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STUDY OF MECHANICAL PROPERTIES OF SCSFRC BY CALCULATING OPTIMUM DOSE OF PEG-400 WITH STEEL FIBER

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Abstract: The main aim of the project is to alleviate the water problems by using self-curing concrete. In this project the attempt has been made by the intention of developing the self-curing concrete by using Polyethylene glycol 400 & replace conventional steel by steel fiber. Because when we think about the use of conventional steel it requires more time for construction & skilled labor to apply reinforcement.Also, quantity of conventional steel required is more so, cost of construction of material also gets increases. Hence in order to reduce the labor cost we can replace conventional steel to steel fiber, because it is easy & quicker to apply so it can save time & cost of labor.This have a look at deals use of PEG-400 in concrete with 1% of metallic fiber by means of varying percent of 0%,0.5%,0.75%,1% and 1.25% by weight of cement for M30 mix. The concrete is examined to discover the mechanical properties for 7 days, 14 days & 28 days.

Index Terms **- Self curing, PEG-400, Steel fiber, Mechanical Properties.**

1. Introduction

In ordinary curing method we use water externally for curing. This approach required more amount of water. Self-curing is one method of curing which reduces the total quantity of water required for curing.Self-curing is help to reduce evaporation of water from concrete & increase water retention capacity. After studying the unique literatures associated with this topic it is found that Polyethylene glycol (PEG-400) may be used as self-curing agent in concrete with steel fiber. The use of steel fiber enhances the structural properties especially tensile & flexural strength. Self-curing concrete has chances of cracking beneathlow tensile strength. Hence using steel fiber overcomes this problem & increase fracture, toughness, durability, strength etc. Also, to be able to make perfect evaluation between conventional &steel fiber we have to recollect total cost of ownership. We should keep in mind total quantity of material, the labor cost to apply reinforcement & the main elementconsisting of creation time. Steel fiber reinforced concrete required much less steel & reduces labor fee because it's easy & faster to apply hence it saves time and money.

2. Literature review

2.1 "Steel fiber reinforced self-compacting concrete Incorporating class f fly ash",by B. Krishna Rao, Professor V. Ravindra.(2010). This investigation is executed to examine the properties of plain normal compacting concrete (NCC) and self-compacting concrete (SCC) with steel fiber. The outcomes indicated that high-quantity of fly ash can be used to supply Steel fiberself-compacting concrete, even though there is some growth in the concrete strength due to using steel fiber and high-volume of fly ash.

2.2 "Study on internal curing of steel fiber reinforced concrete using super absorbent polymer", by Mohammed Naseem Fairoz Kundgol1, Vinayak Vijapur.(July 2016). In this study it is experimentally examined approximatelyhave an impact on of SAP at the mechanical properties together with compressive strength, split tensile strength, flexural strength, shear strength and impact strength ofself-curing concrete by means of various the SAP's addition degrees from 0.1% to 0.4% by weight of cement with 2% steel fibers by using extent of concrete as regular for all mixes and compared with every day traditional cured steel fiber reinforced concrete i.e. water-curing after a period of 28 days.

2.3 "Strength Behavior of Self Curing Fly Ash Concrete using Steel Fibers and Its Analysis using ANSYS", by Cyril Cyriac (Aug 2016). According to this paper, As compared to extremely cured fly ash concreteself –curing fly ash concrete gives excessive compressive strength. Self-curing is a way that may be used to provide greater moisture in concrete for more powerful hydration of cement and decreased self-desiccation Concrete utilization around the sector is second best to water.

2.4 "Study on Strength and Durability Properties of Self Curing Concrete Incorporating PEG-400",by K.Dasthagiri, D.Gayathri, T.Naresh Kumar (Sep 2017). This watches impact, of internal curing agent and pottery powder on the Mechanical

properties and the durable properties like Permeability test and rapid Chloride Permeability take a look at can be accomplished. And the comparative study of normal curing concrete and Self curing concrete of M25 grade.

