Properties of Self Curing Concrete Using Different Polyethylene Glycol

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***Abstract*—Self-curing concrete has become a viable way to overcome the drawbacks of conventional curing techniques, especially in areas with scarce water supplies. Using Polyethylene Glycol (PEG) 400 and PEG 600 as curing agents, this study examines the characteristics of self-curing concrete. PEG, a water-soluble polymer, is well-known for its capacity to retain moisture, which aids in preserving proper hydration during the curing process and enhances the strength and longevity of concrete. The effects of adding PEG 400 and PEG 600 to M20 grade concrete mixtures at varying doses on important characteristics like compressive strength, split tensile strength, and flexural strength were evaluated in this study. The findings showed that both PEG 400 and PEG 600 considerably increased the concrete's ability to retain water, lowering evaporation and guaranteeing better cement hydration. The study aims to find the optimum dosage of PEG 400 and PEG 600 on M20 grade concrete.**

***Index Terms*—PEG, compressive strength, split tensile strength, flexural strength.**

I. INTRODUCTION

An inventive method called self-curing concrete was created to improve the quality and longevity of concrete while streamlining the curing process. Conventional curing techniques require applying water externally to keep the concrete moist, which might be difficult in some situations. To improve hydration and overall performance, self-curing concrete uses additives that allow the concrete to hold moisture internally. Self-curing agents are additives that help keep the concrete at the proper moisture content for hydration and strength development without the need for further water curing techniques.

One kind of polymer that can be utilized as a self-curing agent in concrete is PEG 400 and PEG 600. It is a member of a class of substances that are well-known for their capacity to retain moisture, which may help keep concrete hydrated during the curing process.

II. OBJECTIVES

1. To find the compressive strength, split tensile strength and flexural strength of conventional concrete and self curing concrete.
2. To find the optimum dosage of PEG 400 & PEG 600.
3. To compare the strength of PEG 400 & PEG 600 in conventional concrete.

III. METHODOLOGY

1. Collection of materials
2. Preliminary tests
3. Selection of grade of concrete
4. Preparation of self curing concrete
5. Casting of specimens
6. Tests and comparison

IV. MATERIALS AND METHODS

Polyethylene Glycol: Polyethylene Glycol (PEG) is an effective self-curing agent in concrete due to its ability to retain water, which is essential for cement hydration. PEG with higher molecular weights leads to longer-lasting cures. This makes PEG an effective and sustainable substitute for conventional water-based curing techniques, making it especially helpful in places with scarce water supplies.

Cement: 53 grade OPC (IS 12269:1987)

a. Standard consistency– 32 %

b. Initial setting time– 60 minutes

c. Specific gravity - 3.13

Fine Aggregate: Manufactured sand (IS 383:1970)

a. Specific gravity – 2.76

b. Fineness modulus – 2.93

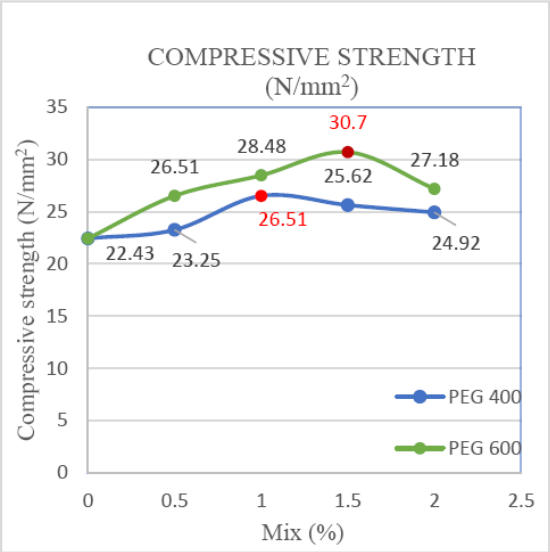
Coarse Aggregate: Locally sourced quarry stones (IS 383:1970)
a. Specific gravity – 2.8
b. Fineness modulus – 6
Details of Mix proportion - 1: 1.5: 3
Details of specimen: 3 cubes, 3 cylinders and 3 beam with varying percentage of PEG 400 and PEG 600 have been cast.

V. RESULT AND DISCUSSION

Compressive strength test: It is an important mechanical characteristic that shows how well a material can withstand crushing and deformation when subjected to axial compressive pressures.

