Issue, April - 2017**

In this paper author studied that the compressive and split tensile strength of the self curing concrete with addition of 0.2% of Calotropis gigantea, 15% Cypress bark extract and 15% silica fume at the age of 7 days and 28 days is less than the conventional concrete. The compressive and split tensile strength of the self curing concrete with addition of 0.3% of Calotropis Gigantea, 15% Cypress bark extract and 15% silica fume at the age of 7 days and 28 days is less than the conventional concrete but greater than the self curing concrete with addition of 0.2%

of Calotropis Gigantea, Cypress bark extract and 15% silica fume. The compressive and split tensile strength of the self curing concrete with addition of 0.4% of Calotropis Gigantea, 15% Cypress bark extract and 15% silica fume at the age of 7 days and 28 days is greater than the conventional concrete. So it is concluded that 0.4% of Calotropis Gigantea is the optimum percentage of bio-admixture can be used as Self Curing Agent

**12) Prof.Md Shafeque,Prof  
Sanofar,Prof Praveen,Prof Jitin Raj-  
Strength Comparison of self curing  
concrete and normal curing concrete –  
International journal of civil engg-vol3-  
issue3-march-2016**

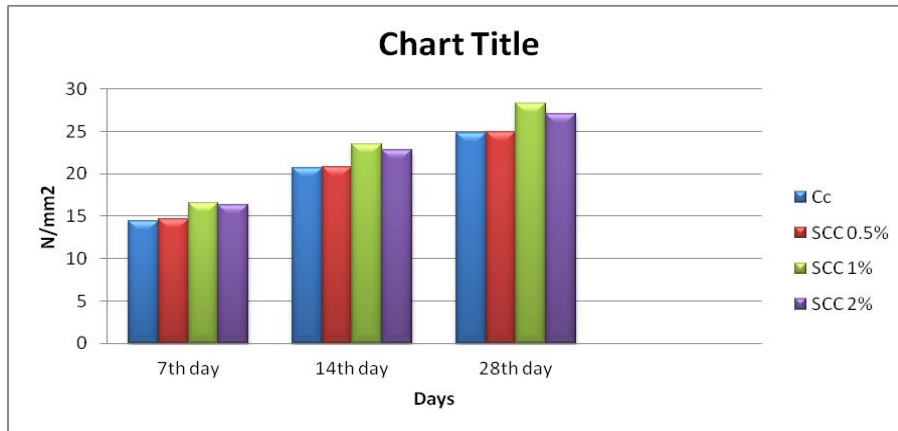
In this paper Author studied on SCT with PEG600 and From the workability tests, it was found that self curing concrete has maximum workability at 1% application of PEG . As percentage of PEG600 increased slump and flow values increased for both M20 and M25 grade of concrete. The optimum dosage of PEG600 for maximum strength (compressive and tensile) was found to be 1% for both M20 and M25 grade. Strength of self-curing concrete is on equal with conventional concrete. Self-curing concrete is an alternative to conventional concrete in desert regions where scarcity of water is a major problem.

**TEST CONDUCTED**

*Table 1: Compressive test*

Days on which test were conducted	Convectional concrete	0.5% OF PEG 400	1% OF PEG 400	2% OF PEG 400
7 <sup>th</sup> Day	14.48 N/mm <sup>2</sup>	14.60 N/mm <sup>2</sup>	16.60 N/mm <sup>2</sup>	16.3 N/mm <sup>2</sup>
14 <sup>th</sup> Day	20.65 N/mm <sup>2</sup>	20.78 N/mm <sup>2</sup>	23.5 N/mm <sup>2</sup>	22.85 N/mm <sup>2</sup>
28 <sup>th</sup> Day	24.78 N/mm <sup>2</sup>	24.93 N/mm <sup>2</sup>	28.3 N/mm <sup>2</sup>	27.04 N/mm <sup>2</sup>

After 28 days the concrete should attain 99% of the designed strength maximum compressive strength was found to be for 1% PEG-400.



