Strength Comparison of Self-Curing Concrete and Normal Curing Concrete

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Abstract

The aim of this investigation was to study about the strength properties of concrete using water soluble Polyethylene Glycol as the self-curing agent. The function of self-curing agent is to reduce the water evaporation from the concrete, and hence they increase the water retention capacity of concrete compared to the conventionally cured concrete. The use of self-curing admixtures is the very important from the point of view that saving of water is a necessity in every day (each one cubic meter of concrete requires 3m^3 of water in a construction, most of which is used for the curing). In this study, compressive strength and split tensile strength of concrete containing self-curing agent is investigated and compared with those of the conventionally cured concrete.

Keywords- *polyethylene glycol (PEG), Self-curing concrete (SCC), Normal curing concrete (NCC), Compressive strength, Split tensile strength*

I. INTRODUCTION

Construction industry needs a lot of water in the name curing. The days are not so far that all the construction industry has to switch over to an alternative curing systemizes, not only to save water for the sustainable development of the environment but also to promote the indoor and outdoor construction activities even in remote areas where there is scarcity of water.

Curing is the process of controlling the rate and extends of moisture loss from concrete during cement hydration. It may be either after it has been placed in a position or during the manufacture of concrete products thereby providing time for the hydration of the cement to occur. Since the hydration of the cement does take time days and even weeks rather than hours curing must be undertaken for a reasonable period of time.

The need for adequate curing of concrete cannot be overemphasized because curing has the strong influence on the properties of hardened concrete; proper curing will increase durability, strength, water tightness, abrasion resistance, volume stability, and resistance to freezing and thawing effect. Curing may be achieved in a number of ways and most appropriate means of curing may be dictated by the site or the construction method.

PATEL MANISHKUMAR DAHYABHAI, PROF.JAYESHKUMAR PITRODA[1] 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". Compressive strength of cube and cylinder by NDT for self-cured concrete is higher than that of conventional concrete cured by full curing and sprinkler curing. The compressive strength of cube by HEICO 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 and water sorptivity 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.MANOJKUMAR,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/m^3 water is added by mean of 1 kg/m^3 SAP.

II OBJECTIVES AND SCOPE OF THE INVESTIGATION

A. Objectives

- Tostudy workability of SCC & NCC
- To study strength characteristics of NCC
- To study strength characteristics of SCC
- To compare strength characteristics of NCC & SCC

B. Scope of the work

The major challenge in construction field nowadays is the lack of availability of water; this problem can be reduced to a greater extent with the introduction of self-curing concrete. Since SCC 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.

III. EXPERIMENTAL PROGRAM

A. Materials

1. Ordinary Portland cement (OPC)

In this study Ordinary Portland Cement-Grade 53, has been certified with IS: 12269 – 1987, Grade 53 which is known for its rich quality and high durability is used.Specific gravity of cement used here is 3.2

2. Coarse Aggregate

Coarse aggregate used in this are passed from 16mm and retained on 10mm. Well graded cubical or rounded aggregates are desirable. Aggregates should be uniform quality with respect to shape and grading. Specific gravity of coarse aggregate used here is 2.81

3. Fine Aggregate

Grading must be uniform throughout the work and must pass through 4.75 mm sieve size which confirms to the code IS: 383 – 1970. Particles smaller than 0.125 mm size are considered as fines which contribute to the powder content. Specific gravity of fine aggregate used is 2.58and fineness modulus 2.783 is used for this study.

4. Water

Potable water available in laboratory was used for casting all the specimens. The quality of water was found to satisfy the requirements of IS: 456-2000

5. PEG

Polyethylene glycol is a condensation polymer of ethylene oxide and water with general formula H (OCH_2CH_2) n(OH), where n is the average number of repeating ox ethylene groups typically from 4 to 180. The abbreviation (PEG600) is termed in combination with a numeric suffix which indicates average molecular weights. The Common feature of PEG appears to be water-soluble nature polyethylene glycol is non-toxic, odorless, neutral lubricating, on-volatile and non-lubricating and is used in variety of Pharmaceuticals

IV. METHODOLOGY OF EXPERIMENT

Experimental program is carried out in different stages. First preliminary tests are conducted in fine aggregate, coarse aggregate and cement. The test includes particle size distribution of fine aggregate and coarse aggregate, specific gravity of cement, specific gravity of fine aggregate, specific gravity of coarse aggregate. With the test data of the material obtained, the concrete mix design for M20 grade and M25 grade is designed using IS codes: IS 10262 :2009,IS 1026 : 1982, IS 456 :2000. 6 set of cube and 3 cylinders are casted for both grades of concrete. Compressive test and split tensile test are conducted to determine the properties of normal concrete of both M20 and M25 grades.

