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Evaluate the Effect of Self Curing Compound on the Properties of Concrete

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Abstract-Sufficient curing cannot be run down as the curing has the strong and direct influence on the proprieties of the hardened concrete. To achieve the target strength the concrete needs to be cured for 28 days. Curing plays the major and crucial role in construction, normal concrete sometimes lacks required strength and durability which are happened due to insufficient water curing. Therefore it is felt necessary to improve the strength and durability of concrete by internal curing. Internal curing is done to fulfil the water requirements of concrete in order to get the desirable properties. In this study explore the suitability of internal curing for solving shrinkage problems and improve the performance of self- cured concrete. In this research, the effect of self-curing admixture (poly ethylene glocol-4000) on the concrete was investigated. A comparison has been made between the concrete mixes with no curing, normal curing and concrete with self-curing admixture. We use self-curing admixture in different prepositions (0.5%, 1.0%, 1.5%, and 2.0% of PEG-4000 by weight of cement). The optimum dosage found was 1.0% of PEG-4000 by weight of cement, where concrete has higher desired properties.

Index Terms-Self curing admixture (Poly ethylene glycol), mixes with no curing, mixes with general curing, mixes cured with admixture. Workability, compressive strength, tensile strength and flexural strength.

1. INTRODUCTION

Concrete is soul of infrastructures, as it provides strength and durability to the structures. The durability, strength and the ease with which the concrete is placed makes the concrete basic engineering material used in civil engineering structures. The properties of concrete like compressive strength, durability, shrinkage mainly depends upon the curing of concrete. Curing is done to keep the concrete moist, by preventing the loss of moisture from concrete during the period it gains the strength. Sufficient curing cannot be run down as the curing has the strong and direct influence on the proprieties of the hardened concrete. Normal concrete sometimes lacks required strength and durability which are happened due to insufficient water curing. Therefore it is felt necessary to improve the strength and durability of concrete by internal curing within suitable admixtures. Human negligence sometimes becomes cause for the affect of strength and durability of the concrete due to inadequate curing. In order to overcome such problems self curing concrete is used to mitigate insufficient curing due to human negligence, scarcity of water in arid areas, high rise buildings, highways. The benefits of internal curing are numerous and include, increased hydration process and strength development, reduced autogenous shrinkage and cracking, reduced permeability, and increased durability.

2. LITERATURE STUDY

Magda+ I.Mousa, et. al (2015) in their study they used two types of self-curing agents. The first type used is pre soaked lightweight aggregates (Leca) with different ratios 0.0%, 10%, 15% and 20% of volume of sand and the second type is a chemical compound of poly ethylene glycol with various percentages 1%, 2% and 3% of weight of cement. They found that the use of poly ethylene glycol as self curing agent in concrete increase the physical properties compared with conventional concrete. They also find out that 15%of saturated leca was effective. They found that poly ethylene glycol was more effective than the saturated leca. The results show that a significant improvement took place in the physical properties studied for self-curing concrete with poly ethylene glycol as self-curing agent.

Remya K M et. al (2015) in their study they used polyethylene glycol 600 in different proportions. Poly ethylene glycol helps in water retention and also helps in reduction of shrinkage. The optimum dosage was found to be 1% PEG by the weight of cement, at which the concrete mix shows higher compressive, flexural and tensile strength.

Basil M Joseph (2016), works on the self-curing concrete using PEG400 as self-curing agent in concrete. He used M20 grade of cement concrete on adding 1.0%, 1.5% of PEG 400 by the weight of cement to the concrete. He found that 1.0% of PEG 400 by weight of cement was optimum dosage for M20 grade of cement concrete. He also experienced that if the percentage of peg was increased, slump as well as compaction factor was increased

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3. OBJECTIVE

Normal curing sometimes lacks required strength and durability which are happened due to insufficient water curing. Therefore it is felt necessary to improve the strength and durability of concrete by internal curing within suitable admixtures. Also there is a lot of water used for curing process in concrete structures and in construction industries. For the sustainable environment we have to save water, the days are not so far that we have to find alternative for the curing water, also in the remote areas where there is scarcity of water or proper curing is not possible, in these places self curing of concrete is best alternative. The main objective of the research includes:

- To study the effect of chemical compound (poly ethylene glycol) as self curing agent in the concrete.
- Different amount of polyethylene glycol is studied i.e. 0.5%, 1.0%, 1.5% and 2.0% by weight of cement.
- To study the strength properties of concrete with normal curing.
- To explore the strength properties of the concrete using polyethylene glycol.
- To compare the strength properties of self curing concrete and normal curing concrete.\

3.1 Materials Used

The materials used in this study were coarse aggregate, fine aggregate, cement and a self curing agent (poly ethylene glycol-4000).

