Influence Of Partial Curing On Strength Of Concrete

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Abstract: This study is based on curing of concrete and determining the compressive strength for M30 grade as per 10262.2018.The cubes were cured using two methods(water ponding and nylon covering) made of two types of cement (ordinary portland cement and pozzolana portland cement)testing on 3,7,14 and 28 days of curing period. The cubes were casted based on mix proportion design. The compressive strength of concrete cubes is tested on the respective curing ages and maximum strength gaining age of concrete i.e. 28days is tested after air drying the cubes for every curing period. The results of the investigations demonstrate that superior strength is achieved by nylon covering method for OPC than nylon covering method for PPC and water ponding for OPC achieved more strength than PPC for longer ages.

Keywords: compressive strength, curing, mix design, OPC, PPC

1. INTRODUCTION

One of the most important properties of concrete is its compressive strength. It is a major indicator of its quality. Curing is one process that facilitates the maximization of its potential strength. Curing ensures that concrete experiences continuous hydration, leading to its continued strength gain. Continued hydration is achieved by maintaining satisfactory moisture content and temperature within the concrete for a sufficient period of time. Besides accelerating the strength gain of concrete, curing also improves its durability, water-tightness, abrasion resistance, volumetric stability, resistance to freezing and thawing, resistance to deicing chemicals, minimizes creep, reduces powdery deposition on concrete surfaces and prevents cracking. Ponding or immersion, sprinkling or fogging, and use of wet coverings are methods used to maintain the availability of water for curing concrete. The use of membrane-forming compounds, impervious paper or plastic sheets and leaving forms in place are methods used for preventing loss of water from concrete. To determine which curing method to adopt, it is necessary to consider factors such as the availability of curing materials, the size and shape of the structure, economics, and environmental conditions. As per the specifications of ACI 308, IS 456:2000 and IS:10262 concrete of grade M30 was prepared using two different types of cement and was exposed to different curing durations. The compressive strength of concrete specimens subjected to different curing durations resulted in determining the effect of various curing periods on compressive strength of concrete which has its impact on concrete structural members.

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2. MATERIALS AND METHODOLOGY

2.1 Material Specifications

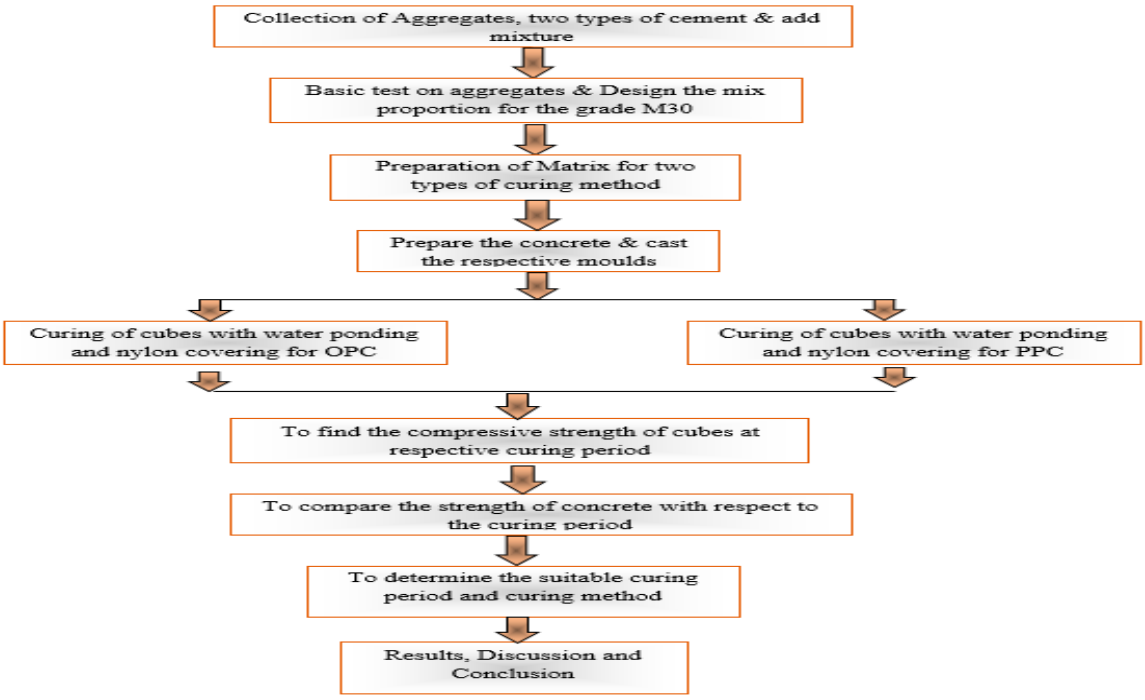
a. Cement: Ordinary Portland cement of 53 grade, confirming to recommendations stated in IS 4031(1999) has been used.

