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STRENGTHENING ON CRIMPED STEEL FIBRE CONCRETE USING PALM OIL FUEL ASH AS PARTIAL REPLACEMENT OF CEMENT

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Abstract- Concrete is a composite substance composed of cement, fine aggregate, coarse aggregate, and water that has a very high hardness. It is the most widely used building material in the world. The result of this investigation is Palm Oil Fuel Ash Concrete, which substitutes 10, 20, and 30% by weight of palm oil fuel ash (POFA) for regular Portland cement.A mixture of 1%, 2%, 3%, and 4% crimped steel fibres is added to concrete. The results show that the addition of POFA and Crimped steel fibre to concrete improved the results of the Compressive strength and Split tensile strength tests conducted after 7 and 28 days.

Keywords: Crimped Steel fibres, Palm Oil Fuel Ash, Compressive strength and Split tensile Strength.

1. INTRODUCTION

In the discipline of civil engineering, concrete is crucial. Concrete is a solidified material made from a carefully measured mixture of cement, sand, gravel, and water.strangled Fibre made of steel is one type of metal reinforcement. The phrase "steel fibre for reinforcing concrete" describes discrete, short lengths of steel fibres with varying cross-sections and an aspect ratio (length (20) to diameter (100)) small enough to be added at random to a mixture of unhardened concrete using standard mixing techniques.Landfills are where palm oil fuel ash (POFA), a waste product from the palm oil industry, is dumped. After being dried in an oven and passing through a 90 micron sieve, ash was collected and used in place of cement.

2. OBJECTIVES

a. Partial OPC cement substitutes of 0%, 10%, 20%, and 30% can be utilised to maximise POFA.

b. The behaviour of crimped steel fibre in concrete is examined in this experiment.

c. To ascertain the split compressive and tensile strengths of the concrete.

3. MATERIALS

a.Cement: Cement has cohesive and adhesive qualities when water is present. We refer to these cements as hydraulic cements. They are mostly composed of aluminates from clay and limestone and silicates of limestone.

b. Fine Aggregate: When making concrete from crushed stone or natural sand, fine aggregate is the most important component. The fine aggregate's size and density mostly dictate the hardened properties of the concrete.

C. Coarse aggregate: It is defined as the material that passes through an IS Sieve measuring 4.75 mm. The standard maximum size increases by 10 to 20 mm, according to IS 383:1970.

d. Water: Needed for several processes like mortar production, cement mixing, and curing activities, water is an essential resource in the building industry. The strength of the motor and the cement concrete are directly impacted by the quality of the water used in the construction project.

e. POFA: Palm oil fuel ash (POFA) is a waste product from the palm oil industry that ends up in landfills. Following an oven-dried process, the collected ash was passed through a 90 micron screen to replace the cement.

f.. Crimped steel fibres: Carbon steel or stainless steel are used to make crimped steel fibres. Due to its ductility, metal may be drawn through progressively smaller dies to create wire. Because the materials used in High Strength Fibre Reinforced Concrete are somewhat stiff, they require particular mechanical qualities.

4. RESULTS AND DISCUSSIONS

a. Compressive strength test: For the compression strength test, a cube-shaped cast specimen of 150 mm by 150 mm by 150 mm is utilised. After the cast specimen had finished curing in a water tank, its strength was assessed 7 and 28 days later.

Table 1: Compressive Strength Results on Concrete By Partial Replacement of POFA In Cement.

Sl.no	% of POFA	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	25.18	39.66
2	10%	26.36	41.23
3	20%	29.92	42.45
4	30%	29.15	41.71

Table 2: Compressive Strength Results with Addition of Crimped Steel Fibre in Concrete

Sl.no	% of CSF	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	25.18	39.66
2	1%	27.26	40.51
3	2%	28.29	41.07
4	3%	30.76	41.92
5	4%	28.53	41.66

Table 3: Combined Compressive Strength Results Of 20% Of POFA With Partial Replacement Of Cement + 3% Of Crimped Steel Fibre Added To Concrete.

Sl.no	20% of POFA +3 % of CSF	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	25.18	39.66
2	20%POFA +3%CSF	30.42	43.15

b. Split tensile strength test: At 7 and 28 days of age, the split tensile strength of cylindrical specimens (150 mm in diameter by 300 mm in height) was assessed.

Table 4: Split tensile Strength Results on Concrete by Partial Replacement of POFA in Cement.

Sl.no	% of POFA	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	2.48	3.91
2	10%	2.71	4.07
3	20%	2.96	4.21
4	30%	2.89	4.19

Table 5: Split Tensile Strength Results with Addition of Crimped Steel Fibre in Concret

Sl.no	% of CSF	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	2.48	3.91
2	1%	2.76	4.01
3	2%	2.85	4.14
4	3%	3.11	4.42
5	4%	2.99	4.23

Table 6: Combined Split tensile Strength Results Of 20% Of POFA with Partial Replacement of Cement + 3% Of Crimped Steel Fibre Added To Concrete.

Sl.no	20% of POFA +3 % of CSF	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	2.48	3.91
2	20%POFA +3%CSF	3.29	4.71

5. CONCLUSIONS

1. The Normal Concrete of Compressive Strength results for 7 and 28 days is 25.18 and 39.66 N/mm².

2. The Normal Concrete of Split tensile Strength results for 7 and 28 days is 2.48 and 3.91 N/mm².

3. By 20% of Partial Replacement Of cement with POFA the Compressive Strength results for 7 and 28 days is 25.18 and 42.45 N/mm².

4. By 20% of Partial Replacement Of cement with POFA the Split tensile Strength results for 7 and 28 days is 2.96 and 4.21 N/mm^2.

5. By 3% of addition of concrete by crimped steel fibre the Compressive Strength results for for 7 and 28 days is 30.76 and 41.92 N/mm^2.

6. By 3% of addition of concrete by crimped steel fibre the Split tensile Strength results for 7 and 28 days is 3.11 and 4.42 N/mm^2.

7. By the combination of 20% partial replacement of POFA with cement + 3% addition of crimped steel fibre concrete the Compressive Strength results for 7 and 28 days is 30.42 and 43.15 N/mm^2.

8. By the combination of 20% partial replacement of POFA with cement + 3% addition crimped steel fibre of concrete the Split tensile Strength results for 7 and 28 days is 3.29 and 4.71 N/mm^2.

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