3.2 Cement

53-grade OPC confirming to IS: 12269-1987was used in the investigation. It has a specific gravity of 3.15 and fineness of cement was 3.2%.

3.3 Fine Aggregate

Local River sand confirming to Zone-II according to IS: 383-1970 was used as fine aggregate. The specific gravity, water absorption and fineness modulus of sand were 2.83, 1.8, and 2.67 respectively.

3.4 Coarse Aggregate

Crushed coarse aggregate having maximum size of 20mm was used in the research. Confirming to IS :383 –1970.

3.5 Water

Potable water was used in the investigations for both mixing and curing of specimens. The specific gravity, water absorption and fineness modulus of course aggregate were 2.73, 0.81 and 6.91 respectively.

3.6 Chemical Admixture (self curing agent)

Polyethylene Glycols (PEG) of high molecular weights (4000) was used in the study. The chemicals were mixed with water thoroughly prior to mixing of water in concrete.

4. METHODOLOGY

Different properties of concrete were studied and tests were conducted after 7 days, 14 days and after 28 days for M30 grade. Workability test was done on fresh concrete and various mixes were casted to find the compressive strength, split tensile strength and flexural strength of the concrete.

4.1 Workability Test:

Concrete slump test is to determine the workability or consistency of concrete mix. The workability test was carried out as per IS: 1199 – 1959. The slump test is the most simple workability test for concrete, involves low cost and provides immediate results.

4.2 Compressive strength Test:

The compression test was done as per IS: 516 -1959. In this study mould of sizes 15cm x 15cm x 15cm were used. A 2000 KN capacity Compression Testing Machine (CTM) was used to conduct the test. Specimens were tested after 7, 14 and 28 days. The specimen is placed between the steel plates of the CTM and load is applied at the rate of 140 Kg/Cm^2/min and the failure load in KN is observed from the load indicator of the CTM.

4.3 Split tensile strength Test:

The cylindrical mould of size 15cm dia and 30cm height was used in this study confirming to IS: 516-1959 code. The cylinder specimens were tested on universal testing machine. 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 was applied continuously and without shock, at a constant rate within, the range of 1.2 N/mm^2/min to 2.4N/mm^2/min splitting tensile stress until failure of the specimen.

4.4 Flexural Strength Test:

The flexural strength of concrete mixes were done as per IS: 516 –1959. The beam of size 15cm x 15cm x 70 cm was used in this study. The specimen was placed in the machine in such a manner that the load is applied to the upper most surface as cast in the mould fails along two lines spaced 13.3cm a part at a rate of 400 kg/min and is increased until the sample.

5. RESULTS AND DISCUSSIONS

5.1 Workability:

The workability test was carried out as per IS: 1199 – 1959. Slump value of the concrete mixes increases as we increase the admixture.

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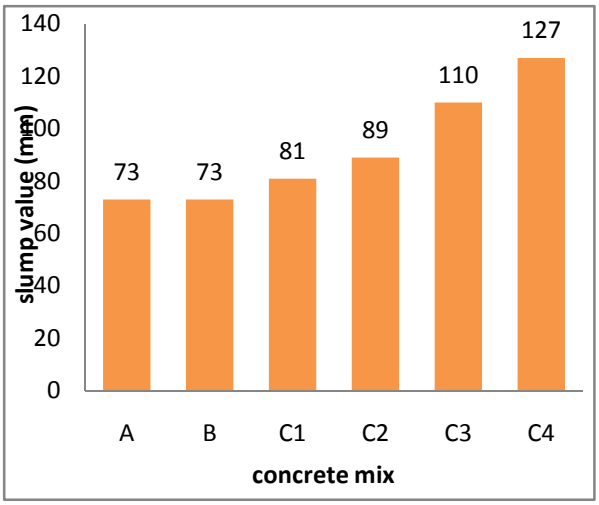
CONCRETE MIX	M30 SLUMP(mm)
A (without curing and without admixture)	73
B (with general curing and without admixture)	73
C1 (with admixture PEG4000 0.5% by weight of cement)	81
C2 (with admixture PEG4000 1% by weight of cement)	89
C3 (with admixture PEG4000 1.5% by weight of cement)	110
C4 (with admixture PEG400 2% by weight of cement)	127



5.2 Compression strength test:
In this study it was found that the optimum dosage of PEG was 1% by weight of cement in the concrete, where compression strength was found higher as compared to other mixes.

