An Effect of Acrylic-Based Compound on Strengthening Property of Concrete

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Abstract- *Curing of concrete is an important process for gaining mechanical properties of concrete, as it leads to proper hydration of cement particles which results in Quality concrete. Curing compound or membrane curing is one of the methods of curing, in which concrete surface is sealed off from the environment, due to this water retention occurs and proper hydration of cement particle is carried out.In this paper, effect of Acrylic based curing compound on Plain concrete is observed and compressive strength of concrete is determined. The curing compound is applied to the surface of specimen after demolding and kept for water curingupto 2 days. The curing compound will be applied after 1 day of water curing and 2 day of water curing in double coat.*

Keywords- Acrylic-Based Curing Compound, Membrane Curing, Curing Compound.

I. INTRODUCTION

Concrete is basic need nowadays in construction industries to build anything i.e. House, bridges, buildings, dams, reservoirs, roads and various structures. The main parameter of concrete is its durability and serviceability. Concrete is mostly known for the compression member in structure and to achieve its desired properties proper hydration of cement is necessary. Hydration of cement takes place in presence of water i.e. complete utilization of water leads to quality concrete. The mix we used has sufficient amount of water to hydrate cement particles completely. But when temperature rises the evaporation takes place and the moisture contents in concrete decreases, these leads to improper hydration of concrete. Therefore, external curing is provided to fulfil the moisture content requires for the Hydration. The curing of concrete is a procedure in which external water moisture is made available which will take place of moisture that has been evaporated. When the temperature rises the water in pores of concrete get evaporated and causes air void which lead to less dense mass and concrete losses its properties and durability. To avoid this loss, traditional method of water curing and moist curing is used. This method is used because water is available everywhere and it is of free cost, also the results obtained from the water curing are more effective. The curing of concrete is done upto 7 to 14 days as per IS code for all types of blended mix and admixtures. Generally curing is done for 28 days, but practically it is not possible, as concrete achieved its 60-70% strength at 14 days code suggest water curing upto 14 days. This causes large amount of water for large structures and in practical it is impossible for some structure like Columns, Piers, Arch and structure situated on slopely region to hold the water and continues water curing will leads to water wastage. Nowadays, curing compound has received much attention due to its assets of water-saving, high-efficient quality and wide-ranging applicability, which offers important economic benefits for the concrete maintenance in water-scarce areas. Curing compound is a kind of paint emulsion or solution. The former can form a moisture retaining membrane by evaporation of its volatile component when it is applied to the surface of the concrete (such as acrylic-based, paraffin-based).

Al-Gahtani [1] assessed the effect of different curing methods on plain and blended cement concretes. The results showed that the concrete specimens cured by wet burlap had higher strength development than specimens cured by water-based and acrylic-based curing compounds. Both kinds of curing compound effectively decreased the drying and plastic shrinkage of plain and blended cement concrete. What's more, acrylic-based curing compound performed better than the water-based curing compound.

Omer Faruk Keles , MuhammetVefaAkpinar[2] conducted research to determine the effects of different curing types and their application times on mechanical properties of Roller Compacted Concrete (RCC). They used 4 different curing types as the curing compound, burlap, membrane and water that have been widely used in the market, and were applied for 15, 30, 60 min and immediately after casting. Acrylic-based curing compound was chosen as curing compound material according to ASTM C309. Compressive strength, flexural strength, weight loss, ultrasonic pulse velocity and rebound hammer tests were applied to determine the physical and mechanical properties of RCC specimens.According to the results, the best curing method for compressive and flexural strengths of RCC was determined as water curing, providing approximately 29% and 34% increase in strength compared to uncured mixtures, respectively.

Curing compound sample shows about 85% of strength gain as that of Reference mix.

Amir Hajibabaee, Mehdi KhanzadehMoradllo, Amir Behravan and M. Tyler Ley [3], a quantitative comparison of how different curing methods affected the rate of drying and subsequent lime water penetration and chloride penetration in concrete was supplied. In the study, it was aimed to investigate a bridge deck concrete mixture cured by two different curing compounds, wet curing of different lengths, and then no curing. Even one day-long water curing application provided significant improvements when compared to no curing and curing compounds. The results confirm that wet curing methods reduce the ingress of external chemicals more effectively. Curing compound used in research was PAMS (poly alpha methyl styrene) and Lithium Silicate.This paper provides important quantitative data that can be used to compare these methods and help with making decisions about different curing practices and the impact on the service life of concrete.

Amir Hajibabaee, Mehdi KhanzadehMoradllo and M. Tyler Ley [4],This paper quantitatively compares the effectiveness of different curing methods with an emphasis on curing compounds to resist moisture loss and subsequent volume changes caused by differential shrinkage.The result shows that the poly-alphamethylstyrene curing compound causes the lowest mass loss and subsequent deflections compared to the water–resin and water–wax-based curing compounds at equal coverage rates at equal costs.The work also shows that a double application of curing compound shows greater benefit than a single layer with the same volume for water–wax-based curing compounds. The results show that if adequate amounts of curing compounds are used then they are a useful curing method for members sensitive to differential drying such as concrete pavements.