b. Fine aggregate: Manufactured sand (M-Sand) passing 4.75mm sieve, retaining 600µm was used as fine aggregate. It is confirming to zone II having specific gravity of 2.59 and water absorption 4.12% has been used.

c. Coarse aggregate: Uniformly graded coarse aggregates have been used throughout. Testing of coarse aggregates were conducted in accordance to IS 383(1970). The specific gravity was found to be 2.67 and water absorption was found to be 0.47% which are within permissible limits.

d. As per recommendations of IS: 456 (2000) portable water with constant water cement ratio has been used

3. PROCEDURE



4. RESULTS AND DISCUSSIONS

TABLE 1. *VALUES OBTAINED BY TESTING CUBES MADE OF PPC*

Sl. NO	grade	Date of casting	Date of testing	Date of testing for air drying	Age at test (days)	C/s area (mm2)	Maximum load (KN)	Compressive Strength (Mpa)	Average Strength (Mpa)
1.	M30	17-3-19	20-3-19		3	225500	448.1	19.91	19.84
2.	M30	17-3-19	20-3-19		3	225500	445.4	19.79	
3.	M30	17-3-19	20-3-19		3	225500	446.5	19.84	
4.	M30	17-3-19		13-4-19	28	225500	943.6	41.93	41.87
5.	M30	17-3-19		13-4-19	28	225500	957.6	42.56	
6.	M30	17-3-19		13-4-19	28	225500	925.1	41.11	
7.	M30	17-3-19	24-3-19		7	225500	646.8	28.74	30.02
8.	M30	17-3-19	24-3-19		7	225500	704.5	31.31	
9.	M30	17-3-19	24-3-19		7	225500	675.6	30.02	
10.	M30	17-3-19		13-4-19	28	225500	1068	47.46	50.9
11.	M30	17-3-19		13-4-19	28	225500	1180	52.44	
12.	M30	17-3-19		13-4-19	28	225500	1188	52.80	
13.	M30	17-3-19	31-3-19		14	225500	797.6	35.44	35.95
14.	M30	17-3-19	31-3-19		14	225500	809.0	35.95	
15.	M30	17-3-19	31-3-19		14	225500	820.5	36.46	
16.	M30	17-3-19		13-4-19	28	225500	1212	53.86	53.71
17.	M30	17-3-19		13-4-19	28	225500	1208	53.68	
18.	M30	17-3-19		13-4-19	28	225500	1206	53.6	
19.	M30	17-3-19	13-4-19		28	225500	1134	50.40	48.34
20.	M30	17-3-19	13-4-19		28	225500	1042	46.31	
21.	M30	17-3-19	13-4-19		28	225500	1087	48.31	

TABLE 2. *VALUES OBTAINED BY TESTING CUBES MADE OF PPC AND CURED USING NYLON COVERING*

Sl. NO	grade	Date of casting	Date of testing	Date of testing for air drying	Age at test (days)	C/s area (mm2)	Maximum load (KN)	Compressive Strength (Mpa)	Average Strength (Mpa)
1.	M30	18-3-19	21-3-19		3	225500	358.7	15.85	16.03
2.	M30	18-3-19	21-3-19		3	225500	360.4	16.01	
3.	M30	18-3-19	21-3-19		3	225500	365.3	16.23	
4.	M30	18-3-19		14-4-19	28	225500	770.8	34.26	37.36
5.	M30	18-3-19		14-4-19	28	225500	910.4	40.46	
6.	M30	18-3-19		14-4-19	28	225500	840.6	37.36	

