Journal of Informatics Education anda Research
ISSN: 1526-4726
Vol 5 Issue 2 (2025)

A Review On Comparative Strength Analysis Of Plain Concrete And Sugarcrete

Anurag Chaubey[1], Siddharth Jain[1], Mukesh kumar[2], Shivani Sonkar[2], Kunal Chaudhary[2]
[1]Supervisor, Assistant Professor, Department of Civil Engineering,School of Engineering & Technology, IIMT University, Meerut, Uttar Pradesh, India
[2]Undergraduate Scholars, Department of Civil Engineering,School of Engineering & Technology, IIMT University, Meerut, Uttar Pradesh, India

ABSTRACT

This project presents a comparative research on the strength characteristics of normal concrete and Sugarcrete—a sustainable construction material that incorporates using by ash from sugarcane fibers, to some percentage replace cement. The study aims to evaluate the mechanical performance, particularly compressive strength, of both materials under standardized conditions. Concrete samples were made by applying distinct amounts of SCBA in the sugarcrete mixture, and after 7, 14,28 days of healing, they were evaluated. The construction industry significantly contributes to global carbon emissions, primarily through the production of conventional Portland cement. In an effort to explore more sustainable building materials, this study investigates the comparative strength analysis of normal concrete and Sugarcrete. Sugarcrete is an innovative composite material that incorporates cement can be partially replaced by ash from sugarcane fibers, a byproduct of the sugar production mills . This research attempts to assess the mechanical capabilities of Sugarcrete, particularly focusing on compressive strength, and compare it with that of standard concrete.

Concrete specimens were prepared using both conventional mix and Sugarcrete mixtures, where SCBA replaced cement in varying proportions (typically 5%, 10%, and 15% by weight). Testing for compressive strength was done after all samples were cured for 7, 14, and 28 days in accordance with standard procedures. The results showed that Sugarcrete with up to 10% SCBA replacement demonstrated comparable compressive strength to normal concrete, with slight reductions at higher replacement levels. This research highlights that Sugarcrete can serve as an environmentally friendly alternative to traditional concrete, especially for non-structural and semi-structural applications. While further investigation is required to evaluate long-term durability and other properties, Sugarcrete presents a promising step toward greener construction materials and sustainable development in the building sector.

1. INTRODUCTION

Due to ability of its strength, adaptability, and durability, Concrete is among the most often utilized building materials used worldwide. However, the primary binding component of concrete, Portland cement, is produced using a lot of energy and greatly increasing carbon dioxide emissions worldwide. In response to the growing environmental concerns, researchers and engineers have begun to explore environmentally friendly substitutes for traditional concrete. Sugarcrete, a green building material that partially replaces cement with agricultural waste, is one example of such an innovation. A byproduct of sugarcane processing called sugarcane bagasse ash (SCBA) is added to the concrete mix to create sugarcrete. Bagasse is the fibrous residue left after extracting juice from sugarcane, and when burned under controlled conditions, it produces SCBA, which contains pozzolanic properties. Because of these qualities, SCBA can partially substitute cement, lessening the environmental effect of producing concrete.

The use of SCBA in concrete not only helps in minimizing industrial waste but also lowers the carbon footprint associated with traditional cement. Moreover, Sugarcrete maintains adequate strength and durability for a wide range of construction applications, making it a promising eco-friendly alternative. This report explores the physical and mechanical properties of Sugarcrete, with a particular focus on its compressive strength, and compares it with normal concrete to evaluate its viability as a sustainable building material

2. LITERATURE REVIEW

Mohit Verma et. al[1] (2024), Researchers are looking at alternatives to Portland cement for the create physical environment because of the scarcity of natural resources, the high cost of manufacture, and environmental concerns. In order to partially replace concrete cement included sugarcane fiber, this reseach used superbly grounded sugarcane bagasse ash. Bagasse ash was used to substitute cement in percentages of 5, 10, and 15%, while sugarcane fiber was added in amounts of 0.6 and 1% by mass of cement. Concrete made of bagasse ash and cement sugarcane fibers was examined for its mechanical and durability characteristics.