II. METHODOLOGY

2.1 Materials

Conventional concrete of M25 grade includes the Cement-OPC 53, fine sand, 20mm aggregates and water. Concrete mix M25 grade will be used throughout the experimental work. The curing compound will be of Acrylic based curing compound by Fosroc Chemicals Pvt. Ltd.

Table 1 -Properties of Cement

Sr. No.	Properties	Values
1	Grade of cement	OPC 53 Grade
2	Standard consistency	29.50%
3	Initial setting time	160 min
4	Final setting time	270 min
5	Fineness	280 m^2/kg
6	Soundness	0.50 mm
7	Specific gravity	3.11

Table 2 - Properties of Acrylic Based curing compound

Sr. No.	Test	Specification	Results	UOM
1	Appearance	A milky white liquid	A milky white liquid	-
2	Density at 30º C	1.04 ± 0.03	1.01	gm/cc
3	Solid content	24 - 30	26.09	%
4	pH Value	7.5-8.5	7.97	-

Table 3-Properties of Aggregates

Sr. No.	Properties	Values
1	Specific gravity of Crush Sand	2.727
2	Specific gravity of C.A. (20mm)	2.93
3	Grade zone of F.A.	Zone I
4	Maximum nominal size of C. A	20mm

The concrete mix were proportioned on a weight basis. The slump of concrete mixtures was controlled within 100–50 mm. In order to control the test variables, no other cementing material and chemical admixture was used and the following parameters were kept constant in the study.

(1) Cement content: 438kg/m^3.
(2) Fine/coarse aggregate ratio: 0.56.
(3) Water cement ratio: 0.45.

2.2. Specimen preparation

Four sets of specimens were cast, each set has 3 samples for cubes.1 set for water curing, 1 set for Air curing, 2 set for double coat of curing compound after 1 day and 2 days water curing.Cubes samplesof 150mm x 150mm x 150mm were cast.

2.3. Curing Methods

The concrete will be cured by 3 types of curing methods after 24 hrs of casting. Water curing, Air curing, Curing compound in double layer in 2 ways. One sample will be water cured for 1 day and then application of curing compound will be done. Second sample will be water cured for 2 days and then application of curing compound will be done.

2.4. Testing of Specimens

Testing of the samples will takes places after 7 and 28 days by compression testing machine for compressive strength. Comparison of results of curing compound samples and validate with the results from water curing and air cured sample is be carried out.

III. RESULTS AND DISCUSSION

For Compressive Strength Test, cubes of 15cm X 15cm X 15cm are used. These specimens are tested by compression testing machine after 7 days curing and 28 days curing. Load was applied gradually at the rate of 140 kg/cm^2 per minute till the Specimens fails. Load at the failure divided by area of specimen gives the compressive strength of concrete. Apparatus used for concrete cube test is compression testing machine.

Fig no. 1Compression Testing machine

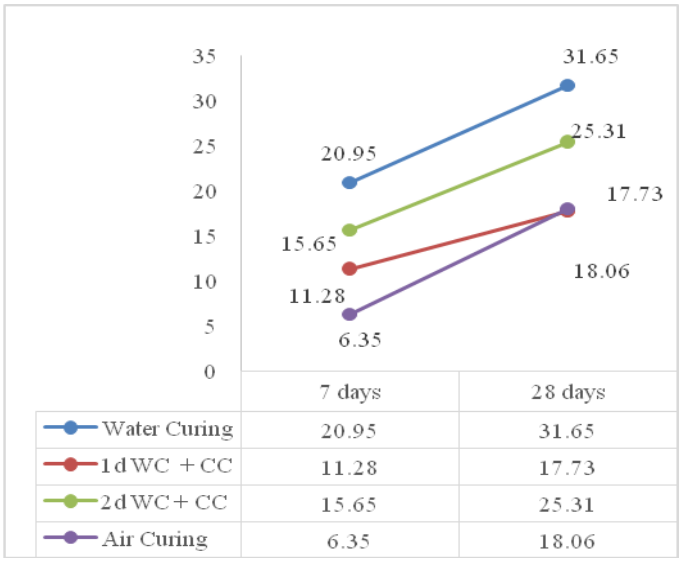

Fig no. 2 Compressive strength results

Where,
1d WC + CC means 1day water curing and then application of curing compound
2d WC + CC means 2day water curing and then application of curing compound

As from the graph, water curing gives maximum results than combine water curing and curing compound. The least results were of specimen cured with air curing. The 2d water curing and curing compound specimen shows acceptable results as compared with water curing. The 1d water curing aslo followed same behaviour at 7th day but gives less strength at 28th day. As specimen cured with air curing gives approx. 60% of strength as compared to water curing. 2d water curing and curing compound gives around 80% of strength as compared to water curing.

From this we can conclude that use of water curing and curing compound can be effectively use as that of water curing. Further more actual site results can be studied as compared with the laboratory results.

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