2.5"Self-Compacting and Self-Curing Concrete with Steel Fiber Reinforcement", by Dr.Maragatham.S 1, Kokilavani.S 2 , Lavanya.S 3 , Meena.G 4 , Ranjithapriya.R 5 (Apr2018). This paper considerationon self-compacting and self–restoring concrete with steel fiber support. To acquireself-compacting viscosity modifying admixture is gotten a predictable dose and to procure self-curing precise dosages of polyethylene glycol are used to produce extraordinary concrete mixes. They likewise use Steel fibers to offer workability and greater flexural reinforcement, shrinkage and retard crack propagation.

2.6 "A Review on Self Curing Concrete", by K. Sumangala M. Banu Sulochana.(2018). These watchesfeature approximately curing of concrete maintain fine moisture content in concrete in its early stages to have an option to create wanted properties.They surveyed of writing with respect to the works accomplished so far inside the region of self-cured concrete. It was discovered that various chemical admixtures were used to deliver self-cured concrete.

2.7 "An Experimental Study on Mechanical Properties of Steel Fiber Reinforced Self Curing Concrete", by J.Balaji Praveen, S. Manju Soniya.(Oct 2019). This paper studied approximately Strength of Self Curing Concrete. Flexural strength of self-curing concrete is superior than traditional concrete.This examines offers with utilization of shrinkage diminishingadmixture polyethylene glycol (PEG 400) in concrete that enables in self-curing.For M20 grade of concrete they discovered that 0.75% of steel fiber gives maximum strength in compression and 1% in tensile and flexural strength without compromising workability.

3. Objectives

The objective is have a look at the mechanical properties of self-curing concrete reinforced with steel fiber that encompasses compressive strength, split tensile strength, flexural strength for percent of PEG-400 such as 0.5%, 0.75%, 1% and 1.25% with the aid of the weight of cement for M30 grade concrete with 1% steel fiber.

4. Materials

1. **Cement:** The Ordinary Portland Cement (OPC) was used of 53 grades having specific gravity of 3.15. This is manufactured by Ultratech cement Ltd.confirming to IS 269.
2. **Fine Aggregate:**The crushed aggregate passed through 4.75mm IS sieve was used having specific gravity was 2.8. The water absorption of fine aggregate was 1.37%.
3. **Coarse aggregate:** The locally available aggregate of 20mm size has been used. The specific gravity of aggregate was 2.85 &fineness modulus of 5.7. The water absorption of coarse aggregatewas 1.49%.
4. **Water:** The water used for mixing was potable water conforming as per IS:456-2000.
5. **Steel Fiber:** Steel fiber of 1mm diameter and tensile strength of 800-900Mpa was used. The specific gravity of steel fiber was 1.2. The aspect ratio & lengths are 50mm, 50mm respectively.
6. **Polyethylene Glycol 400:** The polymer added in the concrete mix mainly from hydrogen bonds with water molecules. The properties of PEG-400 are shown in table.

Table 1: Physical & Chemical properties of PEG-400

Appearance	**Clear liquid or White solid**
Odor	Mild odor
Solvability	Soluble in water
Density range	1.1 to 1.2 (increases as molecular weight increases)

5. Experimental Program:

Mix Proportion: The sample without PEG-400 had been cured for 28 days in potable water &specimen with self-curing agents was cured for 28 days at room temperature. For M30 concrete mix proportion is given in table.

Table 2: Mix Proportion

Water (lit/m3)	Cement(kg/m3)	Fine aggregate(kg/m3)	Coarse aggregate(kg/m3)
197.17	437.80	702.23	1166.20

In this study 45 cubes are casted with varying percentage of 0%, 0.5%, 0.75%, 1%, and 1.25% of PEG-400 with constant 1% of steel fiber for calculating compressive strength. Then 30 cylinders were casted for same percentage of PEG-400 with 1% steel fiber for calculating spilt tensile strength. Also 30 beams were casted for flexural strength.

