Experimental Analysis on Self-Curing Concrete Using Aloe Vera Gel and Hydrogel

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***Abstract*—This study investigates self-curing concrete using aloe vera gel and sodium polyacrylate hydrogel as internal curing agents to enhance cement hydration without external curing. Aloe vera gel (1–5% of mixing water) and hydrogel (0.1–0.5% of cement weight) were incorporated to retain internal moisture and ensure continuous hydration. Concrete cube and cylinder specimens were cast and tested under ambient conditions for compressive and split tensile strength at 7, 14, and 28 days. Results show that internal curing reduces moisture loss, improves workability, and enhances strength, durability, and crack resistance, especially in hot and dry conditions. The mix with 3% aloe vera gel and 0.3% hydrogel exhibited optimum performance, achieving 28-day strength comparable to or higher than conventional concrete. Overall, the combined use of aloe vera gel and hydrogel reduces water consumption and provides a sustainable, cost-effective, and eco-friendly concrete solution.**

***Index Terms*—Self-curing, aloe vera gel, sodium polyacrylate, compressive strength, split tensile strength.**

I. INTRODUCTION

Self-curing concrete has emerged as an effective solution to overcome the limitations of conventional curing methods, especially in areas with limited water availability. This study focuses on the development of self-curing concrete using hydrogel and aloe vera gel as internal curing agents, combined with rapid hardening cement to achieve early strength gain. Hydrogels have the ability to absorb and retain large amounts of water, gradually releasing it for continuous hydration, while aloe vera gel acts as a natural, eco-friendly additive that enhances moisture retention. The incorporation of these materials helps in reducing shrinkage, improving hydration, and enhancing the overall performance of concrete. This research aims to evaluate the mechanical properties and effectiveness of such a mix in comparison with conventional concrete.

II. MATERIALS

2.1. Cement

Cement is the most important constituent of concrete, which helps to bind and make the concrete to attain its maximum design strength. For our study in concrete, the cement that is used is rapid hardening cement 53 grade and tests are made to confirm its workability.

2.2. Fine aggregate

In this study river sand passing through 4.75mm sieve provisions are used as fine aggregate. The sand was washed and screened at site to remove deleterious materials.

2.3. Coarse aggregate

The maximum size of aggregate used for the investigation is 20mm.aggregate must be clean and free from impurities. The aggregate particles retained on 4.75mm sieve. It conforms to the requirements if IS 383:2016.

2.4. Aloe vera gel

It is a natural water-retention agent.it is rich in polysaccharides. It locks the moisture.

2.5. Hydrogel

Sodium polyacrylate is a super absorbent polymer used in this investigation as a hydrogel.

Mix proportion

The concrete mix design is done as per IS 10262-2009. The ratio is 1:1.14:2.2:0.38

III. METHODOLOGY

Concrete mixes were prepared by adding varying proportions of hydrogel (0.1% to 0.5%) and aloe vera gel (1% to 5%) to the conventional mix. Dry materials were mixed thoroughly, after which hydrogel was added, and aloe vera gel was mixed with water before incorporation to ensure uniform distribution. Concrete cubes(150x150x150) and cylinder(150x300) specimens) were cast, compacted, and demolded after 24 hours. The specimens were then kept under ambient room conditions without external water curing to study the self-curing effect. Compressive strength test and split tensile strength were conducted at 7, 14, and 28 days, and the results were compared with conventional concrete to assess performance.

Experimental investigation

Workability:

Workability is the property of fresh concrete that indicates the ease of mixing, placing, and compaction without segregation. It depends on factors like water-cement ratio, aggregate properties, and admixtures. It is commonly measured using the slump cone test.

Compressive strength

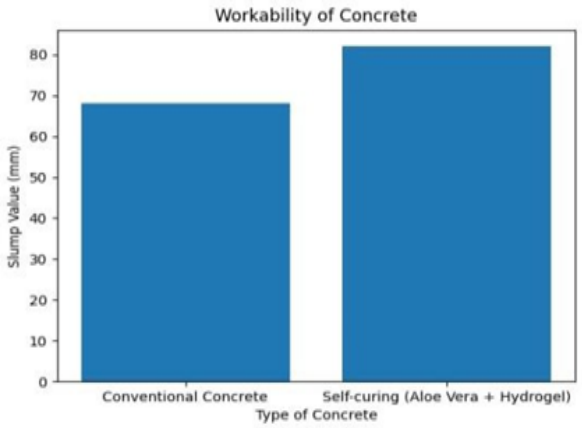
Compressive strength is the ability of concrete to resist axial compressive loads without failure. It is determined by testing standard specimens like cubes or cylinders under a compression testing machine (CTM). The strength is calculated as load divided by area and is usually expressed in MPa (N/mm²).

Split tensile strength

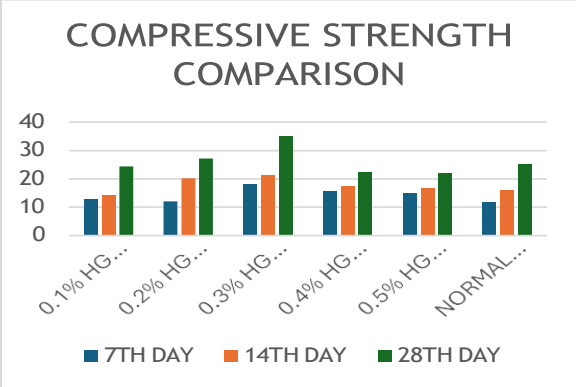
Split tensile strength is the measure of the tensile strength of concrete determined by applying a diametrical compressive load on a cylindrical specimen. It evaluates the resistance of concrete to cracking under tension. The test is conducted using a compression testing machine (CTM) and the result is expressed in MPa (N/mm²).

IV. RESULTS AND DISCUSSION

Workability

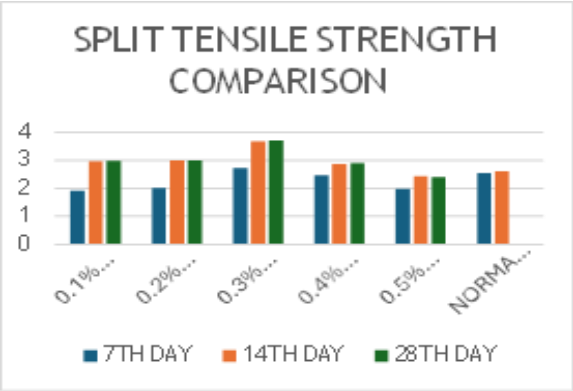


Compressive-strength



From the results obtained it can be observed that the compressive strength for internally cured concrete by adding 0.3% sodium polyacrylate and 3% aloe vera gel increased the compressive strength as compared to that of conventional concrete.

Split tensile strength



The split tensile strength was found higher in concrete added with sodium polyacrylate and aloe vera gel.

V. CONCLUSION

The mix with 0.3% hydrogel and 3% aloe vera gel achieved better strength than normal concrete.

The mix with 0.3% hydrogel and 3% aloe vera gel shows a 7.86% increase in strength compared to conventional concrete.

Overall, self-curing concrete demonstrated good strength development and can be considered an effective alternative where water curing is limited.

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