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EXPERIMENTAL INVESTIGATION ON STRENGTH PROPERTIES OF SELF URING CONCRETE INCORPORATED WITH POLYMERIC MATERIAL AS SELF CURING AGENT

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ABSTRACT

Curing of concrete is for maintaining satisfactory moisture content in concrete during its early stages in order to develop the desired properties. Water inside the materials used to make concrete. If the water just added as mixing water, this would lead to many other quality related issues such as bleeding, segregation etc., Therefore a special material shall be used so that some of the water can be retained in that material. This water will be released into the concrete over a time after the concrete has been placed in the structure and hardened. By doing this, the hardened concrete will be able to undergo continuous curing for a long time which will promote towards a better hydration product. As one such product, I use ALOE VERA GEL with concrete which retains moisture in concrete and thus the process of curing can be neglected after concreting.

KEYWORDS: Concrete, Polymeric Material, Curing Agent, Self-Cured Concrete

The properties of hardened concrete, especially the durability, are greatly influenced by curing since it has a remarkable effect on the hydration of the cement. However, good curing is not always practical and often neglected in many cases. Several investigators asked the question whether there will be self-curing concrete. Therefore, the need to develop self-curing agents attracted several researchers.

The concept of self-curing agents is to reduce the water evaporation from concrete and hence increase the water retention capacity of the concrete compared to conventional concrete. Self-curing concrete is one of the special concretes in mitigating insufficient curing due to human negligence paucity of water in arid areas, inaccessibility of structures in difficult terrains and in areas where the presence of fluorides in water will badly affect the characteristics of concrete. The benefits of internal curing are numerous and include, increased hydration process and strength development, reduced autogenous shrinkage and cracking, reduced permeability, and increased durability.

Therefore, a special material shall be used so that some of the water can be retained in that material. This water will be released into the concrete over a time after the concrete has been placed in the structure and hardened.

ADMIXTURES USED FOR SELF CURING

Internal water curing or self-curing could be achieved using one of the following materials or one or two in combination.

- Natural or Synthetic Light Weight Aggregate
- Super Absorbent Polymers (SAP)
- (Water absorption = 20%)
- Shrinkage Reducing Admixture - SRA polyethylene glycol.
- Saturated Wood powder / fibers.
- In this order here I have used one newest material as self-curing agent called as Aloe Vera

MATERIALS COLLECTION

Concrete is an artificial material, which is made up of cement, fine aggregates and water. In this project additionally I have add a natural admixture (aloe Vera) to improve some of the properties of concrete. Especially it improves the curing property of the concrete. The materials used are Pozzalona Portland cement, natural sand, and natural admixture. The properties of materials are shown in Tables.

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Cement

Sl. No.	Properties	Values
1	Specific gravity	3.15
2	Fineness	4.6%
3	Consistency	32%
4	Initial setting time	30 minutes

Fine Aggregate

In this study, Cauvery river sand has been used as a fine aggregate. The sand was washed and screened at site to remove deleterious materials and tested as per the procedure given in BIS: 2386-1968.

Sl. No	Properties	Values
1.	Specific gravity	2.54
2.	Fineness modulus	2.21
3.	Surface Moisture	0.11%
4.	Water absorption	0.09%
5.	Zone	II

Coarse Aggregate

The aggregate should be sound, free from deleterious materials and must have crushing strength at least 1.5 times that of concrete. Aggregate must be clean and free from impurities. The coarse aggregate used in the project is of the size 20mm.

Unit	Cement	Fine aggregate	Coarse aggregate (20 mm)	Water (lit/m^3)
Kg/m^3	384	655	1143.3	192
Ratio	1	1.7	2.9	0.5

Mix Proportion

Concrete Mix Proportion

Mix ID	Cc	AC11	AC21	AC31
Cement (kg/m^3)	551.23	551.23	551.23	551.23
FA(kg/m^3)	903.5	903.5	903.5	903.5
CA(kg/m^3)	737.33	737.33	737.33	737.33
Aloe Vera -%	-	1.0	1.5	2.0
Water (lit/m^3)	220.48	220.48	220.48	220.48

Number of Specimens Details

S. No	Properties	Values
1.	Specific gravity	2.72
2.	Fineness modulus	6.98
3.	Surface Moisture	0.08%
4.	Water absorption	1%
5.	Bulk density	1642.45 Kg/m^3

WB1- Conventional concrete + 2% aloe Vera cubes for water absorption

EC1- conventional concrete + 2% aloe Vera cubes for Accelerated electrolytic corrosion test

The specimen of standard cube of (150mm x 150mm x 150mm), cylinder (100mm diameter x 200mm high) & Prism (500mm x 100mm x 100mm) were used to determine the compressive strength, tensile strength and flexural strength of concrete. Three specimens were tested for 7, 14&28 days with each proportion of various % of aloe Vera gel. Totally 48 cubes, 36 cylinders and 3prism were cast. The constituents were weighed and the materials were mixed by machine mixing. The mixes were compacted using vibrating needle.

