Effect of sugarcane bagasse fibre on the flexural behavior of geopolymer concrete RCC beams

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Abstract. CO2 is released into the atmosphere during the manufacture of Ordinary Portland Cement (OPC). Fly ash, a by-product of the coal industry, is used to replace OPC in concrete. It contains a lot of silicate gel and is mixed with an alkaline solution to make good concrete. Increased fly ash fineness improves compressive strength while lowering porosity. Advances in modern bio technology is possible freedoms for monetary use of agro-mechanical deposits like sugarcane bagasse ash and fibre. The flexural behaviour of Geopolymer Concrete RCC beams with and without sugarcane bagasse fibre, i.e. GPC and GPCF of G 40 grade, equal to M40, is presented in this study. The 150*150 mm beam is cast across a 1,200 mm effective span and tested for failure under static loads. The ultimate load and load displacement responses of GPC structural elements with and without fibre are measured and compared to normal GPC and conventional concrete elements. The findings suggest that SCBF improves the flexural strength, service load, and peak load of GPC elements.

1 Introduction

In current time, fibre composites are acquiring consideration because of its predominant benefits like high explicit strength and modulus, financial reasonability, less thickness, biodegradability, climate well disposed, minimal expense, diminished device wear, improved energy recuperation, decreased dermal and respiratory disturbance over customary metallic combinations . The attention in regular fibre-supported composite of polymer materials is quickly expanding in both modern applications and crucial exploration. The likely utilization of regular filaments are discovered appealing in non-industrial nations, where they are frequently accessible in tropical plants and agrarian squanders* that right now have restricted monetary worth. Persistent advancement in the creation of normal fibre composites has for the most part cantered around mechanical improvement and decrease of primary deformities to guarantee toughness, unwavering quality, cost decrease and expanded creation rates. Climate cordial materials are advanced .Normal filaments are inexhaustible, modest, biodegradable and totally or to some degree recyclable. Due to their acceptable mechanical qualities and accessibility, plants such as knead, jute, flax, hemp, sisal, cotton, pineapple, ramie, bamboo, banana, and others are believed to be regular strands, eco-invitingness, sustainability, cost and low thickness and a solid option to the artificial fibre parts like glass, carbon utilized in the manufacture of polymer framework composites. The effects of water retention on the mechanical characteristics of hemp fibre-based unsaturated polyester-based regular composites have been studied in Dhaka. The outcomes show that the dampness get increments with the fibre volume part. An increment in dampness get decreases the flexural and malleable properties by polymer debasement. Grande explored the fibre content and width impactson the Leukaemia sort fibre supported polypropylene regular composite. It was discovered that increasing the fibre percentage from 20% to 50% increased the composite's solidity. The firmness qualities are unaffected by the fibre breadth. Osman et al. [11] investigated the sway and flexural properties of sisal, banana, jute, and flax regular fibre built up polypropylene framework composites. They discovered that sisal fibre is superior to other filaments.

Improving the flexural and effect properties of the composites, and ensuring that these qualities are unaffected by the fibre content, using the expulsion and infusion shaping cycle to create a durian skin fibre supported normal composite. The durian filaments utilised in this study were either untreated or pre-treated with NaOH. They discovered that pre-treated filaments significantly improve the mechanical properties of regular composites and provide superior warm solidity when compared to untreated regular composites. They likewise proposed that the surface medicines of regular filaments are fundamental to further develop the holding attributes by eliminating the soil, dampness from the fibre and expanding the surface harshness of the fibre.

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1.1 Methodology

Sugarcane bagasse was collected and submerged in a NaOH solution for one day to alkalize it. After that, the bagasse was let to dry naturally in the open field for several days. A universal power blender was used to crush the sugarcane bagasses. The needle-like filaments were discovered after being dried and crushed. The fibres are then dried a second time in an oven at 50^0c.

When bagasse fibre with varied volume fractions was studied by Isiaka Oluwole Oladele (5,10, 15 and 20 percent). The samples were subjected to mechanical testing. And it was discovered that a 10 wt% bagasse fibre loading offered good results in many tests, and that bagasse particulate fibre in the range of 5-10 wt% gave the best results compared to other volume fractions (15 to 20w percent).The characteristics and chemical makeup of bagasse fibres are the focus of this review. It is a challenge to develop better materials with improved mechanical properties in order to improve quality of life. Bagasse fibres' physical qualities, mechanical properties, fibre kinds, and chemical makeup are also discussed in this review. This research is to take advantage of the advantages that renewable resources provide for the creation of bagasse-based composite materials. It is a challenge to develop better materials with improved mechanical properties in order to improve quality of life. The use of bagasse fibre is also discussed in this review.

2.1 Material

Grade of concrete	Mix
FlyAsh	327.25
GGBS (kg/m^3)	57.75
Fine Aggregate (kg/m^3)	684
Coarse Aggregate (kg/m^3)	1198.114
Super plasticizer	2%
Noah(kg/m^3) 12M	44
Na_2SiO_3(kg/m^3)	110
Ratio of mix proportions	1:1.786:3.128
W/C ratio	0.40
Water content	28.174
Workability	75-100 mm

1. IS 12269-1987 Ordinary Portland Cement (53 grade)
2.IS 3812 (Part 1) :2003 2. Fly ash (class F)
3. IS 12089:1987 Ground Granulated Blast Furnace Slag (GGBS)
4. IS: 383-1970 coarse aggregate (20mm)
5. Alkaline solution: sodium hydroxide (NaOH) pellets (purity 98%), sodium silicate solution (Na2SiO3)
6. SNF (super plasticizer) (sulphonated Naphthalene formaldehyde)
7. Water
8. Bagasse Fibre from Sugar Cane

