

EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF CEMENT BY SAW DUST ASH AND POLY PROPYLENE FIBRE

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Abstract

The aim of this project is to study the strength and durability of concrete when cement is partially replaced by saw dust ash and poly propylene fiber. The attempt has been made to compare the 7 day, 14 day and 28 day compressive strength and 28 day split tensile and flexural strength of concrete of M₂₅ grade. The experiment has been carried out on M₂₅ grade of concrete, wood ash in different percentage 0%, 5%, 10%, 15% and poly propylene 0.15%.

Keywords - specific gravity, compressive strength, poly propylene fibre, wood ash, cement content, concrete testing.

1. INTRODUCTION

The wastes generated from the biomass industries like sawdust, wood chips, wood barks and hard chips are increasing day by day. These wastes can be used as fuel for the safe and efficient disposal of these wastes. Modern technologies are now available for production of the saw dust ash in bulk quantities. The saw dust ash is used as partial replacement of cement in order to give high strength and crack resistance. The production of cement results in emission of green house gases and other pollutants. Hence the replacement of saw dust ash by cement contributes to less production of cement and makes the environment safe. The usage of saw dust ash helps in efficient disposal of waste generated and also a partial replacement of cement. Researches carried out show positive results for saw dust ash in cement. So the usage of these wastes are beneficial in both economically and environmentally.

2. OBJECTIVE

The objective of this study is to find the optimum strength by the mix ratio of cement, saw dust ash, aggregates, poly propylene fiber, and water.

3. COMPONENT MATERIALS

3.1 Cement

Cement is a binding material used in the preparation of concrete. It binds the coarse aggregates and fine aggregates with help of water, to a monolithic matter and also it fills the voids in the concrete.

3.2 Aggregates

The fine aggregates used in the manufacturing of concrete should be free from debris, fungi and chemical attack. It plays a vital role in concrete, so it should be durable, angular and sharp edges. Then only it gives a rich mix concrete and good workability.

3.3 Water

Water is an important ingredient of concrete as it actively participates in the chemical reactions with cement. The strength of cement concrete mainly from the binding action of the hydration of cement. The requirement of water should be reduced to that required for the chemical reaction of un-hydrated cement as the excess water should end up in the formation of undesirable voids or capillaries in the hardened cement paste in concrete.

3.4 Saw Dust Ash

Saw dust ash prepared from uncontrolled burning of sawdust from saw mill is studied for its suitability as partial replacement for cement in conventional concrete. The compressive strength, split tensile and flexural strength of concrete with blended wood ash cement are carefully studied. Water-to-binder ratio is taken as 0.4 and three different replacement percentages of wood ash are taken (5%, 10% and 15%).

3.5 Poly Propylene Fiber

Poly propylene fiber is a thermoplastic polymer, now it is widely used in various applications such as textiles, packaging, concrete mix etc. The raw material of poly propylene is derived from monomeric

C3H6 which is purely carbon in nature. Due to chemical inertness, fiber is mostly resistant to chemical attack hence chemical attack on concrete will not be affected by fiber. Also water demand is nil for the fiber. Polypropylene fiber resists crack formation on the concrete surface.

4. RESULT COMPARISON

4.1 Compressive Strength Test on Concrete

Addition of saw dust ash%	No. of days of curing	Load Applied (kN)			Average Compressive Strength N/mm ²
		Cu be 1	Cu be 2	Cu be 3	
5	7	450	400	430	18.96
10	7	370	340	320	15.25
15	7	200	200	220	9.18

Addition of saw dust ash%	No. of days of curing	Load Applied (kN)			Average Compressive Strength N/mm ²
		Cu be 1	Cu be 2	Cu be 3	
5	14	550	570	550	24.74
10	14	350	370	340	15.70
15	14	250	300	240	11.70

Addition of saw dust ash%	No. of days of curing	Load Applied (kN)			Average Compressive Strength N/mm ²
		Cu be 1	Cu be 2	Cu be 3	
5	28	600	650	630	27.85
10	28	420	450	400	18.81
15	28	390	350	370	16.44

4.2 Split Tensile Test on Concrete

Addition of saw dust ash%	No. of days of curing	Load Applied (kN)			Average Split Tensile Strength N/mm ²
		Trial 1	Trial 2	Trial 3	
0	28	200	180	210	2.78
5	28	225	230	220	3.18
10	28	170	165	165	2.4
15	28	160	155	160	2.23

4.3 Flexural Strength Test on Concrete

Addition of saw dust ash%	No. of days of curing	Load Applied (kN)			Average Flexural Strength N/mm ²
		trial 1	trial 2	trial 3	
0	28	20.5	20.5	20	10.16

5	28	22.5	23	23	11.41
10	28	17	17.5	18.1	9.1
15	28	17	18	18	8.83

5. CONCLUSION

The main purpose of this investigation is to study the effects of saw dust ash and polypropylene fiber on the workability, compressive strength, split tensile and flexural strength of M₂₅ grade concrete.

For comparison, reference specimens were tested without saw dust ash and polypropylene fiber.

Experimental results show that the workability of concrete reduces with addition of polypropylene fiber in concrete and also the results show that the polypropylene fiber concrete specimens give higher compressive, split tensile and flexural strength than the ordinary concrete specimens.

The highest strength has been achieved in samples containing 5% wood ash and 0.4% polypropylene fiber.

Based on the results presented in this paper, it can be concluded that concrete mixture can be prepared with saw dust ash as an additive together with polypropylene fiber to improve the strength of concrete structure.

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