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Experimental Investigation on Crimped Steel Fibre Concrete Using Palm Oil Fuel Ash as Partial Replacement of Cement.

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Abstract- Concrete is a composite building material that is extremely hard and is made of a mixture of cement, fine aggregate, coarse aggregate, and water. It is the building material that is most frequently utilised globally. This study produced Palm Oil Fuel Ash Concrete, which replaces ordinary Portland cement with 10, 20, and 30% by weight of palm oil fuel ash (POFA).Concrete is mixed with a blend of 1%, 2%, 3%, and 4% crimped steel fibres. The findings demonstrate that the Compressive strength and Split tensile Strength tests for 28, 56 and 90 days were enhanced by adding POFA and Crimped steel fibre to concrete.

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

1. INTRODUCTION

Concrete is essential in the field of civil engineering. A precise mixture of cement, sand, gravel, and water is used to create concrete, which is a solidified substance.choked One form of metal reinforcement is steel fibre. The term "steel fibre for reinforcing concrete" refers to discrete, brief lengths of steel fibres with different cross-sections and an aspect ratio (length (20) to diameter (100)) that is tiny enough to be randomly introduced to a mixture of unhardened concrete using conventional mixing processes.Palm oil fuel ash (POFA), a waste product from the palm oil industry, is disposed of in landfills. Ash was gathered and utilised in place of cement after being dried in an oven and filtered through a 90 micron sieve.

2. OBJECTIVES

a. To maximise POFA, partial OPC cement substitutes of 0%, 10%, 20%, and 30% can be used.

b. This experiment looks into how crimped steel fibre behaves in concrete.

c. To determine the concrete's split tensile and compressive strengths.

3. MATERIALS

a.Cement: When water is present, cement demonstrates cohesive and adhesive properties. Such cements are called hydraulic cements. These are mostly formed of limestone silicates and aluminates from clay and limestone.

b. Fine Aggregate: Fine aggregate is the most crucial ingredient in concrete made from crushed stone or natural sand. The concrete's hardened qualities are mostly determined by the size and density of the fine aggregate.

C. Coarse aggregate: It is described as the material that is left behind after a 4.75 mm IS Sieve. IS 383:1970 states that the standard maximum size increases by 10 to 20 mm.

d.Water: Water is a vital resource in construction as it is required for several processes like mortar formation, cement mixing, and curing operations. The quality of the water used in the construction project directly affects the strength of the motor and the cement concrete.

e. POFA: Landfills are the last destination for palm oil fuel ash (POFA), a waste product resulting from the palm oil industry. The ash that was gathered was dried in an oven, then the material was put through a 90 micron screen to replace the cement.

f.Crimped steel fibres: The steel fibres that are crimped are made from either carbon steel or stainless steel. Because metal is ductile, it may be made into wire by drawing it through increasingly small dies. High Strength Fibre Reinforced Concrete must have specific mechanical properties because the materials are fairly stiff.

4. RESULTS AND DISCUSSIONS:

a. Compressive strength test: A cube-shaped cast specimen of 150 mm by 150 mm by 150 mm is used for the compression strength test. The strength of the cast specimen was evaluated 28, 56 and 90 days after it had completed curing in a water tank.

Table 1: Compressive Strength Results on Concrete by Partial Replacement of POFA in Cement.

S.No	% of POFA	Compressive Strength Results, N/mm2		
		28 days	56 days	90 days
1	0%	39.66	42.93	46.11
2	10%	41.23	44.76	48.07
3	20%	42.45	46.19	49.63
4	30%	41.71	45.44	48.79

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

S.No	% of CSF	Compressive Strength Results, N/mm2		
		28 days	56 days	90 days
1	0%	39.66	42.93	46.11
2	1%	40.51	43.88	47.16
3	2%	41.07	44.61	47.98
4	3%	41.92	45.71	49.06
5	4%	41.66	45.38	48.32

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

S.No	20% of POFA +3 % of CSF	Compressive Strength Results, N/mm2		
		28 days	56 days	90 days
1	0%	39.66	42.93	46.11
2	20%POFA +3%CSF	43.15	47.23	50.49

b. Split tensile strength test: The split tensile strength of cylindrical specimens (150mm diameter x 300mm height) was evaluated at 28, 56 and 90 days of age.

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

S.No	% of POFA	Split tensile Strength Results, N/mm2		
		28 days	56 days	90 days
1	0%	3.91	4.23	4.56
2	10%	4.03	4.38	4.71
3	20%	4.23	4.62	4.96
4	30%	4.08	4.49	4.74

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

S.No	% of CSF	Split tensile Strength Results, N/mm2		
		28 days	56 days	90 days
1	0%	3.91	4.23	4.56
2	1%	4.02	4.36	4.69
3	2%	4.06	4.42	4.74
4	3%	4.56	4.97	5.33
5	4%	4.12	4.48	4.81

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

S.No	20% of POFA +3 % of CSF	Split tensile Strength Results, N/mm2		
		28 days	56 days	90 days
1	0%	3.91	4.23	4.56
2	20%POFA +3%CSF	4.71	5.24	5.51

5. CONCLUSIONS

1. The Normal Concrete of Compressive Strength results for 28, 56 and 90 days is 39.66, 42.93 and 46.11 N/mm^2.

2. The Normal Concrete of Split tensile Strength results is for 28, 56 and 90 days is 3.91, 4.23 and 4.56 N/mm^2.

3. By 20% of Partial Replacement Of cement with POFA the Compressive Strength results for 28, 56 and 90 days is 42.45, 46.19 and 49.63 N/mm^2.

4. By 20% of Partial Replacement Of cement with POFA the Split tensile Strength results for 28, 56 and 90 days is 4.23, 4.62 and 4.96 N/mm^2.

5. By 3% of addition of concrete by crimped steel fibre the Compressive Strength results for 28, 56 and 90 days is 41.92, 45.71 and 49.06 N/mm^2.

6. By 3% of addition of concrete by crimped steel fibre the Split tensile Strength results for 28, 56 and 90 days is 4.56, 4.97 and 5.33 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 28, 56 and 90 days is 43.15, 47.23 and 50.49 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 28, 56 and 90 days is 4.71, 5.24 and 5.51 N/mm^2.

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