A REVIEW ON SELF-CURING CONCRETE

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ABSTRACT: *By curing, the concrete maintains a sufficient amount of moisture content so that the concrete can achieve its desired properties. With the help of self-curing, the moisture present in the concrete is held so that it does not evaporate. If curing is done after the concrete is prepared, using external curing then potable water is used more in this process. Self-curing of concrete is done to save this potable water. The function of self-curing is to make the water less vanishing from the concrete and hold the moisture content in it, mostly in the beginning. There are many self-cured agents like Polyvinyl Alcohol (PVA), Sodium Lignosulfonate (SL) and Polyethylene Glycol (PEG) etc. using which concrete is made self-cured. By using self-curing concrete in construction, we can also save a lot of money. Now a days, potable water is hardly available for drinking, so how we use it for curing. In the future, self-curing concrete will be used more because external water is not needed for curing.*

Keywords: *Polyvinyl Alcohol, Potable Water, Self-curing.*

1. INTRODUCTION

The time taken for curing depends on the required properties of the concrete. The main function of self-curing is to keep the water present in the concrete by preventing the loss of moisture from the concrete during the period in which it is gaining strength. Curing is the process of maintaining satisfactory moisture content and temperature in concrete for a period of time so that it can achieve its mechanical properties. Curing matters more to harden any concrete. Durability, strength, water tightness and resistance to freezing and thawing of concrete can be increased by providing sufficient curing.

Curing is a method that promotes hydration of cement. The process of hydration of cement increases the strength of any concrete, so that it runs long-life. We can save a lot of water by making self curing concrete using self curing agents.

1.1 Mechanism of internal curing

Constant evaporation of moisture content takes place from an exposed surface of the concrete due to the difference in chemical potentials between the vapour and liquid phases. The polymers attach in the mix form hydrogen bonds with water molecules and reduce the chemical potential of the molecules, so reduces the vapour pressure, thus reducing the rate of evaporation from surface.

To understand the mechanism of internal curing, the water involved in it needs to be sub divided into following heads: the absorption capacity of the agent, the ability of the water to leave the LWA when needed for internal curing and desorption ability of agent and the effect of particle size, content and distribution of the LWA in the matrix for better dispersion of internal curing water in the paste.

1.2 Potential materials for internal self-curing

Materials that can provide internal water holding are as follows:

- Light weight aggregates (natural / synthetic)
- Super absorbent polymers (60-300 mm in size)
- Light weight fine aggregates (water absorption =20%)
- Shrinkage reducing admixture (SRA) – Polyethylene glycol (PEG)/ Polyvinyl alcohol (PVA)
- Wood powder

2. LITERATURE REVIEW

- Siddharth Jain et al., (1) studied water retention of concrete using PEG-400 as an internal curing compound and CUREFREE-C as an external curing compound. The experiment was conducted on M25 and M30 mix design. In this experiment, percentage of PEG-400 was increased by 0.5% and the various results about its strength parameters were noted and 0.25% CUREFREE-C also consider for experiment. The result of the

performance was that the strength achieved by PEG-400 and CUREFREE-C was good for both types of mix taken. The summary of the experiment was that the compressive and flexural strength of mixes using self-curing compounds (PEG-400 and CUREFREE-C) are at par with that of concrete with conventional curing.