Onkar Yadav et. al[2] (2023), This study sought to determine whether using sugar waste was feasible into concrete and evaluate its effects on concrete properties. The analysis considered various aspects such as compressive strength, workability, durability, and setting time. Additionally, this literature survey explored the different methods of incorporating sugar waste into concrete, including direct replacement, partial substitution, and pre-treatment techniques. It also investigated the optimal dosage of sugar waste to achieve desired concrete performance while ensuring the preservation of its structural integrity and long-term durability. The crack-healing effectiveness is observed to be better under dry-wet cycling or immersion curing, and the method of sugar-coating is deemed feasible.

Tareg Abdalla Abdalla et. al[3] (2022), This study examines the mechanical characteristics of high-strength concrete that contains 10–40% processed sugarcane bagasse ash by weight of cement in a binary combination with silica fume. Investigations are conducted into the workability of fresh concrete as well as its compressive, flexural, and tensile strengths after hardening. Another study looks into the water absorption of hardened concrete as a possible durability indicator. According to the results, the mix with 10% SCBA has the maximum mechanical strength, and water absorption decreases as the proportion of SCBA increases. However, as the amount of ash in concrete increases, its workability in its fresh state significantly decreases.

Biruk Hailu Tekle[5] (2012), A byproduct of sugar mills, sugarcane bagasse ash is produced by combusting sugarcane bagasse, which is produced once all of the commercially useful sugar has been removed from sugarcane. Environmental issues are already being brought on by the disposal of this waste near the sugar refineries. However, the country's increased construction activity led to a shortage of most resources needed to make concrete, particularly cement, which raised prices. The possible application of sugarcane bagasse ash as a substitute for cement substitute material was investigated in this research. A sample of bagasse ash was taken from the mawana sugar mills for this investigation, and its chemical characteristics were examined. After that, the bagasse ash was crushed until roughly 84% of the particles passed through the 63 μm sieve size and the region of particular topface, approximately 4516 cm2/gm. Ground bagasse ash was used in varying percentage ratios to substitute Portland Pozzolana cement and regular Portland cement. The typical consistency and setting time of

Journal of Informatics Education anda Research
ISSN: 1526-4726
Vol 5 Issue 2 (2025)

the pastes made with 5% to 30% replacement of bagasse ash and regular Portland cement were examined. Additionally, the characteristics strengths of various cement mixtures containing bagasse ash were examined.

3. METHODOLOGY

There are numerous strategies and tactics that must be used in order to accomplish the goals of this investigation. To acquire more precise logical results, work approach like survey of the literature, combining techniques, and clinical analysis are crucial. The concrete mix designed for regular concrete, which is provided in Table 1, and uses the volume technique and contains 0.5%, 1.0%, and 1.5% sugarcane. As seen in Fig. 1, the sugarcane fiber was utilized.

Figure 1. fiber from sugarcane.

For seven days, the sugarcane bagasse will be exposed to the sun until it dries fully. After that, the bagasse will be sliced into tiny, roughly uniform strips that range in length from 5 to 10 cm. The sugarcane bagasse is seen drying in the sun in Fig. 2.

Fig.2. The sugarcane was dried.

Additionally, as shown in Fig. 3, bagasse must be treated for three days with a 50% diluted sodium hydroxide NaOH solution. Its objective is to eradicate the sugarcane bagasse, which must be thoroughly dried in the sun before being added to the concrete mixture. The concrete mix designed for standard concrete, which is provided in Table 1, and uses the volume technique and contains 0.5%, 1.0%, and 1.5% sugarcane.

Fig.3. Teat-containing sugarcane in sodium hydroxide solution

For the compression test, a cube measuring 100 mm by 100 mm by 100 mm is utilized, and for the tensile test, a cylinder measuring 100 mm by 200 mm is employed. In order to accomplish the goals, a number of tests are carried out, including typical concrete tensile and compression tests [12, 13]. In order to keep the concrete as wet as possible and allow the hardening process to proceed gradually for optimal strength, the curing process was operated in water at ambient temperature for seven and twenty-eight days.

