

A STUDY ON MECHANICAL PROPERTIES OF SELF CURING CONCRETE FOR M30 GRADE CONCRETE

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ABSTRACT -Concrete, being an essential material plays a vital role in the construction industry. Curing of concrete is done for 28 days in order to attain the desired properties such as strength and hardening of concrete. Improper curing results in strength loss as well as affects its durability. The present study is to investigate mechanical properties of Self curing concrete by using polyethylene glycol (PEG) and pre-soaked light weight aggregate (LECA). Different percentages of Polyethylene glycol (PEG) such as 0%, 1%, 2%, 3% by weight of cement and LECA as 0%, 10%, 15%, 20% by volume of fine aggregate are carried out. 15% of silica fume is replaced with cement which acts as self curing too. The mix design is carried out for M30 grade concrete. The optimum values obtained for 1% PEG and 15% LECA. Silica Fume is incorporated along with optimum values of PEG and LECA.

Key words: PEG, LECA, silica fume (SF), mechanical properties

1. INTRODUCTION

Concrete is one of the most used construction material in the world. Conventional concrete which is mixture of cement, fine aggregate, coarse aggregate and water, needs curing to achieve proper strength. So it is required to cure for a minimum of 28 days in order to achieve its target strength as well as good hydration. Curing is having a strong influence on hardening properties of concrete. So improper curing leads to strength loss as well as reduce the span of a structure. Water is an important utilized commodity in today's life. Water table is going down day-by-day due to the daily needs. Self curing is one of the method through which we can reduce the water usage for curing purpose. Since the concrete is exposed to environment, the water in the form of moisture gets evaporated, due to which incomplete hydration occurs and the quality of concrete gets affected. Self curing agents help in the retention of moisture content in the concrete by reducing evaporation. The self curing agents are light weight aggregate (LECA), shrinkage reducing admixture (PEG).

2.EXPERIMENTAL PROCEDURE

2.1 Materials

2.1.1 Cement

In this study ultatech cement of 53 grade conforming to Indian standards 12269-1987 was used. The specific gravity of cement was 3.13, initial and final setting of cement was 55 min and 245 min and the standard consistency was 33.75%.

2.1.2 silica fume

The specific gravity of silica fume used is 2.63

2.1.3 Fine Aggregate

Locally available Fine Aggregate is used in this study. The specific gravity of sand is 2.63, the bulk density is 1674 kg/m³

2.1.4 LECA

Light weight expanded clay is partially replaced with fine aggregate. The specific gravity of leca is 1.29, the bulk density is 669 kg/m³

2.1.5 Coarse aggregate

A max size of 20 mm aggregate is used in this study which is having specific gravity as 2.808, the bulk density is 1536 kg/m³

2.1.6 PEG

PEG-200 is used as an additive to the weight of cement. Its specific gravity is 1.126

2.2 Mix Design of Self Curing Concrete

Mix design is carried out for M30 grade concrete done by IS 10262:2009

Unit of batch	CEMENT (kg/m ³)	Fine Aggregate (kg/m ³)	Coarse Aggregate (kg/m ³)	Water (kg/m ³)
Content	413.33	681.5908	1187.33	186
Ratio of ingredients	1	1.649	2.873	0.45

2.3 Mixing, Casting, Curing and Testing

All the dry ingredients were mixed in a pan until the uniformity can be seen. The water is added gradually during the mixing followed by PEG or LECA for self curing concrete. After the mixing is done the concrete is casted in cubical moulds of size

150mm X 150mm X 150 mm for compressive test. Cylindrical moulds of size 300mm X 150mm were used for determining split tensile strength. Prismatic moulds of size 100mm X 100mm X 500mm were used to determine flexural strength. After the filling of concrete, compaction is done and then surface is levelled. The moulds were kept in lab for 24 hours. Only control mix is kept in water and remaining mixes were kept for room temperature. After 28 days from casting the specimens were tested. All properties are compared that of control mix. The mixes are tabulated below.

Sl. no	Mix design	Type of mix	Percentage of SF	Percentage of PEG	Percentage of LECA
1	M1	Control mix	0%	0%	0%
2	M2	Concrete with PEG	0%	1%	0%
3	M3	Concrete with PEG	0%	2%	0%
4	M4	Concrete with PEG	0%	3%	0%
5	M5	Concrete with LECA	0%	0%	10%
6	M6	Concrete with LECA	0%	0%	15%
7	M7	Concrete with LECA	0%	0%	20%
8	M8	Concrete with SF	15%	0%	0%
9	M9	Concrete with SF + PEG	15%	1%	0%
10	M10	Concrete with SF + LECA	15%	0%	15%

3 Results and Graphs

Mechanical properties of both conventional concrete and self curing concrete were tabulated below. The graphical representation is shown in fig 1, 2 and 3.

