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Comparative Study on Compressive Strength of Self Cured Concrete and Normally Cured Concrete

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Abstract - *In today's world, concrete is most popular and widely used material in construction sector due to its good compressive strength and durability. Curing of concrete involves maintaining satisfactory moisture content to develop the desired properties. Properly cured concrete has improved durability and surface hardness, and makes concrete less permeable. The use of self-curing agents is to reduce water evaporation for concrete, and hence increase its water retention capacity compared to conventional curing. Several materials, including polyethylene glycol and paraffin wax act as self-curing compounds. This study states the role of paraffin wax as a self-curing agent. The parameter include grade of concrete, type and dosage of paraffin wax and the effect of this curing compound on compressive strength of concrete after 28 days also to analyze their effect on workability, modulus of rupture and split tensile strength. From the previous studies by various researchers we vary the percentage of paraffin wax from 0.2% to 1% as the dosage of internal curing compound. The test results were studied for M20,M25, M30& M40 mixes. It is found through this experimental study that concrete cast with liquid paraffin wax as self-curing agent is better than that obtained by immersion curing.*

Key Words: **Paraffin Wax, unbated, conventional curing, modulus of rupture, polyethylene glycol.**

1.INTRODUCTION

For design a mix a comprehensive knowledge of workability is required. Since the concrete is open to atmosphere, the water used in the concrete evaporates and the water available in the concrete will not be sufficient for effective hydration to take place particularly in the top layer. If the hydration is to continue unbated, extra water must be added to replenish the loss of water on account of absoption and evaporation. Therefore, some measures must be taken by way of application of curing compounds to prevent the loss of water from the surface of concrete. There are number of ways by which curing can be done. However, good curing is not always practical in many cases. Improper knowledge given to proper curing at construction sites has been a topic of discussion since a very long time. Several investigators asked the question whether there will be self-curing concrete. Therefore, the need to develop self-curing agents attracted several researchers. The concept of self-curing agents is to reduce the water evaporation from concrete, and hence increase the water retention capacity of the concrete compared to conventional concrete. This compound will effectively prevents the surface against evaporation. It was found that water soluble polymers can be used as self-curing agents in concrete.

1.1 Objective

The main objective is to study the mechanical characteristics of concrete such as compressive strength by varying the percentage LPW by 0.2% to1% weight of cement for M20, M25, M30 & M40 grades of concrete.

1.2 Experimental Program

The experimental program was designed to investigate the strength of self curing concrete by adding liquid paraffin wax @ 0.2%, 0.3%, 0.4%, 0.5%, 0.6%, 0.7%, 0.8%, 0.9%, 1.0%. The experimental program was aimed to study the compressive strength. To study the above properties mixes M20,M25, M30 &M40 were considered.

2. Scope of Research

To study the strength properties of concrete made with curing compound (such as paraffin wax) with those of concrete made from conventional curing.

Table -2.1: Test for Liquid Paraffin Wax

S. No.	Liquid Paraffin wax	Properties
1	Flash point 0C	>180
2	Appearance	Clear colorless liquid
3	Sp. gravity g/ml	0.845 at 15^0c
4	Vapour Density	>1
5	Vapour Pressure	<0.01 mm Hg at 2.0^0C
6	Solubility in water	Insoluble(soluble in petroleum solvents)

3.Average Strength of Cubes:

The plain three samples of cubes of grade M20, M25, M30 and M40 were cured for 28 days in water curing tank and the average of strength of these samples are given in table

Table3.1 : Average Strength of Cubes after 28 days without curing compound

S. No.	Grade of concrete	Strength of sample after 28 days	Avg. Strength after 28 days
1	M20	S1 26.68 S2.26.60 S3.26.58	26.62
2.	M25	S1. 31.76 S2 31.70 S3 31.64	31.70
3.	M30	S1 38.40 S2 38.30 S3 38.26	38.32
4.	M40	S1 46.78 S2 46.64 S3 46.68	46.70

4.Experimental Results & Discussion:

Various test were done on the ingredients of concrete to collect data require for mix design as well as to study their physical properties. The proportions of ingredients for M20, M25,M30 and M40 for all the three types of mixes were determined by mix design and same proportions were used for casting the concrete specimens cubes.

