An Experimental Study On Comparision Of Curing Of Concrete Using Natural Resin And Curing Components

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Abstract— Concrete is the most widely used construction material in the world. The property of concrete is modified by adding any additives, mineral admixtures, chemical admixtures, polymers and fibers. This research aims to investigate and evaluate the performance of concrete with curing and without curing using natural resin and chemical curing components. Curing is essential if concrete is to perform the intended function over the design life of the structure. Excessive curing time may lead to the escalation of the construction cost of the project and unnecessary delays. In places where there is a scarcity of water such as desert areas and on sloping surfaces where curing with water is difficult and in cases where large areas like pavements, bridges have to be cured, the use of curing compound may be restored. Several studies independently have shown that concrete strength development is influenced not only by the water-to-cement ratio, but that it also is influenced by the content of other concrete ingredients, method of curing, etc. This paper focuses on curing methodology of concrete. M25 grade of concrete is cast and it is cured initially by normal tank curing and then it is compared with two non curing methods. One, by using chemical curing component and the other by using natural resin as curing component. The concrete with and without curing is tested for compressive strength, split tensile strength and flexural strength at age of 7 days, 14 days and 28 days.

Keywords—*curing, curing compounds, natural resin*

I. INTRODUCTION

The water scarcity is the major problem faced by most of the countries all over the world. Also concrete ranks first most used material in the globe. As India , one of the developing country, is in urge need to improve its infrastructure. Hence concrete is largely used over here.

Concrete attains its strength only after certain period of curing. Since curing plays a vital role in strength and durability of concrete, it is unavoidable in every concrete structure. But curing requires large amount of water, that is highly scarce now-a adays.

Research is carried out in most of the places to find a solution to this water used in curing process. Some chemical curing products are available in the market itself, but the cost of chemical curing components hikes. With a view of economical non curing, we have choosen natural resin as the curing component. Natural resin goes organic and economical way of curing.

II. CURING

A. INTRODUCTION

Curing is the process of controlling the rate and extent of moisture loss from concrete during cement hydration. It may be either after it has been placed in position (or during the manufacture of concrete products), thereby providing time for the hydration of the cement to occur. Since the hydration of cement does take time – days, and even weeks rather than hours – curing must be undertaken for a reasonable period of time if the concrete is to achieve its potential strength and durability. Curing may also encompass the control of temperature since this affects the rate at which cement hydrates.

B. NEED FOR CURING

The necessity for curing arises from the fact that hydration of cement can take place only in water-filled capillaries. That is why a loss of water by evaporation from the capillaries must be prevented. Evaporation of water from concrete, soon after placing depends on the temperature and relatively humidity of the surrounding air and on the velocity of wind over the surface of the concrete.

Curing is essential in the production of concrete to have the desired properties. The strength and durability of concrete will be fully developed only if it is properly cured. The amount of mixing water in the concrete at the time of placement is normally more than required for hydration & that must be retained for curing. However, excessive loss of water by evaporation may reduce the amount of retained water below what necessary for development of desired properties. The potentially harmful effects of evaporation shall be prevented either by applying water or preventing excessive evaporation.

C. METHODS OF CURING

Concrete curing methods may be divided broadly into four categories:

- Water curing
- Membrane curing
- Application of heat
- Miscellaneous

D. CONCRETE CURING COMPOUNDS

Concrete curing compound consists essentially of waxes, natural and synthetic resins, and solvents of high volatility at atmospheric temperatures. The compound forms a moisture retentive film shortly after being applied on fresh concrete surface. White or gray pigments are often incorporated to provide heat reflectance, and to make the compound visible on the structure for inspection purpose.

E. NATURAL RESIN

Natural rein in the form of gel is taken from the aloe vera plant and it is used for concreting. Resin when mixed with water and dumped for a period, it forms a highly viscous liquid. This gel prevents the loss of moisture from the concrete. The moisture absorbed by the aloe vera resin can be effectively used for curing purposes.

III. MATERIALS USED

- Cement
- Aggregate
- Jute fiber
- Natural resin

A. CEMENT

Cement is a binder, a substance used in construction that sets and hardens and can bind other materials together. The most important types of cement are used as a component in the production of mortar in masonry, and of concrete, which is a combination of cement and an aggregate to form a strong building material.

B. FINE AGGREGATE

Aggregates are inert granular materials such as sand, gravel, or crushed stone that, along with water and portland cement, are an essential ingredient in concrete.