The specimens were demoulded after 24h, cured in water for 7, 14 & 28 days, and then tested for its compressive and flexural strength as per Indian Standards.

EXPERIMENTAL INVESTIGATION

Workability

Workability is that property of plastic concrete mixture which determines the ease with which it can be placed and the degree to which it resists the segregation to produce full compaction. Workability was measured by the slump cone test. The test is carried out with a mould called the slump cone.

Compressive Strength

Compression test is the most common test on hardened concrete, because most of the desirable characteristic properties of concrete are qualitatively related to its compressive strength. By definition, the compressive strength of a material is that value of uniaxial compressive stress reached when the material fails completely.

Split Tensile Strength

The determination of tensile strength is essential to estimate the load at which the concrete members may crack. As it is difficult to determine the tensile strength of concrete by conducting a direct tension test, an indirect method, such as "Splitting Tension Test" is used.

$f_t = 2P/\pi LD$

Where,

f_t – Tensile strength of the concrete

Flexural Strength

Flexural testing is used to determine the flex or bending properties of the material. The specimens are tested as per IS: 516-2004. Concrete as we know is relatively strong in compression and weak in tension. This test is to test the flexural strength of concrete. The value of modulus of rupture (extreme fiber stress in bending) depends on dimension of loading

Flexural strength (f_b) = P x L / b x d

Accelerated Electrolytic Corrosion

Literatures and case studies reported that 40% of the failure of the structure occurred on account of corrosion of embedded steel reinforcement in concrete. So, it is necessary to study the corrosion behavior of concrete with steel reinforcement.

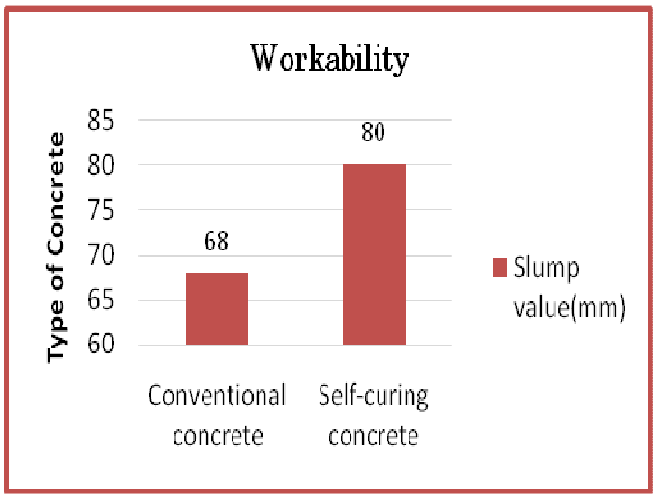
This test fundamentally measures the resistivity of concrete. The test was carried out in 6% NaCl solution with an embedded reinforcement bar working as an electrode and a rectangular copper bar as a counter electrode

Durablity Test

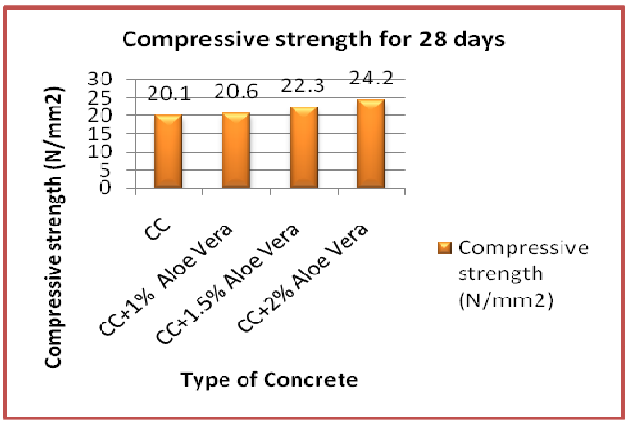
Durability is the ability to last a long time without significant deterioration. A durable material helps the environment by conserving resources and reducing wastes and the environmental impacts of repair and replacement. A concrete shell can be left in place if a building use or function changes or when a building interior is renovated. Concrete, as a structural material and as the building exterior skin, has the ability to withstand nature's normal deteriorating mechanisms as well as natural disasters.

RESULTS AND DISCUSSION

Workability



Compressive Strength

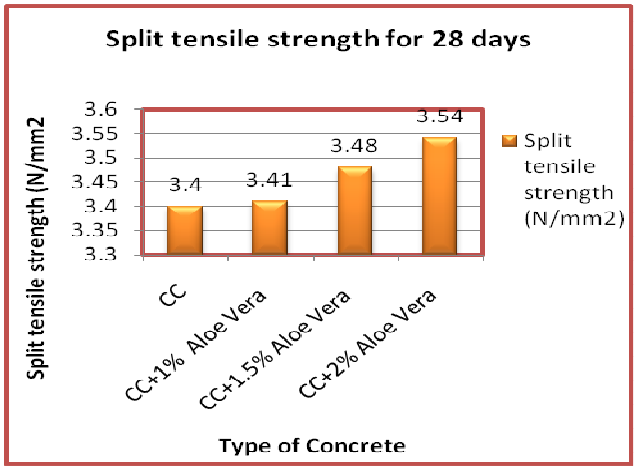


Days	Compressive strength in N/mm^2	
	Conventional concrete	Self-curing concrete
7	13.30	16.47
14	17.45	19.7
28	20.1	24.2

From the results obtained it can be observed that the compressive strength for internally cured concrete by adding 2% Aloe Vera gel increased the compressive strength as compared to that of conventional concrete.