In the second stage of project, the experimental program was designed to investigate the strength of self-curing concrete by adding polyethylene glycol PEG (600) at 0.5%, 1%, 1.5%, and 2% by weight of cement of concrete. 6 set of cube and 3 cylinders were casted and tested for compressive strength and split tensile strength for both the grades of M20 and M25.Casted concrete were removed from mold and kept them at room temperature by placing them in shade for curing. The compressive strength at 7 days and 28 days and Split tensile strength at 28 days ofcuring were studied.

Finally strength comparison of Self curing concrete and normal concrete mix was performed and tabulated.

Table I Mix Proportion of Normal Cement Concrete

Particulars	M25	M20
Cement (kg/m^3)	394	358
Water (liters)	197	197
Fine aggregate (kg/m^3)	676.9	690.5
Coarse aggregate (kg/m^3)	935.87	954.87
Water cement ratio	0.5	0.55

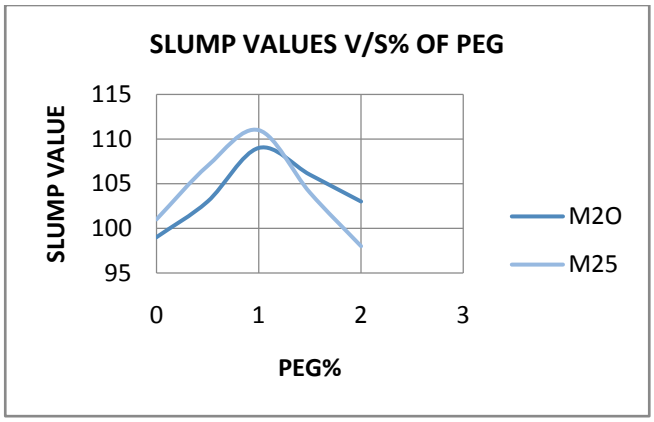

Fig. 1 Slump values comparison M20 v/s M25

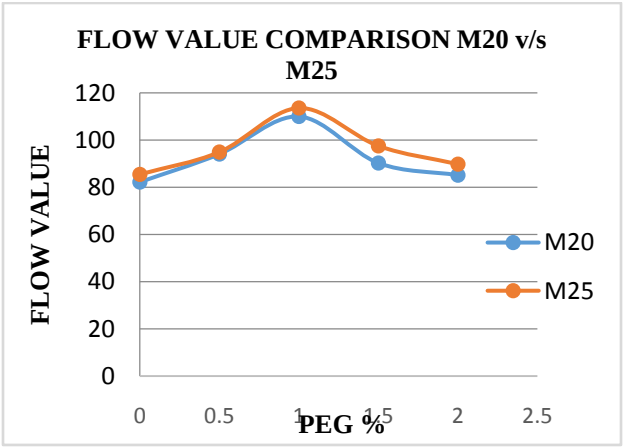

Fig. 2 Flow values comparison M20 v/s M25

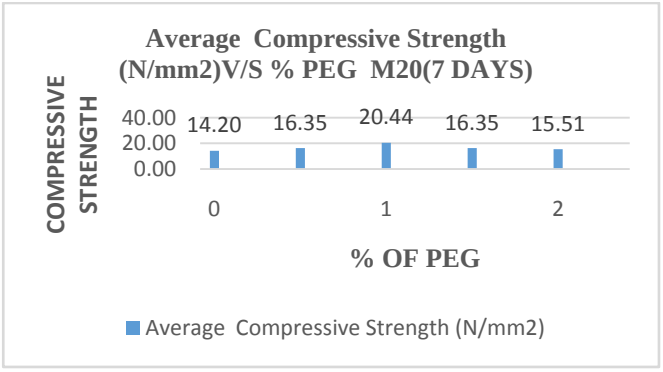

Fig. 3 Average Compressive Strength-M20-7 days

V. RESULTS & DISCUSSIONS

A. Compressive strength test results

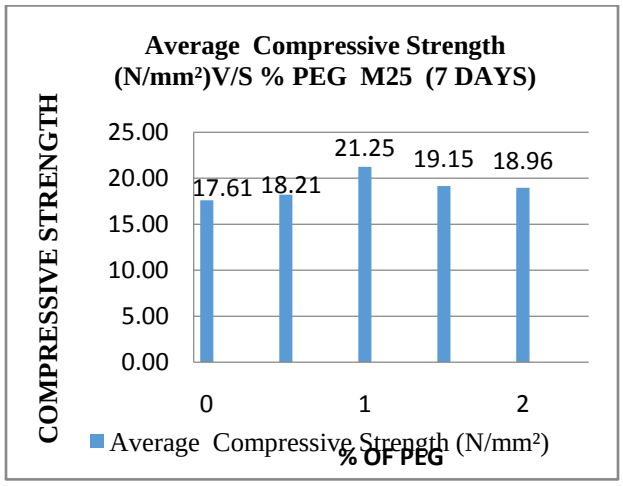

Fig. 4 Average Compressive Strength-M25-7 days

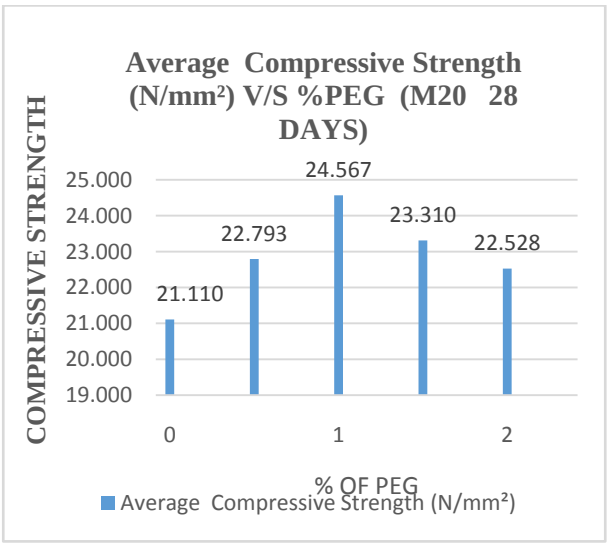

Fig. 5 Average Compressive Strength-M20-28 days

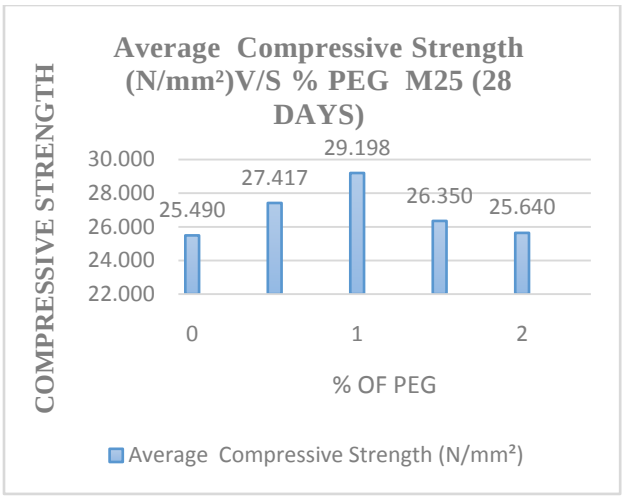

Fig. 6 Average Compressive Strength-M25-28 days

