

Analysis Of Sugar Cane Bagasse Ash use in Cement

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Abstract — This study evaluates bagasse ash as a partial replacement for cement to reduce environmental impact. The ash was ground to match the fineness of Portland cement and analyzed for its chemical composition. Concrete mixes were prepared for 30 MPa strength with varying water-cement ratios and bagasse ash replacements of 5%, 10%, and 15%. Tests on fresh and hardened concrete showed that optimal mix proportions improved strength and reduced cement use, leading to cost savings. However, compressive strength decreased beyond 10% replacement. Overall, all mixes satisfied ASTM C618 requirements.

Keywords: Bagasse Ash; Partial Cement Replacement; Sustainable Concrete; Compressive Strength; Supplementary Cementitious Material; ASTM C618;

I. INTRODUCTION

The study examines using bagasse ash as a partial cement replacement to reduce environmental impact. Concrete mixes with 5–15% ash were tested for strength and performance. Results showed that up to 10% replacement improved efficiency and reduced cost, but higher amounts lowered compressive strength. All mixes met ASTM C618 standards.

II. NEED FOR REPLACEMENT OF CEMENT

Worldwide, ordinary Portland cement is acknowledged as a key building material. The traditional building material that is genuinely accountable for between 5% and 8% of the world's CO₂ emissions is Portland cement. The exponential demand for Portland cement will probably make this environmental issue worse. Today, researchers worldwide Various studies show that sugarcane bagasse ash (SCBA) can be effectively used as a partial replacement for cement in concrete. Results indicate that SCBA improves compressive, tensile, and flexural strength, enhances workability, and refines microstructure due to its pozzolanic properties. Optimal replacement levels generally range between 10% and 15%, though some studies compressive, tensile, and flexural strength, enhances workability, and refines microstructure due to its pozzolanic properties. Optimal replacement levels generally range between 10% and 15%, though some studies are concentrating on how to use agricultural or industrial waste as a source of raw materials for industry. In addition to being cost-effective, this waste utilization could lead to foreign exchange profits and the reduction of environmental damage. In addition to lowering the cost of producing concrete, using these wastes as cement substitutes can lessen the detrimental impacts of disposing of them on the environment.

III. AIM

Analysis & Replacement of Sugarcane Bagasse Ash Use In cement.

IV. OBJECTIVES

The goal of the study is to determine whether sugarcane bagasse ash is suitable for achieving the ideal amount by conducting various tests on it and analyzing the test results.

- 1) To substitute sugarcane bagasse ash (10%, 20%, and 30%) for cement in concrete (M25 grade) and examine the impact on concrete's workability and compressive strength.
- 2) To determine the ideal amount of sugarcane bagasse ash for M25 concrete.
- 3) To compare the price of concrete made with traditional cement versus concrete that uses sugarcane bagasse ash in place of some of the cement.

V. LITERATURE REVIEW CEMENT

Ordinary cement of 43 grade from single batch was used for the entire work. The cement procured was tested for physical requirement in a accordance with IS:12269-1987 and for the chemical requirement in accordance with IS:4032- 1977.

A. Sugarcane bagasse ash

The sugarcane bagasse consist of approximately 50% of cellulose, 25% of hemicelluloses of lignin. Each ton of su5garcane generate approximately 26% of bagasse (as a moisture content of 50%) and 0.62% of residual ash. The residue after combustion presents chemical composition dominate by silica dioxide (SiO₂). In the sugarcane bagasse ash was collected during the clinging operation of a boiler in the sugarcane factory, Deccan sugar factory pvt. Ltd . menogaril, avital

B. Water

The water is required for preparation of mortar, mixing of cement concrete and for curing work etc. during construction work. The quality and quantity of water has much effect on strength of mortar and cement concrete in construction work impurities free, clean portable water are used for casting of cube. Also curing was done in curing tank as per IS 456-2000.

