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STUDY THE STRENGTH DEVELOPMENT OF CONCRETE WITH WOOD ASH BLENDED CEMENT

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Abstract

In this research, wood ash collected from the uncontrolled burning of saw dust and examine for its suitability as a partial replacement of cement into normal concrete. Saw dust has been collected from a wood polishing unit. Chemical and physical properties of wood ash are presented. The mechanical parameters (Compressive Strength, Split tensile strength and Flexural strength) of concrete with blended wood ash cement are investigated and studied. Water to binder ratio 0.4 and seven different percentages of wood ash as partial replacements as been taken i.e., (0%, 2%, 4%, 6%, 8%, 10%, &12%). Results of compressive strength, split tensile strength and flexural strength showed that that strength parameter was increased at 4% partial replacement and decreased by increasing the wood ash. From this study concluded that wood ash can also used as partial replacement material.

Keywords: Wood ash and Strength Parameters.

I. Introduction

Cost of the traditional materials used in construction go on increasing, as due to that materials like cement having a major problem that is global warming due to CO2 which comes from not only cement manufactured industries and also various industries like thermal, agricultural etc., Mainly it was happens faster growing countries like India. Extensive research has being conducted on different industrial by products other than the agricultural material like rice husk ash, wood ash etc. as partial replacements in concrete [I-IV]. An available source, biomass product from forests and waste obtained as a by-product of agricultural has become a promising renewable energy resource. Several researchers had being conducted various tests with partial replacement of wood ash in concrete and showed promising results [V-VI].Thermal properties of fiyashes and biomass ashes including wood bagasse ashes

and sugarcane bagasse ashes can also studied [VII].Mainly the pozzolanic and hydraulic reactivity of the wood ash was depends on the physical properties. In many developed countries wood biomass used as source for renewable power has increasing fame among the wood industry and power sectors. [VII]. Mechanical and completed to utilize wood fiery debris, particularly in development materials to build up a manageable method for its transfer. At 5000C burning temperature carbonate and bicarbonate mixes particularly calcite are dominating in wood fiery remains [VIII] whereas at higher burning temperature like10000C, oxides mixes, for example, speedy lime are in majority in the compound period wood powder. Besides, the nemeses of light metallic components for example, potassium, sodium and zinc diminish after expanding [XI].

The, main aim of the present study to examine the effect of the wood ash as partial cement replacement which it was gathered from the uncontrolled burning of sawdust on the mechanical properties.

II. Materials

i. Concrete Materials
ii. Cement
iii. Fine aggregate(Manufactured Sand)
iv. Coarse aggregate
v. Wood ash

Concrete Materials:
Concrete mixtures have to be investigated in the laboratory by using the following ingredients: cement, gravel,M-Sand, wood ash, Water and super-plasticzer.

Cement:
Ordinary Portland cement of 53 Grade was used in present work conforming type-I (IS-12269-1987).

Table.1. Physical properties of cement

S.No	Particulars	Values
1.	Fineness of Cement	226m^2/kg
2.	Specific Gravity	3.10
3.	Normal Consistency	32%
4.	Initial Setting time Final Setting time	42mins 7hours
5.	Compressive strength 3Days 7Days 28Days	 32.5N/mm^2 43.25N/mm^2 54.5N/mm^2

Fine aggregate (Manufactured Sand):

As there is a shortage for river sand, M-Sand of granite source was used as fine aggregate in the present investigation grading zone conforming zone-II as per IS383:2016. Specific gravity, fineness modulus and water absorption was found as 2.88, 2.80 and 1.2% respectively.

Coarse aggregate:

Both 20mm size as 60% and 40% as 12.5mm crushed granite stone aggregate were used, IS383-2016.Specific gravity 2.71 and water absorption 0.5% was found.

Wood ash:

Saw dust collected from the wood carpenter unit locally and burn with uncontrolled temperature then it was sieved 90microns.

Table.2. Chemical & Physical Properties of Wood ash

S.No	Particulars	Values
1.	SiO_2	32.10%
2.	Al_2O_3	28.05%
3.	Fe_2O_3	2.1%
4.	CaO	10.25%
5.	MgO	9.80%
6.	Specific Gravity	2.02

Super plasticizer:

Master Glenium SKY8630 is an admixture of a new generation based on modified poly carboxylic ether used in the present work for workability. Specific gravity is 1.08.

