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STUDY ON CHEMICALS USED FOR SELF CURING OF CONCRETE

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ABSTRACT: Curing plays a major role in the construction of a building. And the major disadvantage of curing is the excess wastage of water in the form of rundown. In places where water is hard to find, places like Rajasthan, the process of curing becomes hard and costly also. To avoid the cons caused due to general curing, this experiment is conducted. The development of self-curing materials is now being considered for real engineering applications. In the past decade, there has been a huge interest in materials that can self-cure, and provide strength equal to that of general curing. Self-curing chemicals can be made from a variety of polymers and chemicals. In this experiment, a few types of chemicals are considered and are tested on cubes and cylinders to test its compressive strength and split tension for 3 days, 7 days and 28 days.M35 mix was considered as reference. The various conclusions obtained were presented.
KEYWORDS: Concrete, Self-curing, Chemicals Compressive Strength.

I. INTRODUCTION

Curing is the process of controlling the rate and extent of moisture 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. The curing period may depend on the properties of concrete, the purpose for which it is to be used, and the ambient conditions, i.e. the temperature and relative humidity of the surrounding atmosphere. Curing is done primarily to keep the concrete moist during the period in which it gains strength. Curing may be applied in a number of ways and the most appropriate means of curing may be dictated by the site or the construction method. Most of the concrete that is produced and placed each year all over the world already does self-cure to some extent. Some of it is not intended to have anything done to its exterior surface, except perhaps surface finishing. Yet the concrete's ability to serve its intended purpose is not significantly reduced. Curing is the maintaining of a satisfactory moisture content and temperature in concrete during its early stages so that desired properties (of concrete) may develop. Curing is essential in the production of concrete that will have the desired properties. The strength and durability of concrete will be fully developed only if it is cured. No action to this end is required, however, when ambient conditions of moisture, humidity, and temperature are sufficiently favourable to curing. Otherwise, specified curing measures shall start as soon as required. Most of the concrete in the world is placed in quantities that are of sufficient thickness such that most of the material will remain in satisfactory conditions of temperature and moisture during its early stages. Also, there are cases in which concrete has been greatly assisted in moving toward a self-curing status either inadvertently or deliberately through actions taken in the selection and use of materials. To achieve good cure, excessive evaporation of water from a freshly cast concrete surface should be prevented. Failure to do this will lead to the degree of cement hydration being lowered and the concrete developing unsatisfactory properties. Curing can be performed in a number of ways to ensure that an adequate amount of water is available for cement hydration to occur. However, it is not always possible to cure concrete without the need for applying external curing methods. Most paving mixtures contain adequate mixing water to hydrate the cement if the moisture is not allowed to evaporate. It should be possible to develop oil, polymer, or other compound that would rise to the finished concrete surface and effectively seal the surface against evaporation. New developments in curing of concrete are on the horizon as well. In the next century, mechanization of the placement, maintenance, and removal of curing mats and covers will advance as performance-based specifications quantify curing for acceptance and payment. In addition, effective sealants and compounds that prevent the loss of water and promote moist curing conditions will be in high demand. Self-curing concrete should become available in the not-too-distant future.

II. MATERIALS

A brief description about the materials used in this work is given below:

CEMENT:

Cement is a well-known building material and has occupied an indispensable place in construction works. There is a variety of cements available in the market and each type is used under certain conditions due to its special properties. The cement commonly used is Portland cement, and the fine and coarse aggregates used are those that are usually obtainable, from nearby sand, gravel or rock deposits. In order to obtain a strong, durable and economical concrete mix, it is necessary to understand the characteristics and behavior of the ingredients. In this work Ordinary Portland cement (OPC) confirming to IS-12269 (53 Grade) having specific gravity of 3.14.