MIXES	**COMPRESSIVE STRENGTH**		
	7 DAYS	**14 DAYS**	**28 DAYS**
A (without curing and without admixture)	19.01	24.73	30.17
B (with general curing and without admixture)	24.11	31.50	38.89
C1 (with admixture PEG4000 0.5% by weight of cement)	25.42	32.64	39.73
C2 (with admixture PEG4000 1% by weight of cement)	27.28	34.61	40.72
C3 (with admixture PEG4000 1.5% by weight of cement)	23.55	30.89	38.62
C4 (with admixture PEG400 2% by weight of cement)	22.40	29.56	36.73

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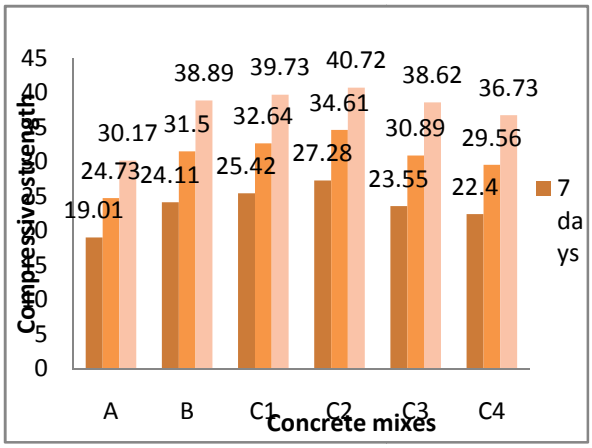


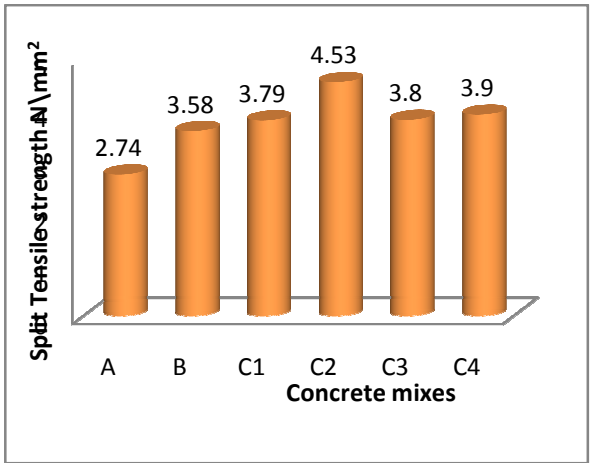
5.3 Split tensile strength:

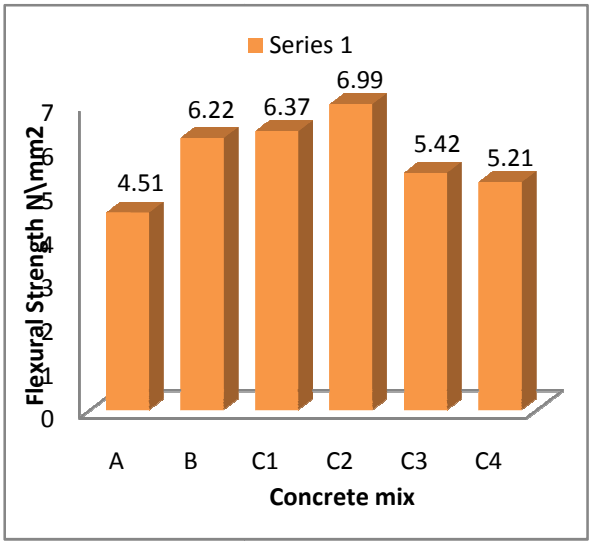
In this study split tensile strength test was carried out after 28 days for different concrete mixes confirming to IS: 516-1959 code. It was found that concrete mix C2 has higher split tensile strength as compared to other mixes.

5.4 Flexural strength:

In this study flexural strength test was carried out after 28 days for different concrete mixes. IS:516-1959 code was referred. It was found that concrete mix C2has higher flexural strength as compared to other mixes.

CONCRETE MIX	SPLIT TENSILE STRENGTH	FLEXURAL STRENGTH
A	2.74	4.51
B	3.58	6.22
C1	3.97	6.37
C2	4.53	6.99
C3	3.80	5.42
C4	3.90	5.21





6. CONCLUSION

- The effect of internal curing agent and its combination with concrete influence on the strength properties, clearly shows that self curing agent (PEG) can be used as an alternative to the general curing of concrete.
- The experimental results presented in this research elaborate that the optimum dosage of PEG-4000 for higher strength properties of the concrete was 1% by the weight of cement.
- It can be clearly demonstrated that self curing concrete can be used in the places where normal curing is not done properly like in arid areas, high rise buildings , areas were supervision is not done regularly, highways where the surface is exposed to hot conditions.
- It can be concluded that self curing is a suitable method for enhancing the performance of the concrete. However when using self curing agent it is necessary to pay close attention towards the site of exploration and the strength properties of concrete.

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