III. Mix And Casting Of Concrete

For the present study, seven concrete mixes with different proportion of wood ash as partial replacement of 0%, 2%, 4%, 6%, 8%, 10, & 12% by the weight of cement. For the compressive strength 150x150x150mm cubes , for flexural strength 100x100x500mm beams and for split tensile strength 150mm diameter,300mm height cylinders are used for casting. Compacting of concrete was done by vibration as per IS: 516-1959.After 24hours casted specimens were removed from the moulds and kept in water curing for 3days, 7days, 28days & 56days for the each mix and each curing age three specimens were tested and reported average results.

Table.3. Mix Proportions

S.No	Mix	W/b	Cement (Kg/m^3)	Wood as (Kg/m^3)	M-Sand (Kg/m^3)	Coarse Aggregate (Kg/m^3)	W ater (Kg/m^3)	S.P (Kg/m^3)
1.	**0%**	0.42	375.23	0	754.79	1245.54	157.6	1.5
2.	**2%WA**	0.42	367.78	7.44	754.79	1245.54	157.6	2.06
3.	**4%WA**	0.42	360.22	15.0	754.79	1245.54	157.6	2.06
4.	**6%WA**	0.42	352.71	22.51	754.79	1245.54	157.6	2.06
5.	**8.%W**	0.42	345.21	30.0	754.79	1245.54	157.6	2.25
6.	**10%W**	0.42	337.70	37.52	754.79	1245.54	157.6	2.25
7.	**12%W**	0.42	330.20	45.02	754.79	1245.54	157.6	2.25

IV. Testing Program

Mechanical properties were carried on the hardened concrete i.e compressive strength test, split tensile strength test & flexural strength for the different curing age of 3days, 7days, 28daya & 56days and the results were reported.

V. Results & Discussions

Compressive strength:

Table.4. Presents the Compressive strength of wood ash blended cement concrete by different partial replacement. Investigation demonstrates that compressive strength of wood ash blended cement concrete diminished by increasing the wood ash replacement any how the Fig.1 shows clearly at 4% of partial wood ash replacement the compressive strength was slightly increased and slowly decrease by the increasing the replacement levels, Various researchers had corroboration including [XII-XIII]. This pattern of compressive strength is legitimized because of the reason that a molecule demonstrations more as a filler material inside the concrete glue network than in the folio materials. As the substitution rate is expanded, surface zone of filler material to be reinforced by bond increments, in this manner lessening quality. Due to the pozzolanic response there was increase in the compressive strength by increasing the curing age.

Split tensile strength:

Table.4. Presents the split tensile strength of wood ash blended cement concrete by different partial replacement. Investigation demonstrates that Split tensile strength of wood ash blended cement concrete diminished by increasing the wood ash replacement any how the Fig.2 shows clearly at 4% of partial wood ash replacement

the split tensile strength was slightly increased and decrease by the increasing the replacement levels. This results in harmony with the finding [XIV] reported similar reduction. This decrease can be credited to filler action of the wood ash molecule in the solid what's more, poor holding by wood ash molecule in mortar grid because of high surface region.

Flexural strength:

The flexural strength of wood ash blended concrete for various curing age is presented in Table4.. It is obvious from the investigation of the information that the utilization of wood ash brought about decline in the flexural strength with increasing the wood ash content as shown Fig 3. Same perception of decrease in strength was accounted [XV].The decrement in the strength can be expected as the wood cinder Content increment, the measure of concrete expected to coat the filler molecule increment prompting poor holding in the lattice.

Table.4. Strengths of Different Mix

S. No	Mix	Compressive Strength (N/mm^2)				Split Tensile Strength (N/mm^2)				FlexuralStrength (N/mm^2)			
		3Days	7Days	28Days	56Days	3Days	7Days	28Days	56Days	3Days	7Days	28Days	56Days
1.	0%	15.86	25.75	38.63	46.75	2.53	2.81	3.68	4.21	4.8	5.1	5.62	5.77
2.	2%WA	15.95	26.84	39.07	46.83	2.62	2.85	3.71	4.35	4.83	5.12	5.71	5.89
3.	4%WA	16.04	26.95	40.95	47.65	2.71	2.91	3.93	4.49	4.95	5.4	5.77	5.97
4.	6%WA	15.72	25.63	38.52	46.25	2.51	2.79	3.59	4.2	4.75	5.35	5.59	5.65
5.	8.%WA	14.32	24.65	37.23	45.04	2.45	2.73	3.49	4.13	4.72	5.23	5.51	5.61
6.	10%W/	14.08	23.92	37.05	44.95	2.41	2.7	3.35	3.91	4.52	5.01	5.43	5.59
7.	12%W/	13.95	23.75	36.91	44.25	2.20	2.69	3.1	3.75	4.3	4.93	5.27	5.43