AGGREGATES:

Aggregates are generally cheaper than cement and impart

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greater volume stability and durability to concrete. The aggregate is used primarily for the purpose of providing bulk to the concrete. To increase the density of the resulting mix, the aggregate is frequently used in two or more sizes. The aggregates provide about 75% of the body of the concrete and hence its influence is extremely important. Aggregate was originally viewed as an inert, inexpensive material dispersed throughout the cement paste so as to produce a large volume of concrete. In fact, aggregate is not truly inert because it's physical, thermal and, sometimes, chemical properties influence the performance of concrete, for example, by improving its volume stability and durability over that of the cement paste. From the economic viewpoint, it is advantageous to use a mix with as much aggregate and as little cement as possible, but the cost benefit has to be balanced against the desired properties of concrete in its fresh and hardened state.

In this work sand conforming to Grading zone II of IS: 383 1970 having specific gravity of 2.6 and fineness modulus 2.47 was used as fine aggregate.

Crushed angular metal of 12 mm size having specific gravity of 2.78 and fineness modulus of 6.92 was used as coarse aggregate.

WATER:

Generally, cement requires about 3/10 of its weight of water for hydration. Hence the minimum water-cement ratio required is 0.35. But the concrete containing water in this proportion will be very harsh and difficult to place. Additional water is required to lubricate the mix, which makes the concrete workable. This additional water must be kept to the minimum, since too much water reduces the strength of concrete.

In this work Potable clean water was used.

SELF CURING CHEMICALS

The following self curing chemicals were used in this experimental investigation:

1. POLYETHYLENE GLYCOL 200
2. ACRILIC POWDER
3.CONCURE WATER BASED CHEMICAL

III. METHODOLOGY

In this experiment, a few types of chemicals are considered and are tested on cubes and cylinders to test its compressive strength and split tension for 3 days, 7 days and 28 days.M35 mix was considered. Experiments are conducted to replace general curing with the use of chemicals. Use of chemicals is done to avoid the excess wastage of water. Chemicals are added to develop self curing in the concrete and provide strength similar to that of general curing. Experimental work was carried out to identify the various characteristics of self curing chemicals and their impact on the strength properties of the concrete. Different self curing chemical were mixed with concrete and specimens were prepared for testing the compressive strength, split tensile strength

POLYETHYLENE GLYCOL 200:

In this project, to replace general curing, the first chemical considered is POLYETHYLENE GLYCOL 200 (PEG). Polyethylene Glycol 200 is a slightly water-soluble difunctionalmethacrylic monomer employed as a cross linking agent or a low viscosity hydrophilic reactive diluents. Its chemical formula is $HO(C_2H_4O)_nH$.

Fig.1. Polyethylene Glycol 200

ACRYLIC POLYMER: Brushbond is a two component acrylic polymer modified cementitious coating which is supplied in ready mix kits. When mixed in the proper proportions, an easy brushable coating is produced. Brushbond can be simply applied by a stiff brush or roller to obtain the desired texture. If mixed with the correct quantity of water, brushbond can also be spray applied. Brushbond consists of specially selected cements, graded hard wearing aggregates and additives supplied in powder form together with a liquid component of blended acrylic copolymers and wetting agents. The acrylic polymer provides Brushbond with exceptional adhesion resiliency, flexibility, toughness and durability.

Fig.2. Brushbond- acrylic polymer

CONCURE WATER BASED CHEMICAL:

Concure WB is a white, low viscosity wax emulsion which incorporates a special alkali reactive emulsion breaking system. This system ensures that the emulsion breaks down to form a non penetrating continuous film immediately upon contact with a cementitious surface. This impervious film prevents excessive water evaporation which in turn permits more efficient cement hydration, thus reducing shrinkage and increasing durability. Once formed, the membrane will remain on the concrete surface until eventually broken down and eroded by natural weathering. Where it is required to

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apply a further treatment to such concrete surface, it may be necessary to remove the membrane remaining after curing by wire brushing or other mechanical means. The use of curing membranes on internal floor slabs is generally to be avoided where additional surface finishes are to be applied. Concure WB is however ideal where the concrete surface of a floor slabs is to be left as 'finished'. Concure WB is water based and non-flammable.

