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STRENGTH STUDIES ON JUTE FIBRE CONCRETE WITH WASTE FOUNDRY SAND

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ABSTRACT
The construction industry continuously seeks sustainable alternatives to conventional materials to mitigate environmental impact. This study investigates the combined effects of utilizing waste foundry sand (WFS) as a partial replacement for fine aggregate and integrating jute fibre into concrete. WFS, a byproduct of metal casting processes, poses disposal challenges and environmental concerns. However, its incorporation as a supplementary material in concrete can offer economic and environmental benefits. To calculate the compressive strength and split tensile strength for 7 and 28 days.

Keywords:
Waste foundry Sand, Jute Fibre, Sustainable, Compressive Strength and Split Tensile Strength.

1.INTRODUCTION

In recent years, there has been a growing concern about the environmental impact of construction activities and the depletion of natural resources. As a result, researchers and engineers have been exploring alternative materials and methods to improve the sustainability of concrete production. One such approach involves the utilization of waste foundry sand (WFS) as a partial replacement for fine aggregate and the incorporation of jute fibers to enhance the properties of concrete.

Waste foundry sand, generated from metal casting processes, is abundantly available and often considered as a problematic waste material due to its disposal challenges. However, recent studies have shown that WFS can be effectively used as a substitute for fine aggregate in concrete production without compromising its mechanical properties. By incorporating WFS into concrete mixes, not only can the environmental burden associated with its disposal be reduced, but also the consumption of natural resources such as river sand can be minimized.

Additionally, the inclusion of natural fibers such as jute fibers in concrete has gained attention due to their favorable properties such as high tensile strength, biodegradability, and low cost. When added to concrete mixes, jute fibers can improve the ductility, toughness, and impact resistance of the resulting composite material. Moreover, the use of jute fibers promotes sustainability by providing an eco-friendly alternative to synthetic fibers.

2.OBJECTIVES

(a) Investigate the durability performance of concrete containing WFS and jute fiber, focusing on factors such as resistance to abrasion, freeze-thaw cycles, chloride ion penetration, and sulfate attack.
(b) Determine the optimum mix proportion of concrete incorporating WFS and jute fiber to achieve desired performance requirements while minimizing material usage and costs.

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3.MATERIALS

1. Cement:- The primary ingredient of concrete, grout, and mortar, cement serves as a common binding agent in construction. Clinker is often produced by burning a mixture of limestone, clay, shale, iron ore, and other materials at high temperatures in a kiln. Clinker is subsequently processed into a fine powder.

2. Fine aggregate:- Particles in sand range in average dimension from 0.075 to 4.75 millimetres (mm). Sand is a granular material. It's also known as fine aggregate at times. It is a fundamental ingredient in mortar and concrete compositions, along with cement and coarse aggregate (such crushed stone or gravel).

3. Coarse aggregate:- Granular materials that normally range in size from 4.75 mm to 75 mm in diameter are referred to as coarse aggregate; however, the maximum limit may change based on regional requirements and restrictions. Along with sand, cement, and fine aggregate, it is one of the primary ingredients of concrete.

4. Waste foundry sand:- Due to its composition and potential environmental impact, waste foundry sand must be managed properly to minimize adverse effects on the environment and human health. Various methods, such as recycling, beneficial reuse, and proper disposal, are employed to manage waste foundry sand responsibly.

5.Jute Fibre:- Jute fibres may also reduce concrete shrinkage and cracking, which enhances the overall performance and durability of concrete constructions.

6. Water:- Water is a common ingredient in concrete mixes, and this affects the hardened material's strength, durability, and use. To create durable, high-quality concrete structures, it is crucial to regulate the water-to-cement ratio, use a suitable mix design, and adhere to the proper curing procedures.

4. TEST RESULTS

(a) Compressive Strength: Compressive strength is the maximum load or force that a material can withstand before collapsing or breaking when compressed (pressed or crushed). To determine for 7 and 28 days.

Table 1 : Compressive Strength Results on Concrete With Partial Replacement of Fine Aggregate With Waste Foundry Sand.

S. No.	% of WFS	Compressive Strength (N/mm^2)	
		7 days	28 days
1	WF0	27.21	39.43
2	WF5	28.73	42.13
3	WF10	30.06	43.44
4	WF15	32.05	45.73
5	WF20	30.35	44.06
6	WF25	29.51	42.22

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Table 2: Compressive Strength Results on Addition of Jute Fibre by Weight of Concrete.

Sl.no	% Jute Fibre	Compressive Strength (N/mm^2)	
		7 days	28 days
1	0%	27.21	39.43
2	0.5%	31.28	45.41
3	1.0%	33.37	47.75
4	1.5%	32.10	45.86

Table 3: Combined Replacements of Compressive Strength Results on Concrete With Waste Foundry Sand and Jute Fibre

Sl.no	% of WFS + % of JF	Compressive Strength (N/mm^2)	
		7 days	28 days
1	0%	27.21	39.43
2	15 % WFS+1.0% JF	34.86	50.91

Split Tensile Strength: One crucial characteristic of concrete that indicates its resistance to tensile stresses and breaking is the split tensile strength. It is especially important when tensile pressures are anticipated to be applied to the concrete.To determine for 7 and 28 days.

Table 4 : Split Tensile Strength Results on Concrete With Partial Replacement of Fine Aggregate With Waste Foundry Sand.

S. No.	Mix ID	Split Tensile Strength (N/mm^2)	
		7 days	28 days
1	WF0	2.58	3.78
2	WF5	2.79	4.06
3	WF10	2.92	4.19
4	WF15	3.07	4.41
5	WF20	2.96	4.25
6	WF25	2.74	3.99

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Table 5: Split Tensile Strength Results on Addition of Jute Fibre by Weight of Concrete.

Sl.no	% Jute Fibre	Split Tensile Strength (N/mm^2)	
		7 days	28 days
1	0%	2.58	3.78
2	0.5%	3.02	4.39
3	1.0%	3.29	4.71
4	1.5%	3.09	4.44

Table 6: Combined Replacements of Split Tensile Strength Results on Concrete With Waste Foundry Sand and Jute Fibre

Sl.no	% of WFS + % of JF	Split Tensile Strength (N/mm^2)	
		7 days	28 days
1	0%	2.58	3.78
2	15 % WFS+1.0% JF	3.71	5.31

5.CONCLUSIONS

1. The Normal Concrete of compressive strength results for 7 and 28 days is 27.21 and 39.43 N/mm^2.
2. The Normal Concrete of split tensile Strength results for 7 and 28 days is 2.58 and 3.78 N/mm^2.
3. At 15% waste foundry sand replacement of fine aggregate, the compressive strength results are optimum for both 7 and 28 days is 32.05 and 45.73 N/mm^2.
4. At 15% waste foundry sand replacement of fine aggregate, the Split tensile strength results are optimum for both 7 and 28 days is 3.07 and 4.41 N/mm^2.
5. At 1.0% jute fiber to concrete by weight, the compressive strength results are optimum for both 7 and 28 days 33.37 and 47.75 N/mm^2.
6. At 1.0% jute fiber to concrete by weight, the compressive strength results are optimum for both 7 and 28 days.3.29 and 4.71 N/mm^2.
7. By combining 15% waste foundry sand as a replacement for fine aggregate and adding 1.0% jute fiber to concrete, the compressive strength results at 7 and 28 days is 34.86 and 50.91 N/mm^2.
8. By combining 15% waste foundry sand as a replacement for fine aggregate and adding 1.0% jute fiber to concrete, the split tensile strength results at 7 and 28 days is 3.71 and 5.31 N/mm^2.

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