



Experimental Study of Concrete Made with Hypo Sludge and Wood Ash

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Abstract:

Rapid development of construction industry increased demand of consumption of cement. But productions of cement increase the greenhouse gases and carbon dioxide. Hence there is need to search for alternative materials in construction. Wood ash and Hypo Sludge (paper waste) is obtained as waste by goods from paper industry and wood industry. This paper industry required large percentage of land space in nearby vicinity every year. Some of wastes are land spread on reep as a disposal technique and some companies blaze their industrial waste in incinerators raising concern about major air pollution problems. Wood ash is obtained from combustion in wood fired, paper mill and other wood blazing facilities. This research investigated the use of Hypo sludge and Wood ash partially replace by cement in conventional concrete. This study examines the wood ash 5% as constant and further 0%, 5%, 10%,15% and 20% replacement of hypo sludge in pace of cement in concrete. It also helps with disposal and pollution problems related with paper industry waste.

Keywords: Cement, Compressive strength, Hypo sludge, Wood ash.

I. INTRODUCTION

Liveliness plays a vital role in developing countries like India. Industrial waste management is a one of the most challenging issues related to the environment. Due to the generation of huge quantity of solid waste we are facing serious air pollution problems. While producing paper many type of wastes are comes out from many process and from these waste preliminary waste is name as hypo sludge. This paper waste contain minimum amount of calcium and silica content. Due to its low calcium is taken out for our project. And during cement production green house gases are emitted in to the environment hence there is a need to find out alternative materials in the construction. By utilizing these waste strength will be increased and reduce the cost of construction. Wood ash is obtained from combustion of wood. And this is prepared from unrestrained blazing of timber. During the last decades it has been recognized with wood ash waste from large volume. Eco friendly and economical solution will be archived by using this waste. Paper waste and wood waste required a large amount of local land space each and every year for disposal technique. Some of wastes are land spread on reep as a disposal technique and some companies blaze their industrial waste in incinerators raising concern about major air pollution problems. Paper industry is a major issue related to the environment and pollution. The re-use of waste is really crucial as it not only decrease the pollution and prevent green house effect but also helps in saving energy in production process by recycling. During the cement production green house gases and CO₂ is emitted in the atmosphere which is harmful to environment. Concrete is mix with Cement, water, coarse, fine aggregates and admixtures. Paper making generally produces a large amount of solid waste. Paper fibers can be recycled only a limited number of times before they become too short or weak to make high quality paper. It means that the broken, low-quality paper fibers are separated out to become waste sludge. The chemical composition of paper will depends on the type or grade of paper. Typically most grades of paper consist of

organic and inorganic material. Organic portion consisting of cellulose, hemi-cellulose, lignin. Hypo-sludge which is available in abundance in the vicinity of every paper mill is not a waste but a useful material which can be used in concrete manufacturing.

II. MATERIALS USED

A. Hypo Sludge

Hypo sludge is formed as waste from paper industry and do not contain any bio-degradable element. Hypo Sludge becomes a new advance material that can be used as material to support the green technology. Hypo sludge behaves like cement because of silica and magnesium properties. This silica and magnesium improve the setting of the concrete. It is used as cement replacement in producing concrete and was investigated on its chemical and physical properties.



Figure 1. Paper Waste

Table 1 : Chemical properties of Hypo Sludge

Sr. No	Constituent	Proportion %
1.	Moisture Content	72.85
2.	MgO	0.15
3.	Calcium oxide	3.16
4.	Silica	31.60
5.	Loss in Ignescient	27

Table.2. Physical properties of Hypo Sludge

Sr. No	Constituent	% Percent in hypo sludge
1.	Specific gravity	2.84

B. Wood Ash

Wood ash is obtained from the combustion of wood. Wood ash prepared from the uncontrolled burning of the wood. During the last decades it has been recognized with growing wood ash waste of large volume and that is increasing year in the household, mills and factories. Wood ash is generated as a by-product of combustion in wood fired power plants, paper mills, and wood burning factories. Since wood is a potential source of energy and environmentally being friendly material, there will be increased usage of wood in energy production in future.

**Figure. 2. Wood Ash****Table .3. Properties of Wood Ash**

Sr. No	Constituent	Composition%
1.	SiO ₂	32.4
2.	Al ₂ O ₃	20.7
3.	Fe ₂ O ₃	3.5
4.	CaO	13.70
5.	MgO	10.65
6.	NaO	8.5

C. Cement

The Ordinary Portland Cement of 53 grade Cement conforming to IS 12269:1987 was used. the properties determined as per Indian standard

Table .4. Physical properties of Cement

Sr. No	Physical properties	Results	Requirements as per IS 12269-1957
1.	Specific gravity	3.5	3.10-3.15
2.	Consistency	34%	30-35%
3.	Initial setting time	48 min	30 min
4.	Final setting time	255 min	600 min

D. Fine Aggregate

Fine aggregate which passes through 4.75 mm IS sieve and retained on 75 micron and conforms to IS 383-1970, zone-used in entire work. The properties are determined as per relevant Indian standards.