Fig.3. Concure Water Based Chemical

IV. RESULTS & DISCUSSION

The following tables &graphs shows the variation between the results obtained from general curing(GC) and the results obtained foe cubes from the use of 0.5% to 2.0%Polyethylene Glycol 200 , Acrylic, and Concure water based chemicals.

Table.1: Comparison Of All The Values Obtained For Cubes From The Use Of Chemicals (compressive strength in N/mm^2)

Da ys	G C	PEG-0.5%	PEG - 1 %	PEG - 2 %	ACRY LIC	Concure Water based
0	0	0	0	0	0	0
3	27. 33	21.11	23.7	16.0 6	16.88	22.66
7	34. 44	27.66	27.5 5	22.9 3	24.44	27.55
28	40	33.33	40	34.0 8	35.55	35.55

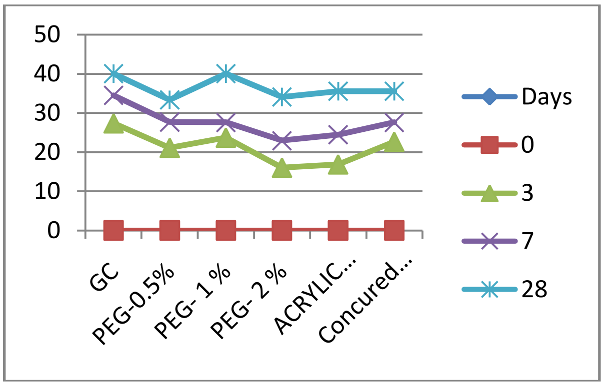

Fig.4. Comparison Of All The Values Obtained For Cubes From The Use Of Chemicals

Table.2: Comparison Of All The Values Obtained For Cylinders From The Use Of Chemicals (Split Tensile strength in N/mm^2)

Da ys	G C	PEG-0.5%	PEG-1 %	PEG-2 %	AC RY LIC	concure water based
0	0	0	0	0	0	0
3	3. 33	3.33	2.77	2.77	2.77	2.77
7	4. 22	3.61	3.33	3.61	3.55	3.88
28	5	4.166	5.27	5	4.55	4.55

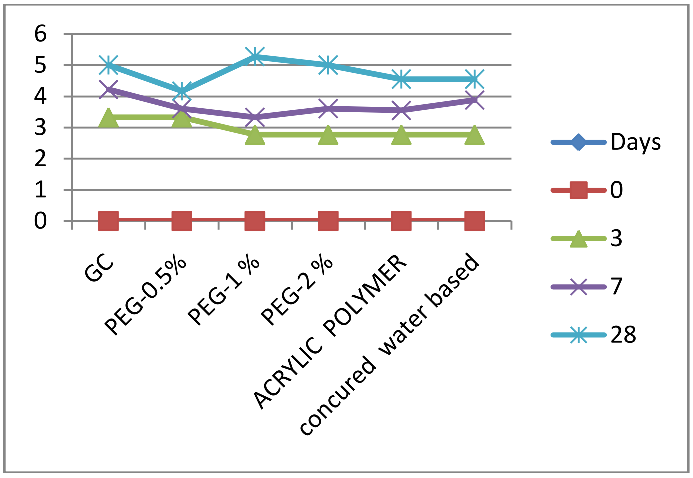

Fig.5. Comparison Of All The Values Obtained For Cylinders From The Use Of Chemicals

V. CONCLUSIONS

Experimental work has been conducted on different self curing chemicals and the results were presented and discussed. The following conclusions can be derived from the above results:

From the experiment conducted, it has been observed that the values of cubes and cylinders, after 28 days, from general curing, give high results.

The values of all the other cubes and cylinders, from the various chemicals used, gave weak results except for the chemical, Polyethylene Glycol 200 used at 1%.

The use of 1% of Polyethylene Glycol 200; gives approximately close values to that of general curing.

The compressive strength of cubes, for 28 days, of the use of 1% of PEG is equal to the values obtained from general curing.

The splitting tension of PEG used at 1% is observed to be more than that of general curing for 28 days.

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