C. Aggregates

Aggregates should be free from impurities like silt, clay, dirt and organic matter. Soft, porous rock can limit strength and wear resistance; it may also break down during mixing and adversely affect workability by increasing the amount of fines.

VI. MIX DESIGN PROCEDURE AND CALCULATIONS

Definition:

Mix design is the process of selecting suitable ingredients of concrete and determines their relative proportions with the object of certain minimum strength and durability as economically as possible

Mix Design Four variables to be considered in connection with specifying concrete mixes are

- 1) Water cement ratio.
- 2) Cement content or cement aggregate ratio.
- 3) Gradation of aggregates.
- 4) Mix design was prepared using IS 10262: 2009. This standard provides the guidelines for proportion.

A. Test Data for Materials Various tests were conducted on materials, and the following observations were recorded:

- 1) Cement- Bharti OPC 53 Grade.
- 2) Specific gravity of cement - 3.15
- 3) Slump required- 50-100mm
- 4) Specific gravity – Water absorption
 - Coarse aggregates (20mm) - 2.86
 - Coarse aggregates (10mm) – 2.80
 - Fine aggregates- 2.64
- 5) Water absorption –
 - Coarse aggregate (20mm) – 1.90%
 - Coarse aggregate (10mm) – 1.92%
 - Fine aggregates- 3.70%
 - Moisture content Coarse aggregates (20mm) –
 - Coarse aggregates (10mm) – 1.01%
 - Fine aggregates – 1.88%

B. Target Strength for Mix Proportioning $f_{ck} = f_{ck} + 1.65s$

Where,

f_{ck} = target average compressive strength at 28 days

f_{ck} = characteristic compressive strength at 28 days s = standard deviation

$$(\text{Target Strength} = 25 + 1.65 \times 4 = 31.6 \text{ N/mm}^2)$$

- Adopt water cement ratio as 0.45
- Maximum water content for 20mm aggregates= 186
- Cement content – 400 kg/m³
- Greater than minimum content therefore O.K. Proportion of volume of coarse aggregate and fine aggregate is 0.62: 0.38.
- The Mix calculation per unit volume of concrete shall be as follows.
- Volume of concrete = 1m³
- Volume of cement = (400/3.15) x (1/1000) = 0.127m³
- Volume of water = (180/1) x (1/1000) = 0.18m³
- Volume of all in aggregates = 1-(0.127+0.180)=0.693m³
- Mass of coarse aggregates = 0.693x0.62x2.83x1000 = 1145.21kg
- Mass of fine aggregates = 0.693x0.38x2.64x1000 = 710.70kg

VII. COSTING

Weight of 1 m³ concrete = 1x1x2500= 2500 kg

Material	Quantity	Rate	Unit	Amount
Cement	8	350	Bag	2800
Fine Aggregates	711	3	kg	2133
Coarse Aggregates	1146	2	kg	2292

Total Amount = 7225/-

Table 1: Cost Analysis for Normal Concrete

Material	Quantity	Rate (RS)	Unit	Amount
Cement	6	350	Bag	2100
Fine Aggregates	711	3	kg	2133
Coarse Aggregates	1146	2	kg	2292
Sugarcane Bagasse Ash	100	50	Tonne	5

Total Amount = 6530/-

Table 2: Cost Analysis for concrete with 15% SGBA replacement for cement

VIII. CONCLUSION

The use of Sugarcane Bagasse Ash (SCBA) as a partial replacement for cement in concrete improves strength, especially at an optimum level of around 25% replacement. It enhances workability, reduces the need for superplasticizers, and lowers the heat of hydration, which helps minimize shrinkage and thermal cracking. Additionally, SCBA contributes to environmental sustainability by reducing cement consumption, lowering CO₂ emissions, and utilizing industrial waste. However, beyond about 30% replacement, the strength begins to decrease slightly. Overall, SCBA is an effective, economical, and eco-friendly alternative material for concrete production.

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