**Fig.1: Compressive test graph**

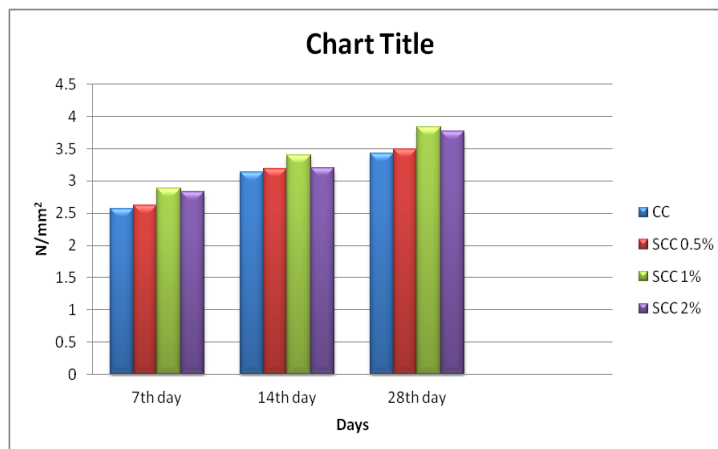
**Table 2: Flexural test**

Days on which test were conducted	Convectional concrete	0.5% OF PEG 400	1% OF PEG 400	2% OF PEG 400
7 <sup>th</sup> Day	2.57 N/mm <sup>2</sup>	2.62 N/mm <sup>2</sup>	2.88 N/mm <sup>2</sup>	2.83 N/mm <sup>2</sup>
14 <sup>th</sup> Day	3.13 N/mm <sup>2</sup>	3.19 N/mm <sup>2</sup>	3.4N/mm <sup>2</sup>	3.2 N/mm <sup>2</sup>
28 <sup>th</sup> Day	3.43 N/mm <sup>2</sup>	3.49 N/mm <sup>2</sup>	3.83 N/mm <sup>2</sup>	3.77 N/mm <sup>2</sup>

As per IS 456-2000, Empirical formula for estimating Flexural strength  
 $= R = 0.7 \sqrt{fck}$

Where, fck is the characteristic cube

compressive strength of concrete in N/mm<sup>2</sup>. All the above values satisfy the condition and there was increase in flexural strength as compared to Conventional concrete.



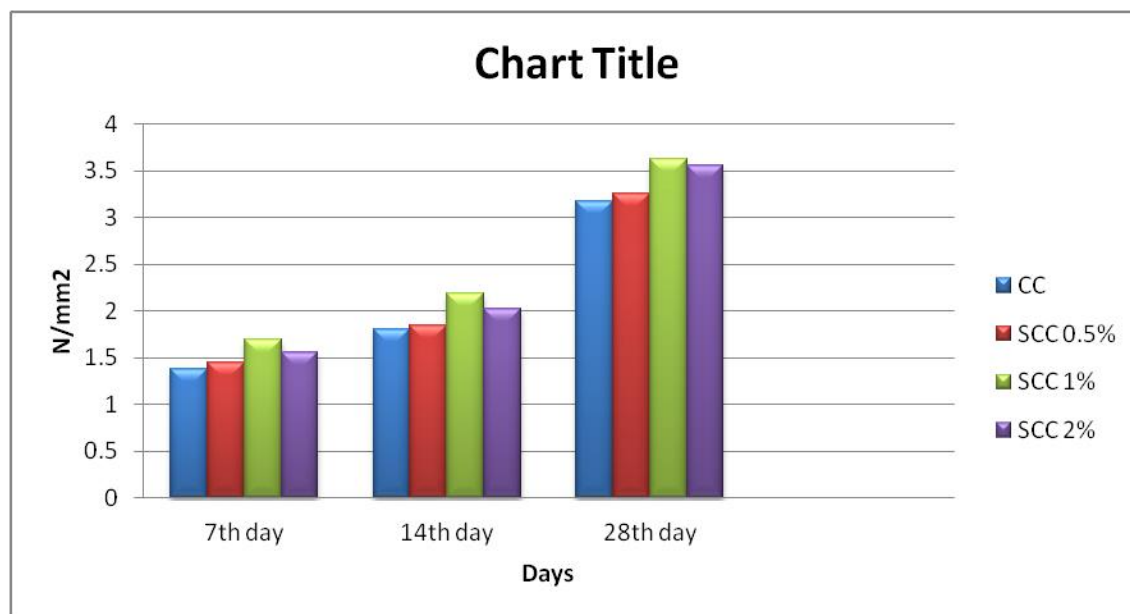
**Fig.2: Flexural strength bar graph**



**Table 3: Split tensile test**

Days on which test were conducted	Convectonal concrete	0.5% OF PEG 400	1% OF PEG 400	2% OF PEG 400
7 <sup>th</sup> Day	1.38 N/mm <sup>2</sup>	1.45 N/mm <sup>2</sup>	1.7 N/mm <sup>2</sup>	1.56N/mm <sup>2</sup>
14 <sup>th</sup> Day	1.81 N/mm <sup>2</sup>	1.85N/mm <sup>2</sup>	2.19 N/mm <sup>2</sup>	2.02 N/mm <sup>2</sup>
28 <sup>th</sup> Day	3.18N/mm <sup>2</sup>	3.25N/mm <sup>2</sup>	3.62 N/mm <sup>2</sup>	3.56 N/mm <sup>2</sup>

Split tensile ranges from 7-11% of its compressive strength. Tensile strength of self curing was found to be 1.14 times greater than conventional concrete.