Table 1: Concrete Mix Design for 1m^3

Water (kg/m^3)	Cement (kg/m3)	Sand (kg/m3)	Coarse Aggregates (kg/m^3)
209	300	980	805

3. RESULTS AND DISCUSSION

Characteristics strength

The mortar moulds were examined in phase 1 at three, seven, and twenty-eight days of age. Only compression tests were conducted for this phase. Fig. 4 presents the findings. Fig. 4 displays the outcomes of the characteristics strength test. The results declined once the highest characteristics strength was reached at 4% SCBA substitute. Strengths in this sample are 1.68, 2.04, and 3.04 MPa at 3, 7, and 28 days of age, respectively. When opposed to the control mixture, these outcomes rose by 3.5%, 17.6%, and 8.75% at ages 3, 7, and 28 days, in the crossponding order. The pozzolanic reaction, in which the C-H produced by the cement's hydration process combines with the silica in SCBA to make more C-S-H, is the cause of this rise.
The concrete cubes underwent compression testing in phase 2. In this phase, the specimens were examined at 7 and 28 days of age. Figure 5 displays the outcomes to the compression test.

The findings are appear in Fig. 5. As opposed to the control mixture, the concrete samples with 5% replacement had a 17% and 20.4% growth in characteristics strength at 7 and 28 days, in the

Journal of Informatics Education anda Research
ISSN: 1526-4726
Vol 5 Issue 2 (2025)

crossponding order. In contrast, the specimens with 7.5% and 10% replacement had nearly the same compressive strength at 7 and 28 days, but at both replacement percentages, the compressive strength decreased. The ideal amount to substitute for cement in concrete is therefore 5% SCBA. Other researchers have previously found similar results [8, 17, 18], with the greatest values for compressive strength at 28 days of age being attained by 5%. Other researchers have previously shown similar results [8, 17, 18], with 5% demonstrating the maximum compressive strength levels at 28 days of life. According to a latest inquire [18], a 4% substitute led to a decrease in capability at 28 days of age, however the results indicated the highest compressive strength values at 120 days of age when in contrast to the control specimens.

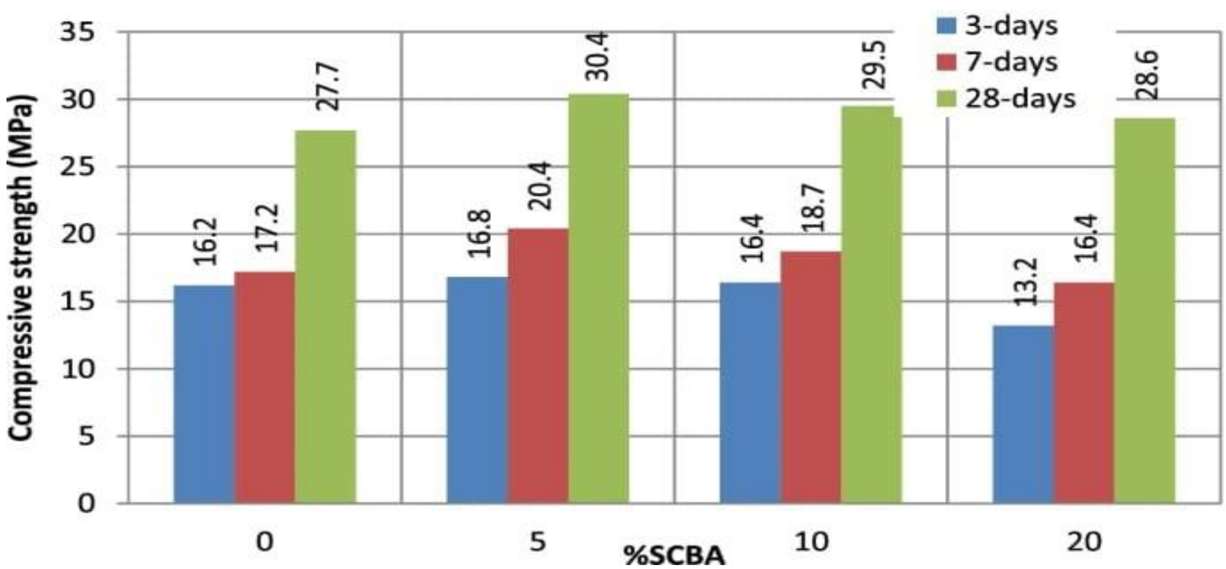

Figure 4. Cement mortar's compressive strength at 3, 7, and 28 days old.