Mix (%)	Compressive Strength (N/mm^2)	
	PEG 400	PEG 600
0	22.43	22.43
0.5	23.25	26.51
1	26.51	28.48
1.5	25.62	30.70
2	24.92	27.18

Table 1: Compressive strength of PEG 400 and PEG 600



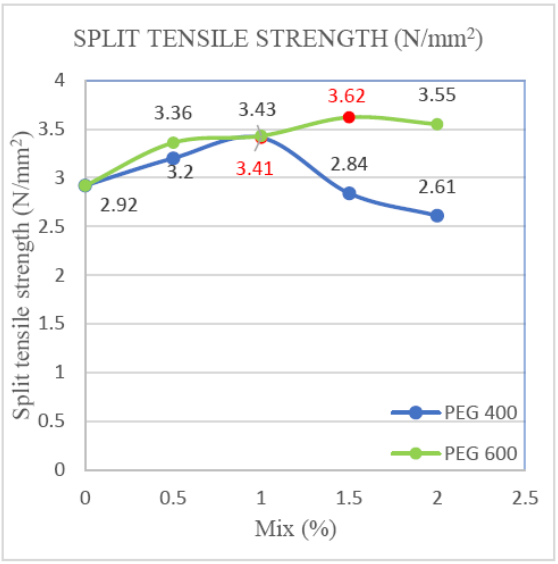
Graph 1: Comprasion of compressive strength test

The optimum dosage of PEG 400 is 26.51 N/mm^2 at 1% and PEG 600 is 30.70 N/mm^2 at 1.5% .

Split tensile strength: It is the capacity of a material; most commonly concrete, to resist tensile forces when under indirect tension. The test is used to assess the material's resistance to cracking and general durability under tension.

Mix (%)	Split Tensile Strength (N/mm^2)	
	PEG 400	PEG 600
0	2.92	2.92
0.5	3.20	3.36
1	3.41	3.43
1.5	2.84	3.62
2	2.61	3.55

Table 2: Split tensile strength of PEG 400 and PEG 600

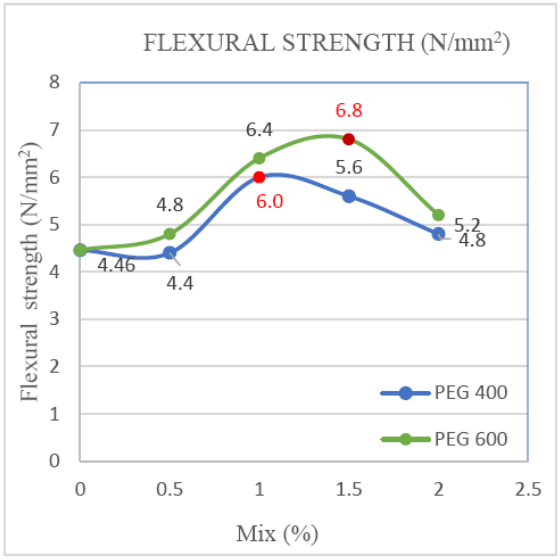


Graph 2: Comparison of split tensile strength test

The optimum dosage of PEG 400 is 3.41 N/mm^2 at 1% and PEG 600 is 3.62 N/mm^2 at 1.5 %.
Flexural strength: It refers to the capability of a material to withstand bending or deformation when subjected to load prior to breaking. It measures a material's capacity to withstand tensile and compressive forces acting perpendicular to its length

Mix (%)	Flexural Strength (N/mm^2)	
	PEG 400	PEG 600
0	4.46	4.46
0.5	4.4	4.8
1	6.0	6.4
1.5	5.6	6.8
2	4.8	5.2

Table 3: Flexural strength of PEG 400 and PEG 600



Graph 3: Comparison of flexural strength test

The optimum dosage of PEG 400 is 6 N/mm^2 at 1% and PEG 600 is 6.8 N/mm^2 at 1.5%.

VI. CONCLUSION

In conclusion, the experimental investigation has demonstrated that PEG 600 surpasses PEG 400 in terms of efficiency for self-curing purposes. The optimum dosage of PEG 600, at 1.5%, has been shown to significantly enhance the strength and durability of concrete outperforming conventional concrete. In contrast, PEG 400, while still exhibiting improved strength at its optimum percentage of 1%, falls short of the remarkable performance displayed by PEG 600.

The implications of this finding suggests that PEG 600 is the preferred choice for applications where it enhance concrete. The self-curing properties of PEG 600-infused concrete mitigate the need for external curing measures and reducing costs. In summary, the experimental evidence supports the conclusion that PEG 600 is more effective than PEG 400 and conventional concrete for self-curing purposes, exhibiting higher strength and durability.

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