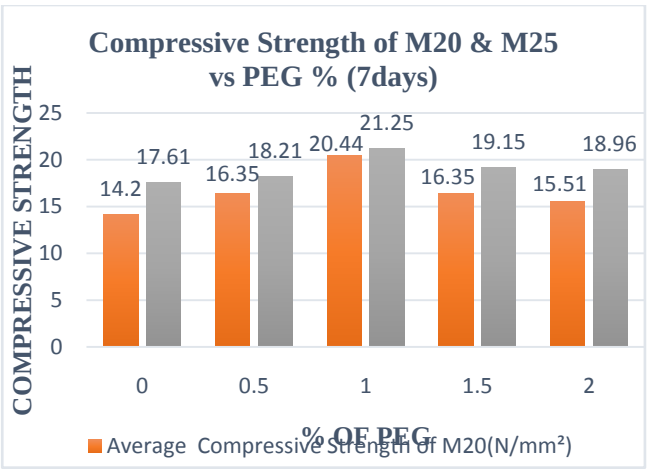

Fig. 7 Compressive strength comparison-7 days

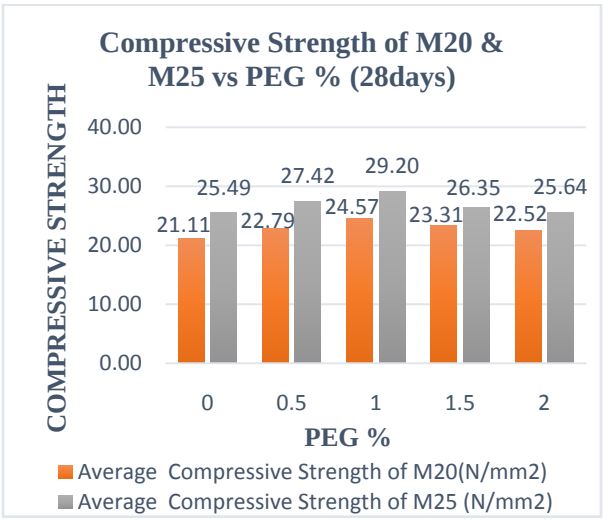

Fig. 8 Compressive strength comparison-28 days

B. Split tensile strength test results

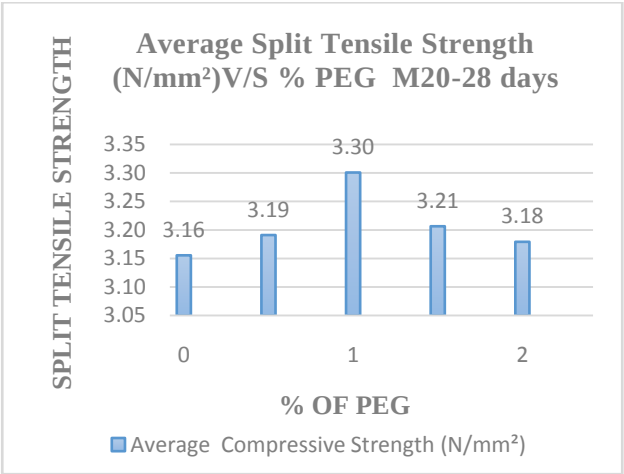

Fig. 9 Average Split tensile Strength-M20-28 days

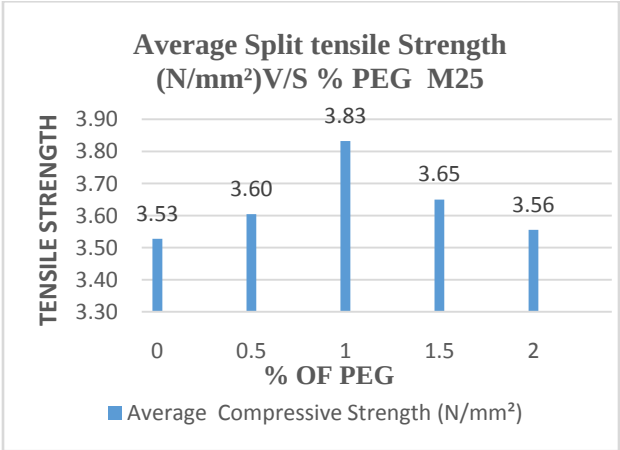

Fig.10 Average Split tensile Strength-M25- 28 days

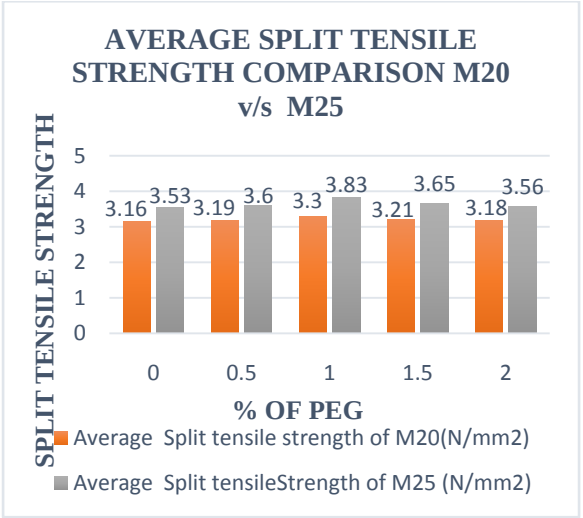

Fig. 11 Split tensile strength comparison-28 days

C. *Compressive strength comparison of NCC & SCC*

Table II Compressive strength comparison of NCC & SCC

GRADE	Compressive strength			
	7 days		28 days	
	Normal concrete	PEG 1%	Normal concrete	PEG 1%
M20	14.20	20.54	21.11	24.56
M25	17.61	21.25	25.49	29.19