2. Materials and Mix Design

2.2 Mix design

M40 grade of concrete	
Cement (kg/m^3)	386
Fine Aggregate (kg/m^3)	684
CA (kg/m^3)	1198.114
SP	1.5%
Mix Proportions Ratio	1:1.77:3.10
W/C ratio	0.40
Workability in terms of Slump (mm)	75-100mm

Table1: Mix proportions Concrolled concrete (CC)

Table2: Mix proportions Geopolymer concrete (GPC)

This paper was made with a grade M40. For computing the mix plan of M40 and G40 concrete, the system is based on IS:10262-2009 and IS:456-2000. Using the advantages of M40, the G40 for Geopolymer concrete is determined through experimentation. In the experimental on concrete, the last mix of M40 with a W/C ratio of 0.4 is replaced by 85 percent fly ash and 15 percent GGBS. Sugar cane baggase was added about 2% which both GPC and controlled cement was made fiber and contrasted and ordinary cement.

3 Specimen and Test setup

According to investigation research, RCC beams estimating 150*150*1200 mm were utilized. Beams protections are point by point in consistence with IS 456-2000 rules, as displayed in Fig.1. 12mm bars are used as main reinforcement and 8mm is used as stirrups. The proper amount of Fly ash, GGBS, fine and coarse aggregate are used to make RCC elements by using M40 and G40 concrete. The mix is consolidated to get required usefulness and afterward to be poured in example with support made for giving examples a role as displayed in Fig 1. Following 24 hours, the entirety of the examples were demoulded as display get required usefulness and afterward to be poured in example with support made for giving examples a role as displayed in Fig 1. The full set of instances was demoulded after 24 hours, as seen in Fig 2. GPC test examples were restored for 28 days in states of comprehensive alleviating. It's worth noting that water isn't required for curing.

4 Test Procedure

For beams testing, a hydraulic loading frame with a capacity of 200 tonnes is used. For diversions in the range of 10mm, linear variable differential transducers (LVDT) with a minimum tally of 0.01mm are used. To obtain strain in the example, strain check sensors are added to the example. LVDTs, strain gauge sensors, and burden shells are connected to the Signal conditioner/marker via pre-programmed No ports in the charge unit. With a proper stacking rate increment the heap bit by bit till example twists/breaks.The robotized information procurement framework is utilized to dissect the information during the experiment.Observe the break designs on the example and get the information gained from the framework to additionally come to results and end results.

Figure 1. RCC Beam Setup for Testing

Figure 2. RCC Beam before Testing

Figure 3. RCC Beam after Testing

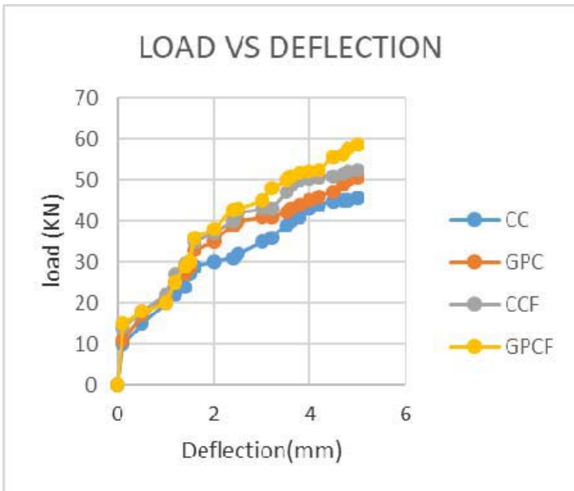
5 Result and Discussion

Beams were casted about estimating 150*150*1200 mm.

Table 1: Loads of Structural Elements

Beams		
S.no	**Service load(kn)**	**Ultimate load(kn)**
CC	38.5	45.8
GPC	40.6	50.6
CCF	41.9	51.3
GPCF	46.7	58.7

The values are obtained after the testing from 1st crack as service load.thestruvctral elements give higher results at GPCF . The ultimate load has the 58.7, gained at the fibre content of sugarcane bagasse .



Graph 1: Load and Deflection

Table 2: Loads againist Deflection (mm) of RCC Beams

Deflection (mm)	Load (KN)			
	CC	GPC	CCF	GPCF
0	0	0	0	0
0.1	10	11	14	15
0.5	15	17	18	18
1	20	21	22	20
1.2	22	25	27	25
1.4	24	27	29.5	29
1.5	27	29	30	30
1.6	29	33	35	36
2	30	35	37	38
2.4	31	39	40	42.8
2.5	32	40	42	43
3	35	40.9	42.9	45
3.2	36	41	43	48
3.5	39	42	47	50
3.6	40	43	49	51
3.8	41	44	50	51.8
4	43	45	50.5	52
4.2	44	46	50.8	52.5
4.5	44.9	47	51	55.8
4.7	45	49	51.5	56.4
4.8	45.2	50	52	57.6
5	45.8	50.6	52.5	58.7

6 Conclusion

1. Load carrying capacity of RCC beam with CCF is found to be 12.01% more than CC beam and GPCF is increased by 16.01% compared to GPC beam.
2. It has been observed that the compressive strength is increased up to 0.5% of fibre and further increase in dosage of SCBF, compressive strength is fallen.
3. In comparison to CCF and GPCF, CC and GPC showed larger cracks..
4. Workability is decreased as the dosage of SCBF increased, but still it is in the required limit.
5. When compared to CC beams, the load carrying capacity of GPCF at first crack increased by 21.29 percent and with GPC 15.02 percent rspectively.
6. Deflections are controlled in GPCF and GPC compared to GPC and CC beams.

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