The strength was found to increase in the concrete added with natural admixture which was internally cured. From the above result we can interpret that the self-curing concrete shows 17% increase in strength compared to conventional concrete without external curing requirement.

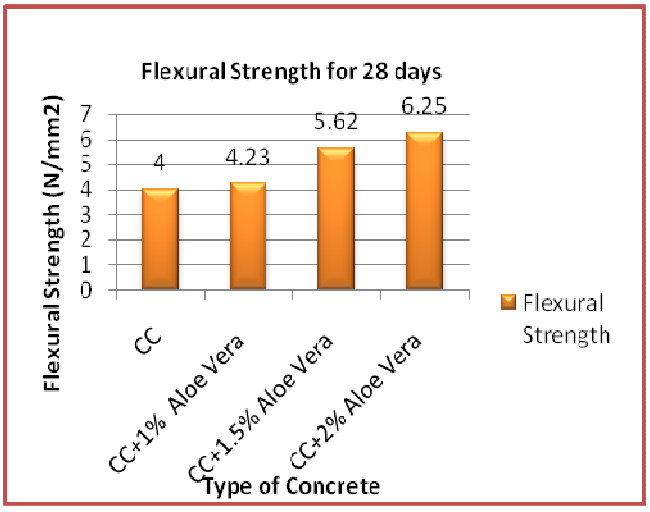
Split Tensile Strength



The split tensile strength was found higher in concrete added with natural admixture. From the above result we can conclude that the self-curing showed 4% increase in split tensile strength when compared to conventional concrete.

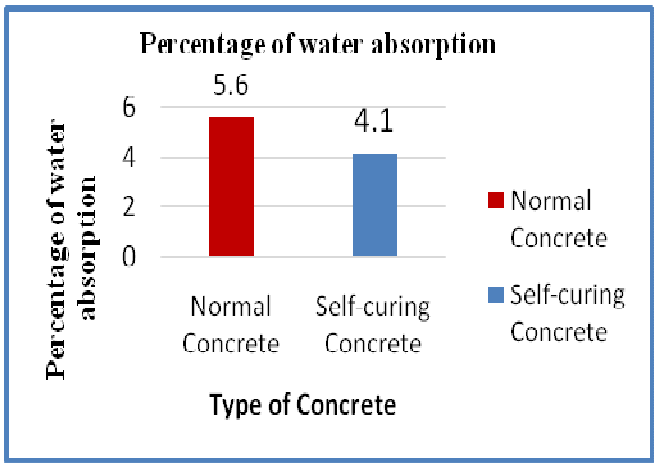
Flexural Strength

Days	Flexural strength in N/mm^2	
	Conventional concrete	Self-curing concrete
7	3.4	5.75
28	4.00	6.25

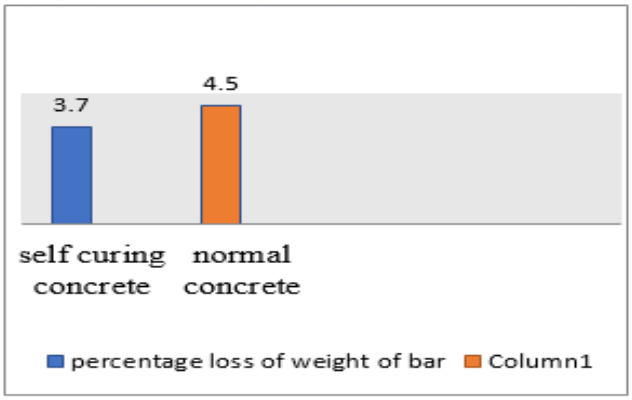


Water Absorption

From the above result we can conclude that the self-curing concrete absorbs considerably less water compare to conventional concrete.



Accelerated Electrolytic Corrosion



Rebound Hammer Test

From the rebound hammer test we get the average value of R.H.N is 24.8 so the concrete have the durable property.

CONCLUSION

- The workability of self-curing concrete was found to be as moderate.
- The compressive strength of self-curing concrete was found to show 17% increase in strength compared to conventional concrete.
- The split tensile strength of self-curing concrete showed 4% increase in strength compared to conventional concrete.
- The flexural strength of self-curing concrete showed 36% increase in strength compared to conventional concrete
- The self-curing concrete absorbed less amount of water in comparison with conventional concrete.

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