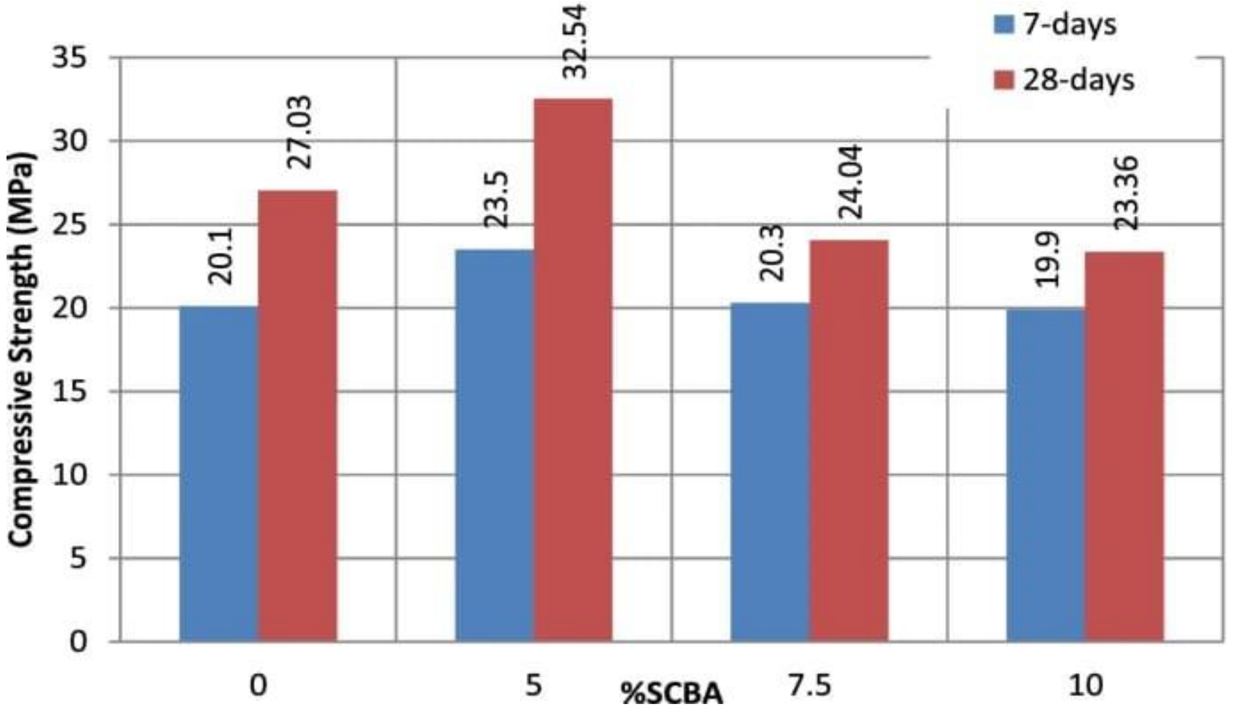

Fig 5. Concrete cubes' characteristics strength at 7 and 28 days of period.