6. Results

Test results on mechanical properties of concrete

1.1 Compressive strength test

Table 3 Compressive strength test results for varying % of PEG-400

% OF PEG-400	Compressive strength (N/mm2)		
	7 Days	14 Days	28 Days
0%	21.18	29.77	35.41
0.5%	22.67	30.37	32.13
0.75%	21.79	26.07	33.03
1%	24.22	32.15	36.15
1.25%	21.78	30.37	32.51

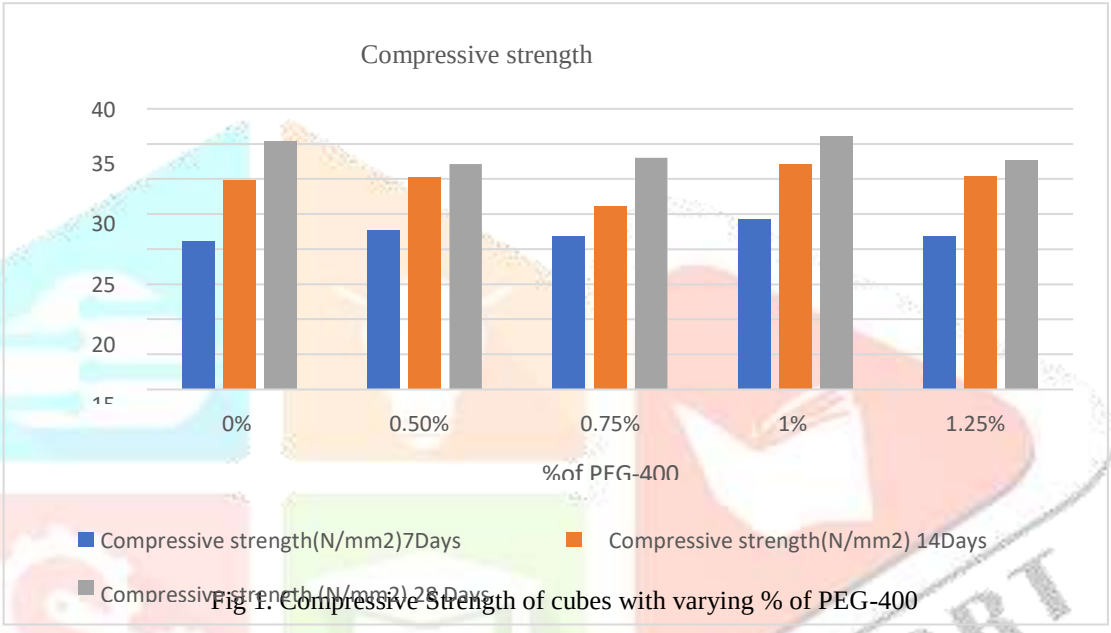

Fig 1. Compressive Strength of cubes with varying % of PEG-400

1.2 Split tensile strength

Table 4 Split tensile strength test results for varying % of PEG-400

% of PEG-400	Split tensile strength	
	14 Days	28Days
0%	3.17	3.52
0.5%	2.78	3.08
0.75%	3.35	3.35
1%	3.65	4.04
1.25%	3.32	3.53

