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SELF CURING CONCRETE BY SUPER ABSORBENT POLYMER: A REVIEW

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ABSTRACT
Today concrete is most extensively used construction material due to its good compressive strength and durability. The strength and durability of concrete will be fully industrial only if it is cured. Due to the curing of concrete large amount of water is required. To overcome the high consumption of water it is needed to study self-curing concrete. Self curing also refers the internal curing and external curing. Self-curing concrete is one of the particular concretes in extenuating insufficient curing due to human disregard and also due to scarcity of water in arid areas, inaccessibility of structures in hard terrains and in areas where the presence of fluorides in water will badly affect the characteristics of concrete. This paper reviews the internal curing of concrete super absorbent polymer. This review shows detail investigation on super absorbent polymer. To review the physical properties and strength aspect of self concrete done in experiments with different variations. The review results show the physical properties and strength properties of concrete by adding of super absorbent polymer with dosage limit.

1. INTRODUCTION

Curing of concrete is maintaining satisfactory moisture content in concrete during its early stages in order to develop the desired properties and therefore it is one of the most important requirements for optimum concrete performance in any environment or applications. However, good curing is not always practical in many cases. Therefore, the method of using self-curing agents will be a good alternative.

The ACI-308 code states that "Internal curing refers to the process by which the hydration of cement occurs because of the availability of additional internal water that is not part of the mixing water." "Internal curing" is often also referred as Self–curing. Self Curing Concrete can be achieved by adding 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. It was found that water soluble polymers can be used as self-curing agents in concrete. Curing of concrete plays a major role in developing the concrete microstructure and pore structure and hence improves its durability and performance.

2. SELF-CURING AGENT

Superabsorbent polymer (SAP) is a polymeric material which is able to absorb a significant amount of liquid from the surroundings and to retain the liquid within its structure without dissolving It takes up water during the mixing process, so it can be used as a dry concrete admixture and the use of SAP permits free design of the shape and the size of the formed inclusions. Most SAPs are cross-linked polyelectrolyte. They absorb large quantities of water and other aqueous solutions without dissolving because of their ionic nature and interconnected structure. The maximum water absorption is approximately 5,000 times their weight.

3. OBJECTIVE AND SCOPE OF REVIEW

OBJECTIVE

- To determine the compressive, flexural and split tensile strength of concrete by adding self curing agents of super absorbent polymer by varying percentages.
- To compare the strength behaviour with normal concrete.

SCOPE

- Lacking of water problem will be solved by self curing concrete
- self curing concrete controlling the rate and extend of moisture loss from concrete during hydration.
- Reduce the excess usage of water.

4. LITERATURE REVIEW

M. Manoj Kumar, D. Maruthachalam Studied on self-curing. Super absorbent polymer was used as self-curing agent. M40 grade of concrete is adopted for investigation. Based on this experimental investigation was carried out. The following conclusions were drawn. Water retention for the concrete mixes incorporating a self-curing agent is higher compared to conventional concrete mixes. As found by the weight loss with time. The optimum dosage is 0.3 % addition of SAP leads to a significant increase of mechanical strength. Compressive strength of self-cured concrete for the dosage of 0.3% was higher than water cured concrete. Split tensile strength of self cured concrete for dosage of 0.3% is higher than water cured concrete. Flexural strength of self-cured concrete for dosage of 0.3% is lower than water cured concrete. Performance of the self-curing agent will be effected by the mix proportions mainly the cement content and w/c ratio. There was a gradual increase in the strength for dosage from 0.2 to 0.3 % and later

gradually reduced. Self-cured concrete using SAP was more economical than conventional cured concrete. In the study cubes were casted and kept for curing in room temperature about 250 to 300 c practically feasibility of self-cured member is needed to be checked in hot regions. The effectiveness of internal curing by means of SAP applied to concrete was the highest if 45 kg/m3 water is added by mean of 1 kg/m3 SAP.

Dayalan Jhad used super absorbent polymers as a self curing agent in concrete. He was added 0.0-0.48% of super absorbent polymer by weight of cement for M25 grade concrete. He was found that super absorbent polymer 0.48% by the weight of cement provides higher compressive, tensile as well as flexural strength than the strength of conventional mix.

Abhishek Singh Deshmukh concluded that the specimen can be used with SAP to increase their strength to a great extent. The 0.3% SAP specimens to increase the result in this test compare to the 0%,0.2% and 0.4% SAP specimens. This material may be used in RCC compression members and pre-stress concrete. This material is used where water problem presence in civil engineering construction.

