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EXPERIMENTAL INVESTIGATION ON STRENGTH PROPERTIES OF POLYPROPYLENE FIBER CONCRETE WITH SUGARCANE BAGASSE ASH

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Abstract: Concrete is a building material made from a mixture of broken stone or gravel, sand, cement and water. The demand for concrete leads to increased usage of cement and aggregate. In concrete, cement and aggregate can be partially replaced by different supplementary materials to enhance the properties of concrete mix. Sugarcane bagasse ash is a waste material which is a byproduct of sugarcane processing and can be used in various applications such as construction materials. This substitution can enhance the sustainability of concrete by reducing the demand for natural aggregate and lowering the environmental impacts associated with their extraction. This present paper works, aims to investigate the strength properties of polypropylene fiber concrete with sugarcane bagasse ash. Control mix M30 PFC is prepared by replacing 25% of cement with fly ash and adding 0.1% of polypropylene fiber to the total mass of M30 grade concrete. Polypropylene fiber sugarcane bagasse ash concrete (PFSC) is prepared by replacing the cement with varying percentages 5, 10 and 15%. Mechanical properties tested for the fresh and hardened concrete includes slump test, compressive strength test, split tensile test and flexural strength test.

Key words: Pozzolanic property, sugarcane bagasse ash, eggshell.

1.INTRODUCTION

Concrete is a composite material that is created by mixing the binding material (cement) along with the aggregate (sand, gravel, stone, brick chips, etc.), water, admixtures, etc. in specific proportion. As the use of concrete in the construction industry continues to increase for high rise-rise buildings and infrastructure, the need to improve its quality in terms of workability and strength becomes more pressing, requiring the use of higher -grade mixes such as M25 and above. To achieve these properties of M30 concrete, proper mix proportioning of its ingredients is essential. M30 concrete are commonly used for the construction of slabs, beams, columns, and footings which require higher strength concrete than standard mixes. In concrete cement and aggregate can be partially replaced by different supplementary materials to enhance the properties of concrete mix.

This study aims to investigate the effect of sugarcane bagasse ash on the mechanical properties of the fiber reinforced concrete. Polypropylene fiber is a synthetic fiber made from the polymer polypropylene. It is a versatile material with various applications due to its unique properties. The key properties associated with the use of polypropylene fibres in concrete are crack control, durability, toughness and impact resistance, workability, corrosion resistance etc. Fly ash is a byproduct of burning pulverizes coal in electric power generating plants. Fly ash offers several properties in concrete mix such as pozzolanic reactivity, reduced heat of hydration, improved workability, enhanced strength and durability etc. The base concrete contains 0.1% of polypropylene to the total concrete weight and 25% of fly ash to the total weight of cement. Sugarcane ash(bagasse) is a pozzolanic material which possess binder property, and which also improves the compressive strength of concrete. Therefore, the cement is partially replaced with sugarcane ash in concrete. To conduct this investigation, a series of polypropylene fiber concrete mixtures were prepared with replacing cement with various percentages of sugarcane bagasse ash (5%,10% and 15%) for finding the optimum percentages.

2. MATERIALS

2.1 Polypropylene fiber

Polypropylene fibre is a synthetic material known for its versatility and widespread use. Derived from the polymerization of propylene, polypropylene fibres exhibit excellent chemical and moisture resistance, making them suitable for various applications.

Figure no. 2.1 Polypropylene fiber

2.2 Fly Ash

Fly ash is a fine powder, predominantly composed of spherical glass particles, generated as a by-product from the combustion of pulverized coal in power plants. Due to its pozzolanic properties, fly ash is widely used in the construction industry as a supplementary cementitious material in the production of concrete.

Figure no. 2.2 Fly ash

2.3 Sugarcane Bagasse Ash

Sugarcane ash is the residue left behind after the combustion of sugarcane biomass. This ash is a by-product of various processes in the sugarcane industry, such as the burning of sugarcane fields before harvesting or the combustion of bagasse, the fibrous residue from sugarcane extraction used as a biofuel. Sugarcane ash is rich in minerals, including potassium, calcium, and phosphorus.