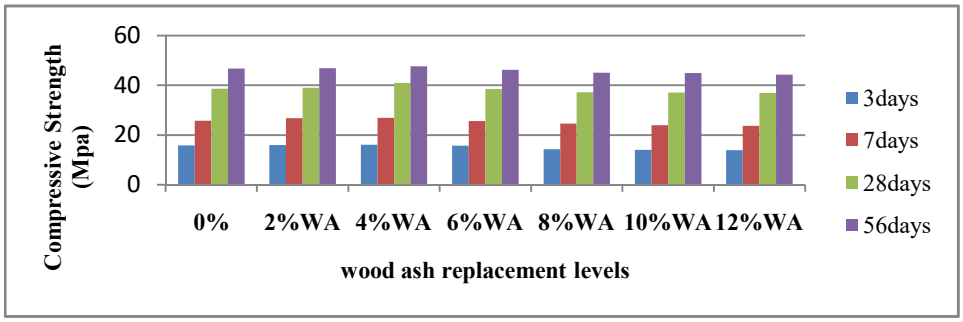

Fig.1.Compressive strength

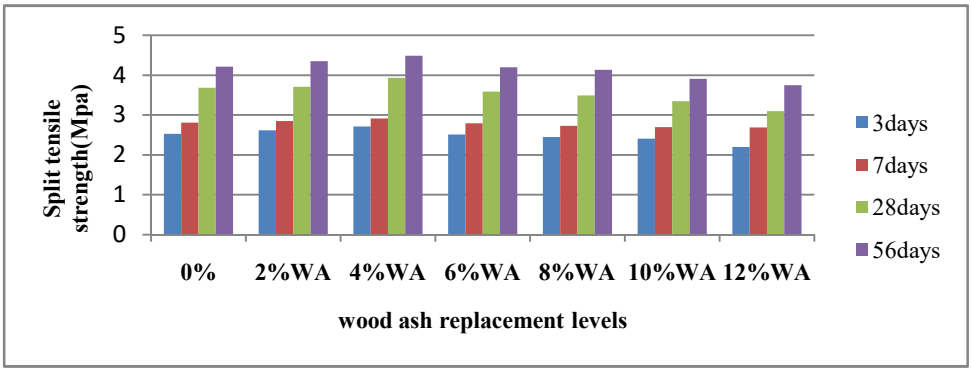

Fig.2. Split tensile strength

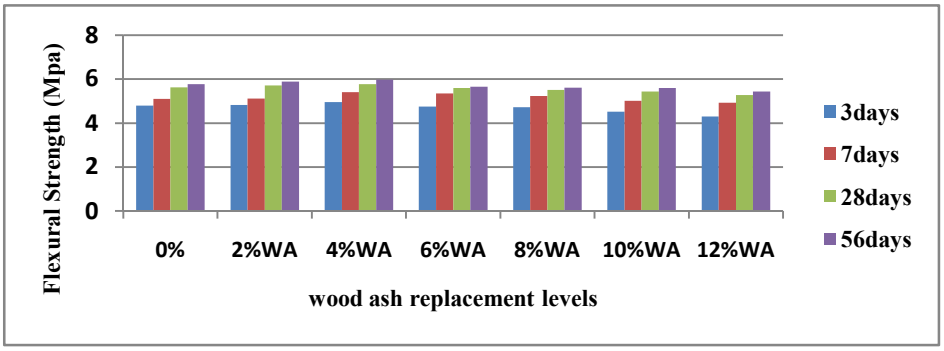

Fig.3. Flexural strength

VI. Conclusion

- Utilization of wood ash in the concrete, changes it from an ecological worry to a valuable asset for the creation of an exceptionally compelling option establishing material.
- Blended wood ash concrete can be used for making the structural grade concrete and precast items.
- Mechanical properties of the concrete mixes slightly increase at 4% and decrease possibly with the increase the percentage of wood ash content. Due the pozzolanic actions the strength was increases with the increasing curing age.

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