- Ankith MK et al., (2) performed the experiment using polyethylene glycol and light weight aggregate. The experiment is based on increasing percentage of PEG and replacement of coarse aggregate by granite. In this, 0% PEG and 10% granite and further 0.1% PEG and 10% granite were added to the concrete mix and so on and carried out tests. Tests on compressive and tensile strength of various types of grades were performed. The conclusion was that 0.1% PEG gives maximum compressive strength for different grades, also slump value increases for M20 grade of concrete. The strength of concrete by using self-curing agents is quite good than conventional concrete.
- Mohanraj A et al., (3) conduct the experiment on M20, M30 and M40 grades of concrete. Polyethylene glycol-400 was taken as self-curing agent. The proportion of self-curing agent was kept at 0.3% by weight of cement. In this experiment, the table of slump and compacting factor test results of M20, M30 and M40 were presented. The compressive and split tensile strength of all taken grades was increased when tested at 28 days. The brief of the study was that the compressive strength of cubes and cylinders based on NDT are higher for self-cured concrete and also the compressive strength by HEICO compression testing machine is higher for self-cured concrete when compared with conventionally cured concrete.
- Basil M Joseph et al., (4) studied the mechanical properties of concrete by adding different proportion of PEG from 0 to 1.5% by weight of cement in M25 grade of concrete. In this, the compressive strength test at 7 days was conducted and found that the values get increased by varying the proportion of PEG-400 and also there was sudden decrease in strength after a certain percentage of PEG-400. Finally, 1% PEG-400 gives the maximum compressive strength, split tensile strength and modulus of rupture were concluded.
- M V Jagannadha Kumar et al., (5) conducted experiment on M20, M40 and M60 grades of concrete and take polyethylene glycol admixture as self-curing agent. This study evaluated that there was 5-20% increase in compressive strength, tensile strength of self-cured concrete with PEG-400. As the PEG percentage increases, workability increases. Under this experiment, the best dosage of PEG for M20 is 1% by weight of cement, for M40 and M60 are 0.5% by weight of cement to get the maximum strengths. The study also show that there is a significant cost saving when concrete is internally cured.
- Latha Chinnaswamy et al., (6) performed the experiment with super absorbent polymer and recycled coarse aggregate to make concrete self-cured. Demolition waste of building comes to waste. Waste concrete is recycled and it is used as Recycled Coarse Aggregate (RCA). RCA added in the proportion of 25%, 50% and 75% in the concrete mix. A table between conventional concrete and concrete with SAP and RCA with different proportions were presented. The brief of the experiment was that when 50% RCA with SAP is used, then the compressive and split tensile strength has increased than conventional concrete.
- V. Karthikeyan et al., (7) studied that self-curing is done with super absorbent polymer (as self-curing agent) in M30 grade of concrete. The SAP provides surplus voids in the concrete mass. In this study, the experiment by taking SAP ranges from 0.1 to 0.4% by weight of cement was performed and then compared its various properties with normally cured concrete. The tests of compressive, split tensile and flexural strength of concrete were conducted. Finally, based on the study, the summary was that the optimal dosage of SAP was 0.3% by weight of cement for M30 to give maximum strengths.
- E Arundhava Priya et al., (8) under this study, sodium lignosulfonate is used as self-curing agent and light weight aggregate is also used. M25 grade of concrete is considered for performing experiment. In this study, sodium lignosulfonate is added in different ratio and 10% light weight aggregates also added by replacement of coarse aggregate. Compressive strength tests on cubes, split tensile strength tests on cylinders and flexural strength tests on concrete prism specimens were done. The essence of the study was that on adding 0.5% sodium lignosulfonate with concrete mixes then better results shown.
- Riyaz Ahamed K et al., (9) perform the experiment for improving the influence of water content in concrete by adding sodium lignosulphonate, to determine the various properties of self-curing concrete and to compare the strengths between conventional concrete and self-cured concrete. In concrete mix, sodium lignosulphonate act as water-reducing additive. M20 grade of concrete was used for the study and addition of 0.5%, 1%, 1.5%, 2%, 2.5% and 3% sodium lignosulphonate take place successively. The study revealed that the compressive strength increased by 6.25% and split tensile strength increased by 2.5% at 0.5% sodium lignosulphonate when compared with conventional concrete at w/c ratio = 0.5.
- T.A. Sajana Khader et al., (10) aimed to study the performance behaviour of polyvinyl alcohol (PVA) and sodium lignosulphonate (SL) cumulatively in the concrete mix. 0.24%, 0.48% and 0.96% PVA and 0.5%, 1%, 1.5% and 2% SL by weight of cement were added. M35 grade of concrete was taken for the experiment. The optimum dosage of PVA is 0.48% and SL is 1% by weight of cement. In this, the split tensile strength is increased by 50.7% and flexural strength is increased by 27.5% at 0.48% PVA and 1% SL on comparing with conventional concrete. Acid resistance test also give satisfactory results under this study.

- B. Ajitha et al., (11) studied evaluate that the lack of curing has considerable impact on concrete strength and durability, so it is essential to add such self-curing agents in concrete mix that can prevent the loss of moisture from the concrete during its strength gaining period. In this study, Polyvinyl Alcohol was used as self-curing agent and 0.03%, 0.06%, 0.12% and 0.24% PVA by weight of cement was added to concrete mix separately and then the specimens such as cubes, cylinders and beams were tested at 3, 7 and 28 days with each proportion of PVA. The conclusion was that the concrete gain maximum strength when PVA is 0.24% by weight of cement was added.

3. CONCLUSIONS

From the studies of various literature reviews, the following conclusions are obtained:-

- For M20 grade of concrete, the optimum dosage of PEG-400 for maximum compressive, tensile and flexural strength was found at 1%.
- When the PEG-400 percentage increased then slump also increases for M20 grade of concrete.
- When 0.3% super absorbent polymer (SAP) with Recycled Coarse Aggregate (RCA) are used, then the concrete mix obtain maximum strengths for M30 grade of concrete.
- 0.5% Sodium lignosulfonate with 10% light weight aggregates are mixed in concrete, the concrete mix attains better strengths for M25 grade.
- 0.48% PVA and 1% SL give maximum strengths for M35 grade.
- The use of various types of self-curing agents reduces the use of external water for curing.
- Self-curing concrete is the best solution in desert area where there is lack of water.

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