Figure no. 2.3 Sugarcane Bagasse Ash

3. MIX PROPORTIONS

3.1 M30 Mix ratio**:** 1: 2.07: 3.31

Mix ID	Cement kg/m^3	Fine Aggregate kg/m^3	Coarse Aggregate kg/m^3	Flyash kg/m^3	Propylene fibre kg/m^3	Sugarcane bagasse ash kg/m^3
M30.	369.16	767.73	1224.07	-	-	-
PFC	276.87	767.73	1224.07	92.29	2.51	-
PFSC5	263.03	767.73	1224.07	92.29	2.51	13.84
PFSC10	249.19	767.73	1224.07	92.29	2.51	27.68
PFSC15	235.34	767.73	1224.07	92.29	2.51	41.53

Mixes were subjected to slump test, compressive strength test, split tensile strength, flexural strength.

4. RESULT AND DISCUSSION

4.1 Slump Test

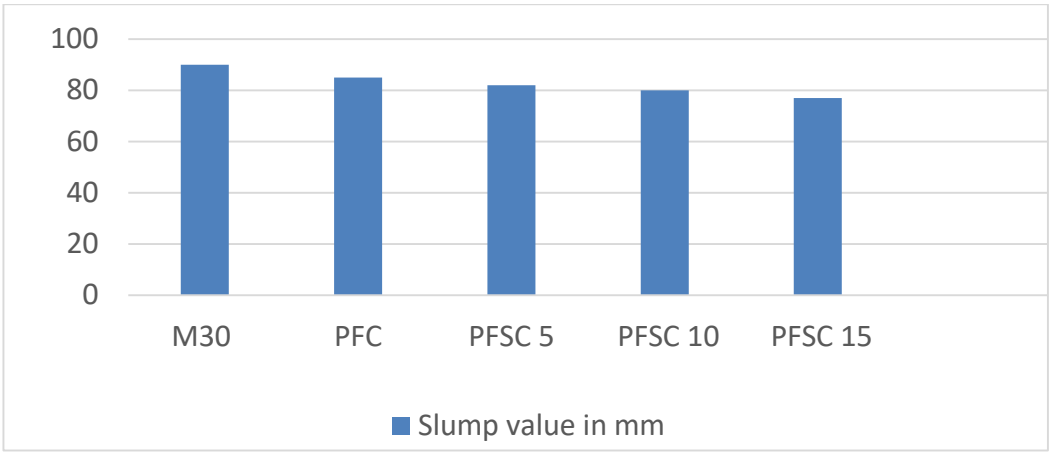

Figure no. 4.1 Sugarcane Bagasse Ash

To assess the effect of sugarcane ash on workability, a slump test was conducted for both the base concrete and mixes with varying percentages of sugarcane bagasse ashes. This reduction in workability may be due to the smaller particle size of the sugarcane bagasse ash results in greater water absorption. Therefore, the slump values decrease on increasing percentages of sugarcane bagasse ash.