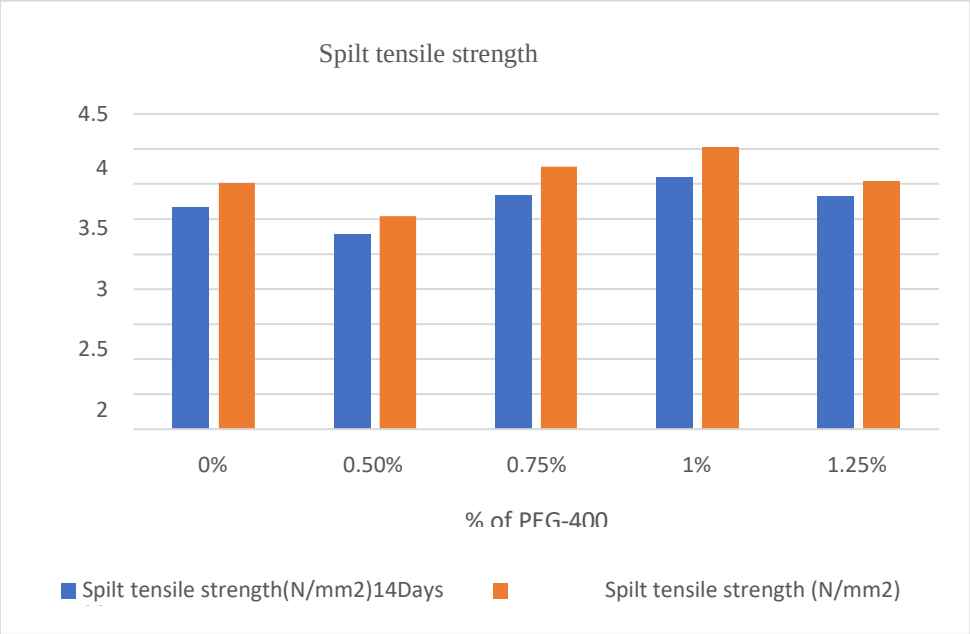

Fig 2. Split tensile Strength of cylinder with varying % of PEG-400

1.3 Flexural strength test

Table 5: Flexural strength test results for varying % of PEG-400

% of PEG-400	Flexural strength test	
	14 Days	28Days
0%	2.42	2.92
0.5%	1.36	1.64
0.75%	1.61	1.61
1%	2.58	2.92
1.25%	1.93	2.24

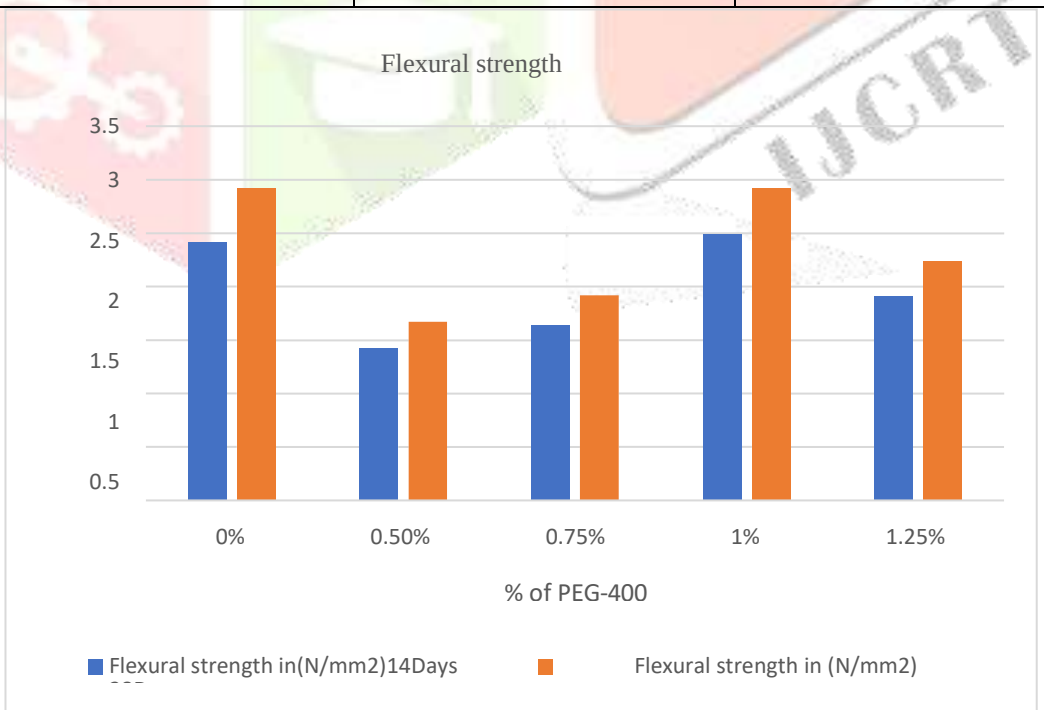

Fig 3. Flexural Strength of cylinder with varying % of PEG-400

7. Result & Discussion

Test aftereffects of the Compressive strength, split tensile strength & Flexural strength are appeared in table 3, 4, 5 with chart. In each situation of test, it is seen that strength of concrete increases bit by bit as PEG-400 increases from 0.5%-1%. Be that as it may, it shows diminishing pattern after 1%. It implies that strength decreases for 1.25% PEG-400 towards the finish of 7, 14, and 28 days. Addition of 1% of PEG-400 with the aid of weight of cement it shows most extreme quality.

8. Conclusion

Compressive, split tensile & Flexural strength of concrete specimen containing 0%, 0.5%, 0.75%, 1% and 1.25% of PEG-400 with constant 1% steel fiber were explored. For M30 grade solid ideal measurement of PEG-400 for compressive, split tensile, flexural strength was seen as 1% by weight of cement. So, this investigation presumes that self-curing concrete of PEG-400 with 1% demonstrated better execution with regard to strength.

9. Referances

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