E. Coarse Aggregate

Coarse aggregate which passes through 20 mm IS sieve and retained 4.75 mm, naturally occurring crushed stone used in the work. The properties of coarse aggregate are determined as per relevant Indian standards

F. Water

Fresh and clean tap water was used for casting the specimens in the present study. The water was relatively free from organic

matter, silt, oil, sugar, chloride and acidic material as per BIS: 456-2000.Prepare

III.DESIGN MIX METHODOLOGY

Mix design was done for M25 concrete as per the Indian standard code specifications (IS 10262-2007).

Initial tests on all the ingredients of concrete were done. The degree of workability was found using slump test. Testing of concrete plays an important role in calculating and confirming the quality of cement concrete works. The experimental work involves the compressive test on cube involving various grades of replacement material of Hypo sludge (0%, 5%, 10%, 15% & 20%) and Wood ash(5% as constant) and hence a total no of 45 cubes were casted and tested.

Table .5. Mix Design Proportions

	Cement	Fine Aggregate	CA Aggregate	Water
By Weight (Kg)	350kg/cu m	746kg/cu m	1278kg/cu m	151kg/cu m
By volume(m ³)	1 cum	2.1cum	3.6cum	0.43cum

Table. 6. concrete design mix proportion for m25 grade

Concrete mix	CONCRETE DESIGN MIX PROPORTION FOR M25 GRADE					
	W/C	Cement	FA	C A	Wood Ash	Hypo Sludge
M1	0.43	350	1055	875	-	-
M2	0.43	315	1055	875	17.5	17.5
M3	0.43	297.50	1055	875	17.5	35
M4	0.43	280	1055	875	17.5	52.5
M5	0.43	262.50	1055	875	17.5	70

IV.RESULTS AND DISCUSSIONS**a. Workability**

Workability of concrete was tested using slump test apparatus immediately after preparing concrete. The slump value for each mix with and without hypo sludge and wood ash is given in Table 7.

Table.7. Slump test for M25 partial replacement in % wood ash & hypo sludge

Mix	Wood ash and Hypo sludge	Slump in mm	Workability
M1	0%	100	Medium
M2	5%+5%	90	Medium
M3	5%+10%	85	Medium
M4	5%+15%	80	Medium
M5	5%+20%	75	Medium

It was observed that the workability of concrete decreases as the content of Wood ash and hypo sludge increases. The slump for 0% Wood ash and hypo sludge was 100mm, while slump for 20% hypo sludge was 75mm.

b. Compressive Strength

150mm×150mm×150mm concrete cubes are casted by using M25 grade concrete design. Specimens with Ordinary Portland Cement (OPC) and OPC replaced with wood ash 5% as constant and further 0%, 5%, 10%, 15% and 20% replacement of hypo sludge in place of cement in concrete. During casting, the cube is mechanically vibrated in vibrator. After 24 hours the specimens are removed from the mould and subjected to water curing for 7, 14 and 28 days. After curing, the specimens are tested for compressive strength using a compression testing machine of 3,000 KN capacity. The following graph below shows the compressive strength test result of concrete cube containing Cement replaced by hypo Sludge and wood ash

Table.8. compressive strength at 7, 14 and 28 days for M25

Concrete Mix	% Replacement of cement by WA & HS	Avg. Compressive Strength(N/mm ²)		
		7 Days	14 Days	28 Days
M1	WA0%-HS0%	21.32	27.60	31.76
M2	WA5%-HS5%	22.72	28.85	31.84
M3	WA5%-HS10%	21.49	28.51	29.88
M4	WA5%-HS15%	21.46	26.65	28.75
M5	WA5%-HS20%	20.82	25.84	28.54

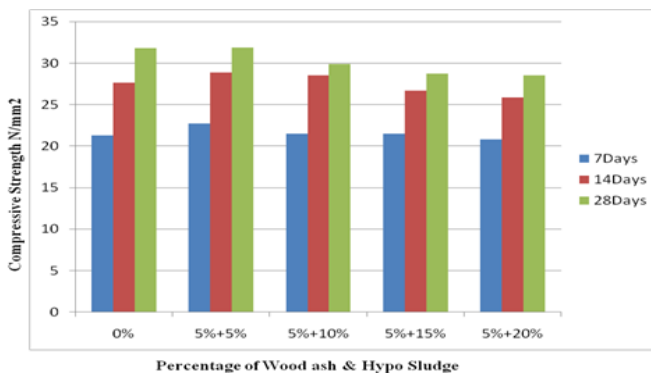


Figure. 3. Compressive strength of cubes for M25

A table vibrator was used for compaction of the hand filled concrete cubes. The specimens were demoulded after 24 hours and subsequently immersed in water for different age of testing. For each age three specimens were tested for the determination of average compressive strength. The test was performed on compression testing machine.

V. CONCLUSION

Hypo Sludge is a better inventive supplementary cementations construction material which is used in concrete, so it can save the paper industries waste disposal costs and produce a greener concrete for construction. Compressive strength initially increases when cement replaced hypo sludge and wood ash as we step by step increase the percentage from 0% up to 5%. As hypo sludge and wood ash percentage increases compressive strength. Workability of concrete mix decreases with increase in hypo sludge and wood ash content. Use of hypo sludge and wood ash in concrete can minimize disposal problems and useful concrete for construction. Environmental effects from wastes and residual amount of cement production can be reduced through this research. This research concludes that hypo sludge and wood ash can be inventive supplementary cementation construction Material.

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