**Fig.3: Split tensile test graph**

**CONCLUSION**

- 1) We found that there was a decrease in the slump value with the increase in percentage of PEG-400
- 2) There was an increase in all the mechanical properties of self curing concrete as compared to conventional concrete
- 3) From result we found out that on an average there was 6.23% increase in strength as compared to conventional concrete
- 4) Compressive strength was found out to be maximum for 1% of PEG-400
- 5) There was slight decrease in the strength as percentage of dosage was increased. So the optimum dosage was found to be 1%

- 6) Self curing concrete has 1.14 times higher tensile strength than conventional concrete.
- 7) Cost of self curing concrete is greater as compared to conventional concrete.
- 8) Self-curing concrete can be an alternative to conventional concrete in areas where problems occurs while curing due to acute shortage of water.

**REFERENCES**

1. Chunpeng Zhang, Chaoming Pang , Yunrui Mao and Zhiyuan Tang – “Effect and Mechanism of Polyethylene Glycol (PEG) Used as a Phase Change Composite on Cement Paste” –MDPI -8 April 2022

2. *David O. Nduka<sup>1</sup>, John O. Ameh<sup>2</sup>, Opeyemi Joshua<sup>3</sup> and Rapheal Ojelabi<sup>4</sup>* - “Awareness and Benefits of Self-Curing Concrete in Construction Projects: Builders and Civil Engineers Perception”- Received: 28 June 2018; Accepted: 6 August 2018; Published: 14 August 2018
3. *M.Vidhya, S. Gobhiga & K. Rubini* - Experimental study on self curing concrete using biomaterials as admixtures - International Journal of Engineering Research and Modern Education - Impact Factor 6.525, Special Issue, April – 2017
4. *N.Y.ELWakkad<sup>1</sup>, KH. M. Heiza<sup>2</sup>, Prof Dr Aqial eladly<sup>3</sup>* - “Review on – Self-Curing Concrete”-MONO UNI EGYPT – 2019
5. *Prof.Md Shafeque,Prof Sanofar,Prof Praveen,Prof Jitin Raj*-Strength Comparison of self curing concrete and normal curing concrete – International journal of civil engg- vol3-issue3-march-2016
6. *Prof.Rahul Dev ,Prof.R.Navaneethan*-“Self Curing Concrete”-International Journal of advance research,ideas and innovation in technology-Vol-4,Issue3, 2018
7. *Rayees Ali Khan, Chhavi Gupta* – “A review on the study of self curing concrete”-Journal of Engineering Sciences - Vol 11, Issue 2, Jan-2020
8. *S.P.Raju.V , Martha Saikumar , T.Srinivas , G.V.D.N. SaiVamsi , A. Vijaya Srinivas Srikar* – “Experimental Study on Compressive Strength, Water Retention And Water Absorption of self-curing Concrete With Different Curing Conditions” - ICMED 2020
9. *T.Udaya Banu M.E.,(Ph.D.) , Fredy.A , Ditto Bensiger. C M* “Study of Self Curing Concrete Using Peg-400 in PPC”, International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET), Volume 7, Special Issue 5, April 2018
10. *V. Athiyamaan*,– “Admixture-based self-compacted concrete with self-curing concrete techniques a state of art of review” –Elsevier Ltd, 25 August 2021
11. *Vedant P. Chavan* –“Self-Curing Concrete with Polyethylene Glycol” – International Journal of Engineering Research & Technology (IJERT) - Vol-09, Issue09, September-2020
12. *Vikant Dixit<sup>1</sup>, Vivek Viswakarma<sup>2</sup> , Rajeev Chandak<sup>3</sup>* – “Study of self curing concrete with LWPA: A Review”, International Journal for Research Trends and Innovation (IJRTI)- Volume 5, Issue-2020