Mix designation	Compressive strength (mpa)	Split tensile strength (mpa)	Flexural strength (mpa)
M1	40.22	3.11	3.24
M2	42.22	3.26	3.32
M3	39.77	2.97	3.14
M4	37.34	2.76	2.93
M5	38.89	2.83	3.06
M6	40.89	3.15	3.35
M7	39.56	3.04	3.18
M8	44	3.18	3.30
M9	46.67	3.36	3.56
M10	45.33	3.27	3.42

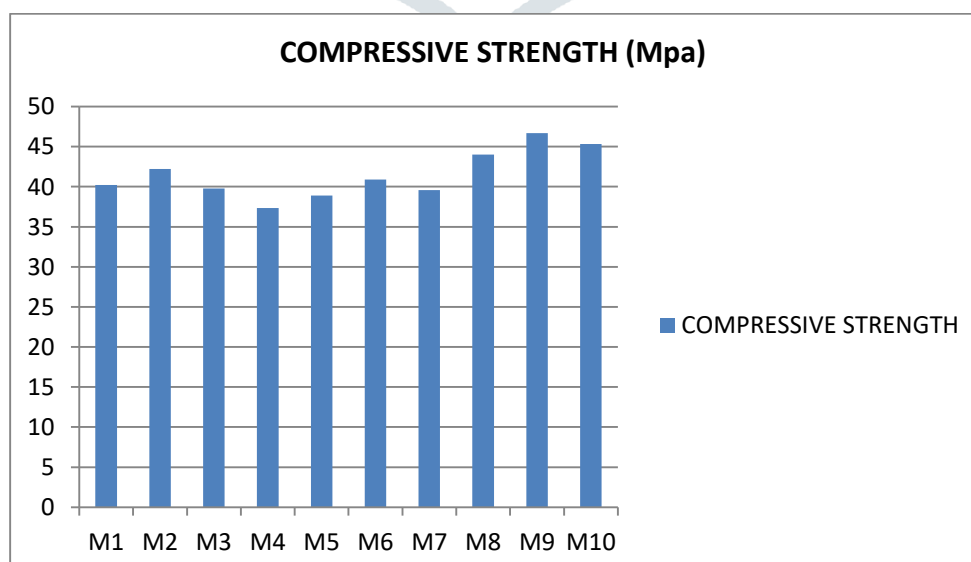


TABLE 1 compressive strength for 28 days

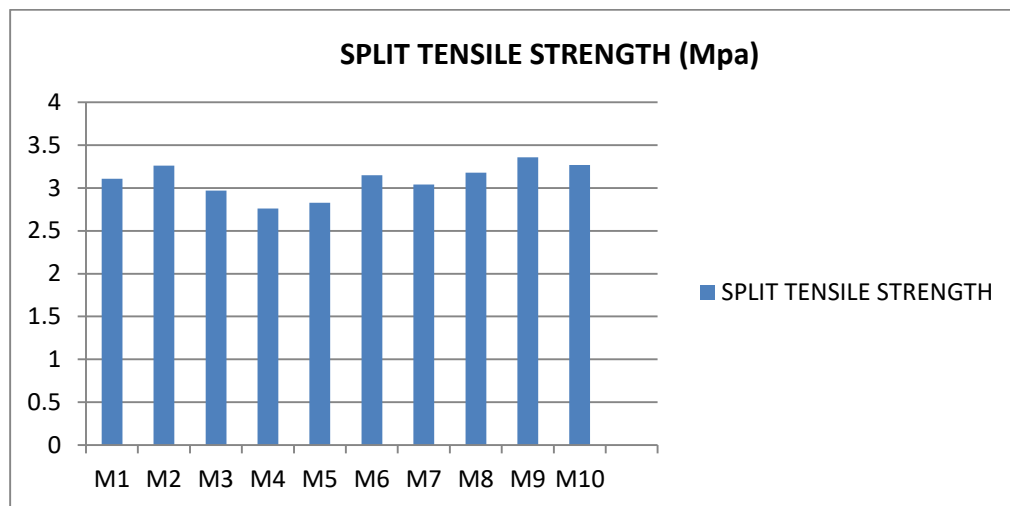


TABLE 2 split tensile strength for 28 days

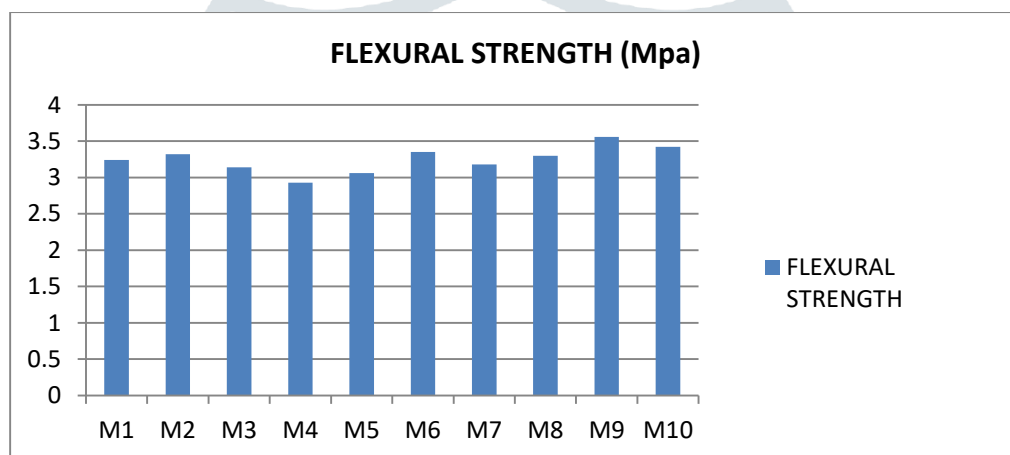


TABLE 3 Flexural Strength for 28 days

4. Conclusion

Based on the above study, the following observations are made regarding the strength properties of self curing concrete

1. For the mechanical properties the optimum values are obtained for 1 % PEG, 15 % LECA and 15% silica fume.
2. The combination of silica fume along with PEG as well as LECA causes addition improvement in the mechanical properties.
3. For 1 % PEG 42.22 N/mm² of compressive strength is obtained which is greater than the control mix.
4. For 15 % LECA 40.89 N/mm² and 15% silica fume 44 N/mm² of compressive strength is obtained.
5. Silica fume can also be used as a self curing agent since it shows an increase in strength in all properties

5. References

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