Aggregates strongly influence concrete's freshly mixed and hardened properties, mixture proportions, and economy. Consequently, selection of aggregates is an important process. Although some variation in aggregate properties is expected, characteristics that are considered include:

- grading
- durability
- particle shape and surface texture
- abrasion and skid resistance
- unit weights and voids
- absorption and surface moisture

C. COARSE AGGREGATE

It is the aggregate most of which is retained on 4.75 mm IS sieve and contains only so much finer material as is permitted by specification. According to source, coarse aggregate may be described as:

- Uncrushed Gravel or Stone– it results from natural disintegration of rock
- Crushed Gravel or Stone– it results from crushing of gravel or hard stone.
- Partially Crushed Gravel or Stone– it is a product of the blending of the above two aggregate.

According to size coarse aggregate is described as graded aggregate of its nominal size i.e. 40 mm, 20 mm, 16 mm and 12.5 mm etc. for example a graded aggregate of nominal size 20 mm means an aggregate most of which passes 20 mm IS sieve.

D. WATER

The strength of cement concrete depends mainly from the binding action of the hydrated cement paste gel. A higher water-binder (w/b) ratio will decrease the strength, durability, water-tightness and other related properties of the concrete. As per Neville (2000), the quantity of water added should be the excess water would end up only in the formation of undesirable voids (capillary pores) in the hardened cement paste of concrete. The strength of cement paste is inversely proportional to the dilution of the paste. Hence, it is essential to use as little paste as possible, consistent with the requirements of workability and chemical combination with cement. Potable water is used for concreting.

E. CURING COMPONENTS

The chemical curing components are mixed with water and this water is used for concreting.

F. NATURAL RESIN

Aloe vera resin is dumped in water for a certain period. This resin water is used for concreting.

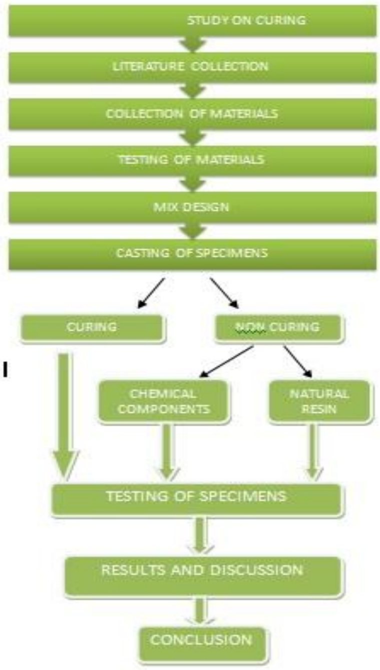
IV. MIX DESIGN

The mix design was carried out using IS codal provisions.

The mix proportion is as follows:

Water	Cement	Fine Aggregate	Coarse Aggregate
197.16	438.133	835.43	1157.649
0.45	**1.00**	**1.906**	**2.64**

V. EXPERIMENTAL METHODOLOGY



VI. TESTS ON CONCRETE

To evaluate the strength properties of mix properties used in this project , the following tests were performed.

- Compressive strength
- Split tensile strength
- Flexural strength test

A. COMPRESSIVE STRENGTH TEST

The specimen were removed from chamber after 24 hours, demoulded carefully and were kept in ambient conditions. Testing was done after 3 days, 7 days, 14 days and 28 days of ambient curing. The bearing surface of the testing machine was cleaned. The specimen was placed in 2000KN capacity compression testing machine in such a manner that the load could be applied to the opposite sides of the cube. The specimen was aligned centrally on the base plate of the machine. The movable portion was rotated gently by hand that, it touched the top surface of the specimen. The load was applied gradually without shock and continuously at the rate of 140Kg/cm2/minute till the specimen failed. The maximum load at which the specimen failed was recorded.

B. SPLIT TENSILE STRENGTH

Concrete being a brittle material is not expected to resist direct tensile forces. However tensile strength is of important with regards to cracking, due to tensile failure. Some researchers have observed that the type of coarse aggregate has a relative effect on tensile strength that on compressive strength. Generally for quality control concrete tensile strength is never made.

C. FLEXURAL STRENGTH OF PRISM

Beam flexural strength tests will be carried out on beam specimen of 700*150*150mmat the age of 28 days curing and without curing using compression testing machine of 2000KN capacity.