4.2 Compressive Strength

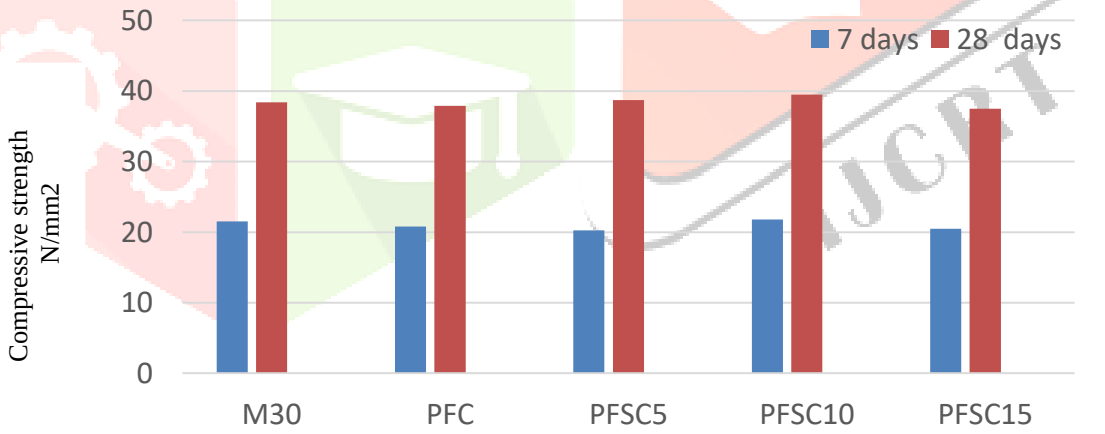

Figure no. 4.2 Sugarcane Bagasse Ash

7 days' compressive strength of PFC reduced by 3.4% and 28-days compressive strength of PFC reduced by 1.3% on comparing with M30 concrete. The addition of Polypropylene fiber to concrete will negatively affect the strength since the fibers are not distributed homogeneously in cementitious system and increases the risk of flocculation of fiber. For 5%, 10% and 15% PFSC, compressive strength has increased by 1.44%, 4.8% and 1.58% respectively on 7 days when compared to PFC. For 5%,10% and 15% PFSC, compressive strength

has increased by 2.11%, 4.74% and decreased by 1.05% respectively on 28 days when compared to PFC. The test results showed that optimum compressive strength was achieved at 10% replacement of cement with SBA on PFC.

4.3 Split Tensile Strength

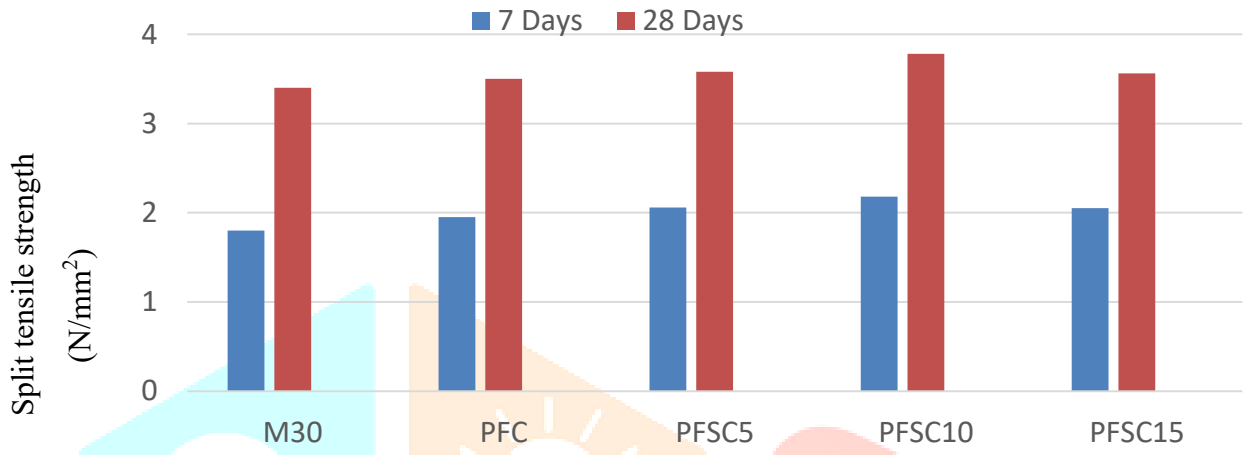

Figure no. 4.3 Split tensile strength values of M30, PFC, PFSC5, PFSC10, PFSC15

7 days and 28 days tensile strength of PFC increased by 11.8% and 2.9% respectively on comparing with M30 conventional concrete. PF can increase the resistance of concrete to cracking as these fibers are able to absorb energy and distribute the load of the concrete much more efficiently. For 5%,10% and 15% PFSC, tensile strength has increased by 6.6 %, 11.7% and decreased by 5.1% respectively on 7 days when compared to PFC.For 5%,10% and 15% PFSC, tensile strength has increased by 2.2%, 8% and decreased by 1.71% respectively on 28 days when compared to PFC. The test results showed that optimum tensile strength was achieved at 10% replacement of cement with SBA on PFC.