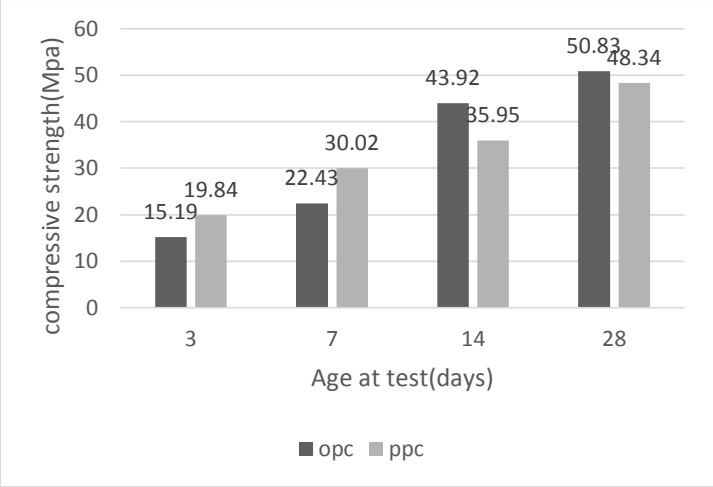
TABLE 3. *VALUES OBTAINED BY TESTING CUBES MADE OF OPC*

Sl. NO	grade	Date of casting	Date of testing	Date of testing for air drying	Age at test (days)	C/s area (mm2)	Maximum load (KN)	Compressive Strength (Mpa)	Average Strength (Mpa)
1.	M30	14-3-19	17-3-19		3	225500	333.9	14.84	15.19
2.	M30	14-3-19	17-3-19		3	225500	350.8	15.59	
3.	M30	14-3-19	17-3-19		3	225500	340.50	15.13	
4.	M30	14-3-19		11-4-19	28	225500	729.5	32.42	32.81
5.	M30	14-3-19		11-4-19	28	225500	751.2	33.39	
6.	M30	14-3-19		11-4-19	28	225500	733.1	32.58	
7.	M30	14-3-19	21-3-19		7	225500	522.4	23.21	22.43
8.	M30	14-3-19	21-3-19		7	225500	504.9	22.44	
9.	M30	14-3-19	21-3-19		7	225500	487.4	21.66	
10.	M30	14-3-19		11-4-19	28	225500	801.5	35.62	42.3
11.	M30	14-3-19		11-4-19	28	225500	769.7	34.21	
12.	M30	14-3-19		11-4-19	28	225500	1284	57.07	
13.	M30	14-3-19	28-3-19		14	225500	1022	45.42	43.92
14.	M30	14-3-19	28-3-19		14	225500	988.3	43.92	
15.	M30	14-3-19	28-3-19		14	225500	954.7	42.43	
16.	M30	14-3-19		11-4-19	28	225500	879.9	39.11	48.86
17.	M30	14-3-19		11-4-19	28	225500	1306	58.04	
18.	M30	14-3-19		11-4-19	28	225500	1112	49.42	
19.	M30	14-3-19	11-4-19		28	225500	1215	54	50.83
20.	M30	14-3-19	11-4-19		28	225500	1163	51.69	
21.	M30	14-3-19	11-4-19		28	225500	1053	46.80	

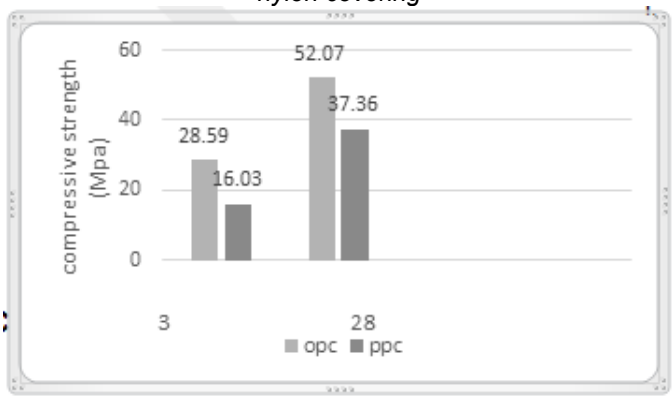
TABLE 4. *VALUES OBTAINED BY TESTING CUBES MADE OF PPC AND CURED USING NYLON COVERING*

SI. NO	grade	Date of casting	Date of testing	Date of testing for air drying	Age at test (days)	C/s area (mm2)	Maximum load (KN)	Compressive Strength (Mpa)	Average Strength (Mpa)
1.	M30	15-3-19	18-3-19		3	225500	639	28.4	28.59
2.	M30	15-3-19	18-3-19		3	225500	658	29.24	
3.	M30	15-3-19	18-3-19		3	225500	632.7	28.12	
4.	M30	15-3-19		12-4-19	28	225500	1113	49.47	52.07
5.	M30	15-3-19		12-4-19	28	225500	1173	52.13	
6.	M30	15-3-19		12-4-19	28	225500	1229	54.62	