- Mix designs were done as per IS: 10262-2009.
- Materials were weighed by weigh batching.
- Each set consists of 3 specimens cubes and the test strength of the sample has been taken as the average strength of the specimens.
- The size of each cubes used is150mm x 150mm x 150mm.
- The details of test results such compressive strength, for the mix design M20, M25, M30 and M40 by adding different percentage of liquid paraffin wax are shown in the tables below.

Table4.1: Compressive Strength of the concrete block by varying the percentage of liquid paraffin wax

S.NO.	% LPW	M20	M25	M30	M40
1	0	26.62	31.70	38.32	46.70
2	0.20	26.63	31.74	38.48	46.78
3	0.30	26.68	31.77	38.53	46.73
4	0.40	26.71	31.78	38.64	46.24
5	0.50	26.73	31.80	38.56	46.20
6	0.60	26.73	31.85	38.50	45.94
7	0.70	26.75	31.76	38.46	45.78
8	0.80	26.80	31.70	38.40	45.26
9	0.90	26.70	31.64	38.35	45.10
10	1.00	26.62	31.65	38.28	44.84

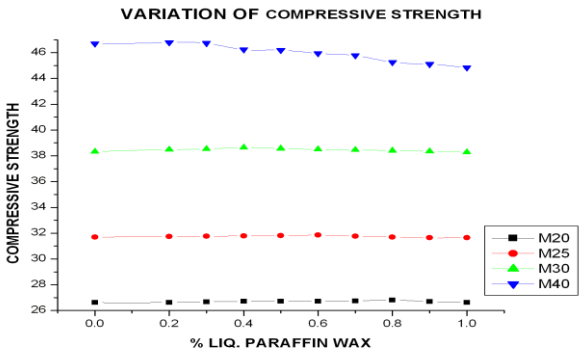

Fig -4.1: Variation of compressive strength for different % of LPW for grade M20, M25,M30 &M40

5. Results:

The test results are obtained by keeping the mix proportions constant without any inclusion of plasticizers and super-plasticizers. Only curing compounds are additionally added in the mix as a substitute of curing water.

- The Strength of concrete achieved by conventional curing is at par as compared to internal curing methods. The results obtained from conventional curing method (ponding) are under ideal conditions when the specimens are kept completely submerged in water for 28 days. Such long and ideal curing conditions may not be possible under actual site conditions. Thus these results do not give a true picture of conditions existing at construction sites.
- Concrete mixes prepared using curing compounds are at par with specified target strength values

calculated during design mix for M20, M25, M30 and M40 grade of concrete. Also it can be seen that more than the minimum strength as per the codal provisions has been achieved by the specimens cured through curing compounds. The strength achieved by liquid paraffin wax is comparable for different types of mix i.e. M20, M25, M30 and M40. The results obtained after the use of curing compounds show a better picture of the actual site conditions in comparison to those obtained from conventional curing techniques. Only the environmental conditions existing at site and laboratory may vary. Rest all parameters are more or less the same.

- The strength achieved cured through curing compound paraffin wax is nearly 99% of that achieved through conventional curing method for both M20, M25, M30 and M40 grade of concrete.
- The extra cost of procuring water from deep underground or far off sources specially in developing areas can be saved by the use of curing compounds.

6. Conclusion:

I. As per the results compiled in Table 4.1 compressive strength of various mixes for M20, M25,M30 and M40 Grade of concrete we conclude that the compressive strength of mixes using self-curing compound Liquid paraffin wax are at par with that of the concrete with conventional curing.

2. The compressive strength achieved through curing compound LPW is nearly 99% of that achieved through conventional curing method for M20, M25, M30 and M40 grade of concrete.

3. It can be seen that the minimum strength as per the codal provisions has been achieved by the specimens cured through curing compounds. The strength achieved by the LPW is comparable for different types of mixes i.e. M20, M25, M30 and M40. The results obtained after the use of curing compounds show a better picture of the actual site conditions in comparison to those obtained from conventional curing techniques.

All this led to the need to develop self-curing agents. The concept of self-curing agents is to reduce the water evaporation from concrete, and hence increase the water retention capacity of the concrete compared to conventional concrete. These compounds will rise to the finished concrete surface and effectively seal the surface against evaporation.

Thus our experimental study has been successfully completed. We have been able to achieved good concrete quality with sufficient strength. The results show that curing compounds have the potential of replacing water as the curing agent. Further study is required to check the durability of self cured concrete structures. With research work going on in this field, self cured concrete will become very common and curing compounds will again a lot of importance in the upcoming years.

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