4.4 Flexural strength

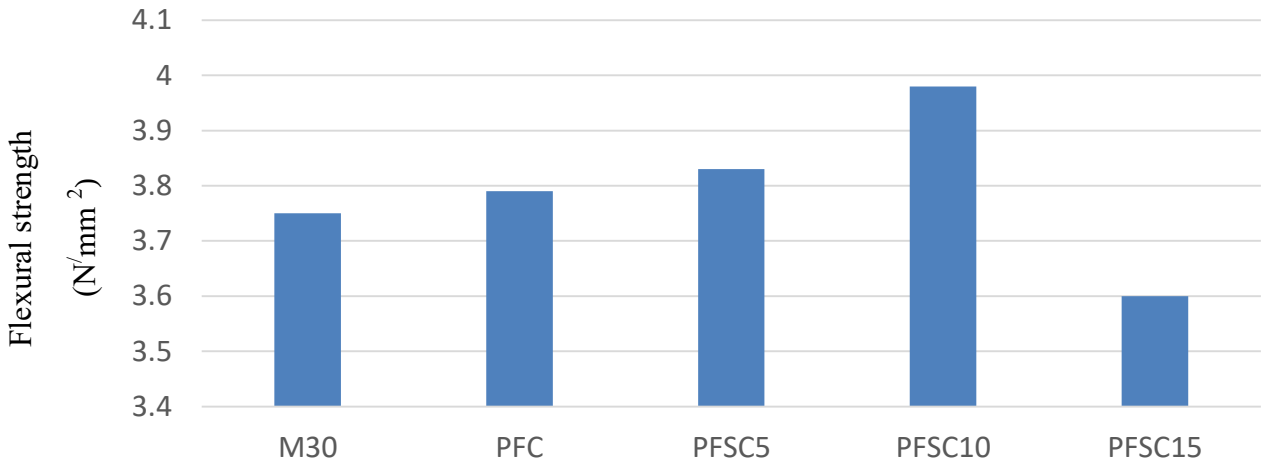

Figure no: 4.4 Flexural strength values of M30, PFC, PFSC5, PFSC10, PFSC15

Flexural strength of PFC slightly increased by 1.06% on comparing with M30 concrete. These increasing trends may have occurred due to crack bridging of the fiber for 5%,10% and 15% PFSC, flexural strength has increased by 1.05%, 5.01% and 5% respectively when compared to PFC. The test results showed that optimum flexural strength was achieved at 10% replacement of cement with SBA on PFC.

5. CONCLUSION

- Slump value decreases with increase in the content of sugarcane bagasse ash, it is due to the smaller particle size of sugarcane bagasse ash surface area increase as a result water absorption increases thus the slump value decreases.
- Due to the addition of polypropylene fibre compressive strength for PFC decreases compared to the M30 grade concrete, tensile strength and flexural strength increases for PFC on comparing with M30 grade concrete.
- On comparing PFC with PFSC 5, PFSC 10 and PFSC 15 optimum percentage obtained is 10%.

REFERENCES

1. Arunachalam K, Kottaisamy M, Rajasekar A, Saraswathy V (2018), Durability characteristics of ultra-high strength concrete with treated sugarcane bagasse ash, Vol- 171, PP: 350-356.

2. Baqi. A, Fuzail Hashmi. A, Shariq. M (2020), Optimization of fly ash concrete mix – a solution for sustainable development, *Materials today: proceedings*, PP: 1-7.

3. Cengiz, Duran Atis, Okan Karahan (2010), The durability properties of polypropylene fiber reinforced fly ash concrete, *Materials and design*, PP: 0261 – 3069.

4.David Otieno Koteng, Mohammed Matallah, Stanley Muse Shitote, Tareg Abdalla Abdalla, (2022), Mechanical and durability properties of concrete incorporating silica fume and a high volume of sugarcane bagasse ash, *Results in Engineering*, vol 16 ,100666, PP:1613.

5.Harsha Vardhan G, Nithin Kumar Reddy G, Vijaya Bhaskar Reddy (2016), Partial replacement of cement on concrete with sugarcane bagasse ash and its behaviour in aggressive environments, *Journal of Mechanical and civil Engineering*, pp: 29-35.

6. Mallikarjuna Rao G, Praveen Oggu, Sai Jagan Mohan Reddy Sripathi, A Study on Partial Replacement of Cement by Aluminium Powder in polypropylene Fiber Reinforced Concrete, Earth and Environmental Science, PP: 1755-1315