Graph. 1 Comparison of compressive strength of concrete made of OPC and PPC at different ages of water ponding



Graph.2 Comparison of compressive strength of concrete made of OPC and PPC at different ages of curing using nylon covering



From the above graph it can be seen that PPC is having greater strength at shorter ages of curing, whereas OPC is having more strength at longer ages of curing. From the above graph it can be seen that OPC is having more strength at all ages of curing using nylon covering

5. CONCLUSION

The effect of different durations of curing was studied on concrete prepared using two different varieties of cement and two different methods of curing were adapted. From the experimental observations following results can be drawn.

The compressive strength was more influenced by long duration curing irrespective of method used. The experimental observations show higher strength for PPC concrete with water ponding for longer duration. The nylon cover curing method which is suitable for vertical columns achieves greater strength for OPC concrete than PPC at laboratory conditions. The air-drying curing method has more significance in allowing the concrete to settle and gain strength for it intend use, the air-dried observations has more strength for both two types of cement used irrespective of curing method.

1. With the lesser water cement ratio of 0.45, the significance of curing in strength gaining parameter can be recorded seeing the values above.
2. The effect of short curing periods for grade M30 in the lab conditions has been recorded and the adverse effects of formation of major cracks can be seen in site at the earlier stages.
3. The significance of curing and its duration has been observed, it is preferable to cure the RCC structures for minimum of 14 days to gain the required strength at all conditions in the site.

REFERENCES

[1] Effect of curing methods on the compressive strength of concrete" by T James, A Malachi "https://www.researchgate.net/publication/315481485_EFFECT_OF_CURING_METHODS_ON_THE_COMPRESSIVE_STRENGTH_OF_CONCRETE

[2] "Effect of self-curing compound on strength and durability of M25 mix concrete" by A Sreenivas Kumar. https://www.academia.edu/17500072/Effect_of_Self_Curing_Compound_on_Strength_and_Durability_of_M25_Mix_Concrete

[3] A Literature review on experimental studies on properties of self-curing concrete using poly-ethylene glycol 400 https://www.scribd.com/document/364114395/A-Study-on-Properties-of-Self-Curing-Concrete-using-Polyethylene-

Glycol-400
[4] Critical review of literature of self-curing concrete by Jay M Patel, Chirag. https://www.researchgate.net/publication/283016201_Critical_Review_of_the_Literature_on_Self_Curing_Concrete
[5] Effects of curing methods of efficiency of curing of cement mortar https://www.sciencedirect.com/science/article/pii/S2212670814000414
[6] Effect of curing compounds on strength and durability of concrete mix https://www.irjet.net/archives/V3/i6/IRJET-V3I6540.pdf
[7] Effects of curing methods on efficiency of cement mortar https://www.researchgate.net/publication/265470452_Effect_of_Curing_Methods_on_Efficiency_of_Curing_of_Cement_Mortar
[8] A study on the influence of curing on the strength of standard grade concrete https://www.researchgate.net/publication/307432863_Effects_of_Different_Types_of_Curing_on_Strength_of_Concrete
[9] A Literature review on experimental studies on properties of self-curing concrete using poly-ethylene glycol 400 https://www.scribd.com/document/364114395/A-Study-on-Properties-of-Self-Curing-Concrete-using-Polyethylene-Glycol-400
[10] Effects of Different Types of Curing on Strength of Concrete - Gokul. T1, Arun. M2, Arunachalam. N3 PG Student.
[11] Effect of Curing Methods on Density and Compressive Strength of Concrete -Akeem Ayinde Raheem.
[12] A literature review on experimental studies on properties of self-curing concrete using poly-ethylene glycol-400 - Hans W. Reinhardt et al. (1998)
[13] A literature review to find out the effect of admixture on compressive strength and split tensile - Patel Manish Kumar Dahyabhai et al. (2014)
[14] Introducing the self-curing concrete in construction industry- Patel Manish Kumar et al. (2017) Pitroda
[15] A review on internal curing composition- Sreenivasa kumar A et al. (2015)