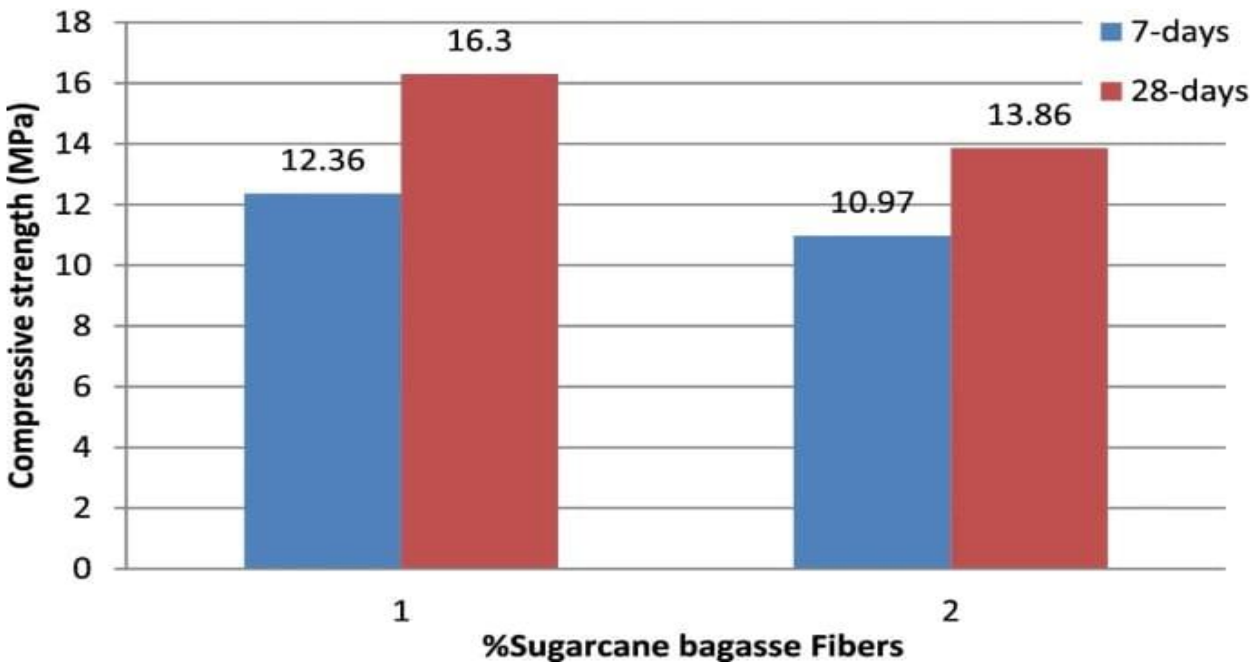

Fig 6. characteristics strength of concrete cubes produced by sugarcane fibers at 7 and 28 days of period.

As observed in Fig. 6, all of the cube examples demonstrated a substantial reduction in compressive strength during step 3, which involves adding bagasse fibers to the concrete mix. The incorrect handling of fibers and blending techniques, when particular care should have been taken to separate the glucose from the fibers, might be blamed for these outcomes. Since glucose is known to influence cement's setting time and concrete's characteristics, it was also evident while the mixture is being mixed required high content of water because the When the fibers were put to the mixture, they were arid and immersed a significant percentage of water, resulting in unworkable concrete. Prior studies [20] demonstrated that the way the bagasse fibers are treated has a big impact on how the paving materials behaves.

Tensile Strength

In stage 2, the splitting tensile strength of cylinders measuring 15 cm in diameter and 30 cm in height was assessed after 28 days of age. Fig. 7 displays the outcomes at which the samples failed.