Sona K. S studied the Compressive strength of self curing concrete was increased by applying the self - curing agents. The optimum dosage of SAP for maximum compressive strength was found to be 0.5% of weight of cement for M25 and M30. The optimum dosage of SAP for maximum split tensile strength was found to be 0.5% of weight of cement for M25 and M30 grades of concrete. For M25 and M30 concrete the maximum flexural strength was found to be 0.4% of weight of cement. Self curing concrete was the best solution to the problems faced in the desert region and faced due to lack of proper curing.

Parth C. Bhavsar, Mahesh R. Rao studied the optimum dosage of SAP for internal curing was found out to be 0.3% by weight of cement. If SAP adds as gel form in concrete, water content is increase and obviously strength of concrete will reduces as compare to powder form. Here also seen that SAP add 0.3% as gel form the strength of concrete is reduces in 7 days and it's gradually increase hydration and an achieving in 28 day. If SAP adds as powder form in concrete SAP absorbs water then due to lowering water content strength of concrete increases.

S.Vidhuna studied Super Absorbent Polymer (SAP) was used as self curing agents. M40 grade of concrete is adopted for the investigation. Based on the experimental investigation carried out, the following conclusions were drawn. The optimum dosage is 0.3%. Leads to a significant increase of mechanical strength (Compressive and Split tensile). The Self cured concrete using SAP was more economical than conventional cured concrete. From the durability study Self-curing concrete and fibrous self-curing concrete shows better performance for 28, 56 and 90days.

Kenneth Sequeira, B.H.V. Pai studied the compressive strength of material with SAP is lesser than that of reference mix in general. However at the optimum dosage of 0.15% by weight of cement and 30 kg /m^3 of internally cured water it has a slight-ly higher value of compressive strength. With the addition of greater amounts of internally cured water this value is found to decrease. However, it should always be noted that this is an ad-mixture which is used primarily to reduce shrinkage most prominently autogenous shrinkage and can results in major losses in strength if higher percentages of SAP are used indiscriminately.

Ananthakumar.R studied The mix combinations of SCSCC with SAP and CM satisfied the fresh workability concrete properties up to 0.5% as per recommended guide lines given in EFNARC standards. The compressive strength, split tensile strength, modulus of rupture and modulus of elasticity values are remarkably increased up to 0.3% after that it slightly decreased. So, the optimum percentage of addition of SAP in SCC for internal curing is 0.3%. This extends the hydration and thereby increases the strength of concrete. Therefore, self-compacting self-curing concrete with SAP is recommended for field application where curing is difficult and water scarcity areas.

Mr.Vivek, studied the adding of super absorbent polymer in the weight of cement by 0-0.3% in self curing and self compacting concrete. Super plasticizer was used to achieve the required workability, the dosage being restricted to maximum permissible limit. For all the concrete types, the compressive and the flexural strengths increase with age.

5. MATERIAL COLLECTION

Cement: Ordinary Portland cement of 53 grades available in local market is used in this project. The Cement used has been tested for various proportions as per IS 4031-1988 and found to be confirming to various specifications of are IS 12269-1987.The specific gravity is 3.14.

Fine Aggregate: Locally available river sand conforming to Indian standard (Zone-II).

Coarse Aggregate: Locally available quarry stone in good strength.

Water: Ordinary potable water without acidity and alkaniety available in the Material Testing laboratory was used.

Super Absorbent Polymer: The common SAPs are added at rate of 0.2, 0.3 and 0.4 wt % of cement. The SAPs are covalently cross-linked. They are Acryl amide/acrylic acid copolymers. One type of SAPs are suspension polymerized, spherical particles with an average particle size of approximately 1.00 mm; another type of SAP is solution polymerized and then crushed and sieved to particle sizes in the range of 0.50–2.00 mm. The size of the swollen SAP particles in the cement pastes and mortars is about three times larger due to pore fluid absorption. The swelling time depends especially on the particle size distribution of the SAP. It is seen that more than 50%swelling occurs within the first 5 min after water addition.

6. CONCLUSION

Based on the literature Based on literature review, following conclusions are obtained:

- The optimum dosage of Super absorbent polymer for maximum strength of concrete (Compressive, Split tensile, Modulus of rupture) was found to 0.3-0.5%.
- As the percentage of Slump value also increased for various grade of concrete.
- Strength Self curing concrete by super absorbent polymer is compared with conventional conventional concrete.
- Self-curing concrete is the answer to many problems faced due to lack of proper curing.

- Self-curing concrete is an alternative to conventional concrete in desert regions where scarcity of water is a major problem.

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