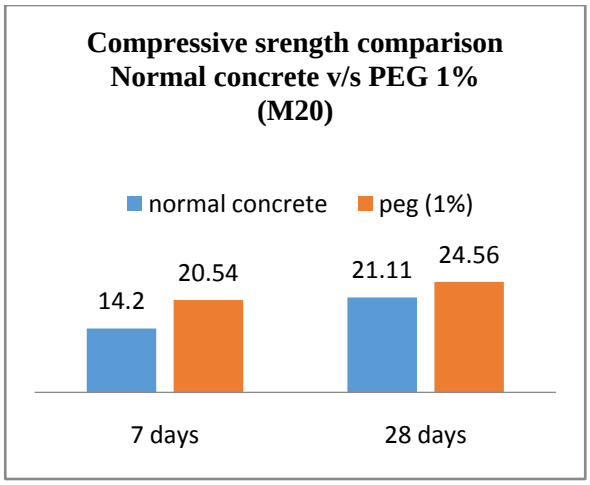

Fig. 12 Compressive strength comparison of NCC & SCC

B. *Split tensile strength comparison of NCC &SCC*

Table III Split tensile strength comparison of NCC & SCC

GRADE	SPLIT TENSILE STENGTH	
	28 DAYS	
	Normal concrete	PEG 1%
M20	3.16	3.30
M25	3.53	3.83

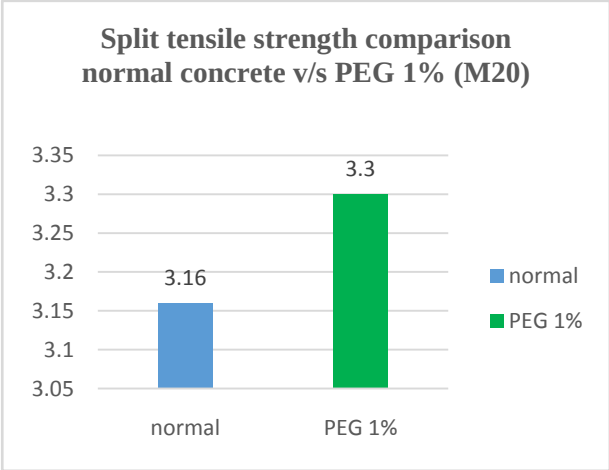

Fig.13 Split tensile strength comparison of NCC & SCC-M20

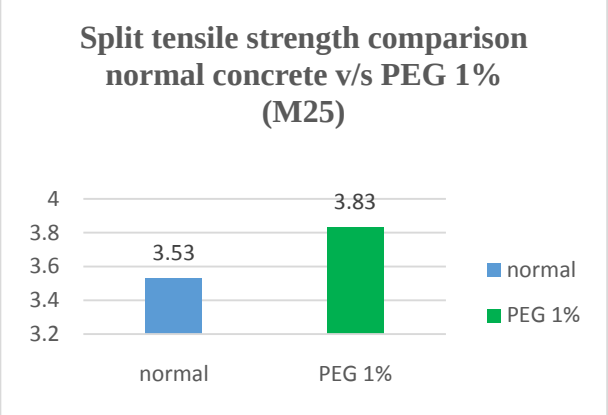

Fig.14 Split tensile strength comparison of NCC & SCC-M25

VI. CONCLUSIONS

- 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.

ACKNOWLEDGEMENT

First and foremost we take immense pleasure in thanking the **Management** and the respected Principal**, Dr. Priestly Shan**, for providing us with the wider facilities for our needs.We express our sincere thanks to **Dr. Surendran A**, Head of the Department of Civil engineering for giving us opportunity to present this project and for timely suggestions.

We wish to express our deep sense of gratitude and hearts to our project coordinators**Mr. MuhammedShareef K,** Asst.Professor& **Mr. Mahesh K.M,** Asst.Professor, in Department ofCivil Engineering, who coordinated in right path. Words are inadequate in offering our thanks to **Mr. Mohammed Shafeeque.V,** Asst. Professor, Department of Civil Engineering, for his encouragement and guidance in carrying out the project.

Above all that we would like to thank the Almighty God for the blessings that helped us to complete this venture smoothly.

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