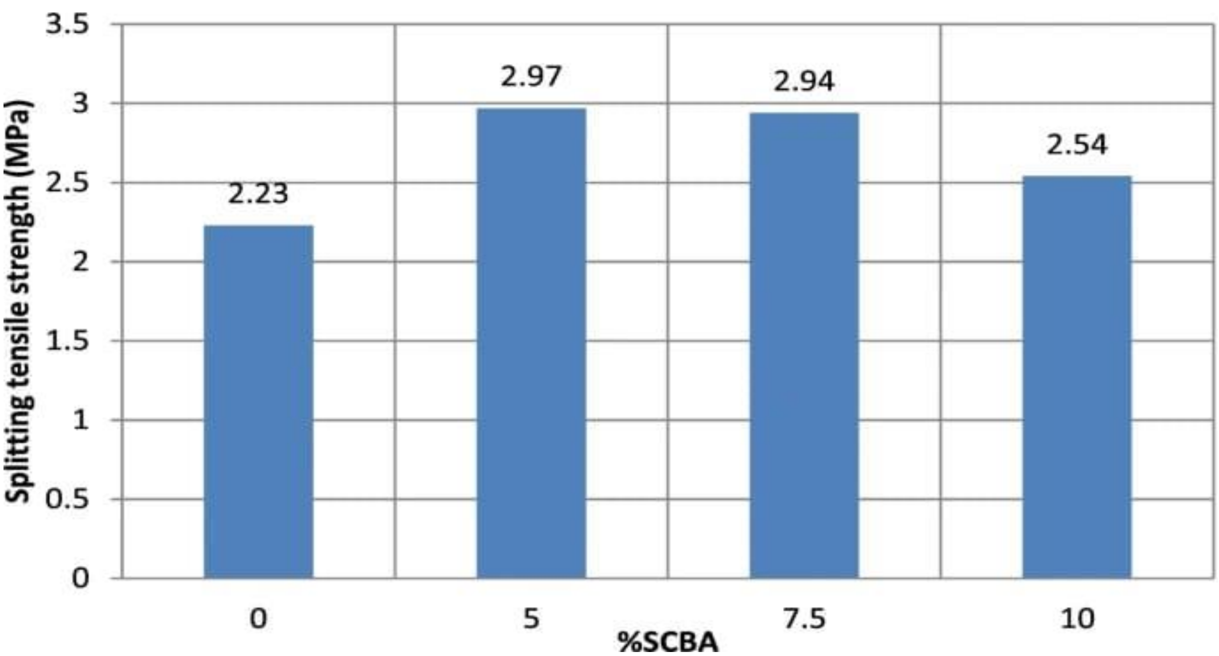

Figure 7. Tensile strength of 28-day-old concrete cylinders.

Fig. 6 displays the split tension test results. At 28 days of age, the strength at which splitting occurs can reach 2.85 MPa. At 5% SCBA replacement, the splitting tensile strength reaches its peak. Comparing this result to the control mix revealed a 33.2% increase.

3. CONCLUSIONS

- It was significantly successful to use SCBA in replace of portion of the cement.

- For SC in cement mixture, concrete mold, and concrete cylinders samples, the ideal replacement amount that yields the maximum characteristics strength and splitting pulling strength was determined to be 4%.

- In comparison to the control mix, the outcomes of the top models, which included 4% SCBA, demonstrated a 32% rise in splitting tensile strength and a 21% improvement in characteristics strength.

- After 5%, increasing SCBA causes the mechanical characteristics to decrease.

- The use of ash leads to the development of high C-S-H compounds since the hydration process of the cement would react with silica in SCBA to produce free CH, which is distinguished by its durability increasing. This is why the strengthening rate increases over time.

- By raising the proportion of SCBA that is replaced in cement mixture and the workability of the cement mixture increases.

- Concrete that had sugarcane bagasse fibers added to it developed cracks that were smaller in both breadth and length than the control specimen.

3. REFERNCES

1. k5YRJG2yQE0 https://sl.bing.net/p This
2. link: https://sl.bing.net/cBdamGNeEns The
3. URL is https://sl.bing.net/dFEgJCAMt.
4. The URL is https://sl.bing.net/gxprEFH8jZY.
5. content://media/external/downloads/1000269060
6. content://media/external/downloads/1000269059
7. content://media/external/downloads/1000269058
8. content://media/external/downloads/1000269057
9. Strength properties of concrete strengthened with fiber from sugarcane bagasse, IOSR Journal of Mechanical and Civil Engineering, 12(3), 68-71, 2015;
10. Bagasse using ash instead of cement in lightweight concrete: An experimental investigation on International Journal of current developments in Engineering and Technology, 3(3), 253-260 (2013)
11. Wirquinb E, Bokhoree C, Quedoua PG (2021) ash derived from sugarcane fibers effectiveness as a cement-like substance in the building sector is known as "sustainable concrete." Mater J Case Stud Construct 14:e00545
12. (2018) Assessment of the effectiveness of Cement composites' pretreatment of sugarcane bagasse fibers. J 18:1092–1102 Arch Civil Mechan Engineer