VII. RESULTS AND DISCUSSION

COMPRESSIVE STRENGTH OF CONCRETE WITH RESIN CURING			
S. NO.	**Age of concrete**	**Compressive Strength in N/mm^2**	**Avg. Compressive Strength in N/mm^2**
1	3 Days	10.56	10.17
		10.87	
		9.09	
2	7 Days	19.65	19.37
		19.82	
		18.64	
3	14 Days	22.20	23.24
		23.37	
		24.19	
4	28 Days	27.23	28.07
		28.40	
		28.62	

COMPRESSIVE STRENGTH OF CONCRETE WITH CURING COMPONENTS			
S. NO.	Age of concrete	Compressive Strength in N/mm^2	Avg. Compressive Strength in N/mm^2
1	3 Days	8.25	8.09
		8.01	
		8.01	
2	7 Days	12.39	13.17
		13.68	
		13.44	
3	14 Days	19.10	18.58
		18.67	
		18.00	
4	28 Days	25.05	27.02
		26.31	
		29.54	

SPLIT TENSILE STRENGTH OF CONCRETE WITH RESIN CURING			
S. NO.	Age of concrete	split tensile Strength in N/mm^2	Avg. split tensile Strength in N/mm^2
1	3 Days	0.89	0.93
		0.91	
		1	
2	7 Days	2.1	1.91
		1.98	
		1.65	
3	14 Days	2.35	2.43
		2.39	
		2.57	
4	28 Days	2.5	2.76
		2.8	
		3	

SPLIT TENSILE STRENGTH OF CONCRETE WITH CURING COMPONENTS			
S. NO.	Age of concrete	split tensile Strength in N/mm^2	Avg. split tensile Strength in N/mm^2
1	3 Days	0.65	0.68
		0.7	
		0.7	
2	7 Days	1.96	1.74
		1.72	
		1.55	
3	14 Days	2	2.1
		2.1	
		2.22	
4	28 Days	2.38	2.41
		2.39	
		2.46	

FLEXURAL STRENGTH OF CONCRETE WITH NATURAL RESIN (N/mm^2)				
Sl .No	Age of concrete	Ultimate Load	Ultimate Flexural Strength	Average Flexural Strength
		W	(M/Z)x10^6	(N/mm^2)
		(KN)	(N/mm^2)	
1	7	12	3.2	3.1
2		11.25	3	
3	14	15.38	4.1	4.04
4		14.93	3.98	
5	28	25.88	6.9	6.85
6		25.31	6.75	

FLEXURAL STRENGTH OF CONCRETE WITH CURING COMPONENTS (N/mm^2)				
Sl. No	Age of concrete	Ultimate Load	Ultimate Flexural Strength	Average Flexural Strength
		W	(M/Z)x10^6	(N/mm^2)
		(KN)	(N/mm^2)	
1	7	11.06	2.95	3
2		11.44	3.05	
3	14	15.45	4.12	4.06
4		15	4	
5	28	25.54	6.81	6.55
6		23.63	6.3	

COMPARISION OF RESULTS

COMPRESSIVE STRENGTH OF CONCRETE (N/mm^2)				
S. NO.	Age of concrete	With curing	Without curing	
			Natural resin	Curing components
1	3 Days	8.07	10.17	8.09
2	7 Days	12.03	14.37	13.17
3	14 Days	18.18	23.24	18.58
4	28 Days	26.35	28.07	27.02

SPLIT TENSILE STRENGTH OF CONCRETE (N/mm^2)				
S. NO.	Age of concrete	With curing	Without curing	
			Natural resin	Curing components
1	3 Days	0.60	0.93	0.68
2	7 Days	1.67	1.91	1.74
3	14 Days	1.93	2.43	2.1
4	28 Days	2.40	2.76	2.41

FLEXURAL STRENGTH OF CONCRETE (N/mm^2)				
S. NO.	Age of concrete	With curing	Without curing	
			Natural resin	Curing components
1	3 Days	1.36	1.56	1.41
2	7 Days	2.78	3.1	3
3	14 Days	3.85	4.04	4.06
4	28 Days	6.46	6.85	6.55

The compressive strength, split tensile strength and flexural strength of concrete increases in all age of concrete in addition of natural resin.

VIII. CONCLUSIONS

- The compressive strength of concrete using natural resin is 6.5% greater than the conventional curing concrete at 28 days.
- The split tensile strength of concrete using natural resin is 15% greater than the conventional curing concrete at 28 days.
- The flexural strength of concrete using natural resin is 6% greater than the conventional curing concrete at 28 days.
- Thus, in all age of concrete, the strength of concrete is more when natural resin in used.
- Thereby,

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