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An Experimental Study on Concrete by Partial Replacement of Cement with Woodash and Fine Aggregate with Saw Dust

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ABSTRACT— In this project main objective is to study the partial replacement of the Cement with Wood Ash and Fine Aggregate with Saw dust with the varying proportion in the concrete and to check the different properties of the concrete by comparing with the controlled concrete. In this study an attempt has been made with a M25 mix proportion. Experimental study is conducted to evaluate the strength characteristics of hardened concrete. The Cement has been replaced by Wood Ash in the range of 0%, 5%, 10%, 15% and 20% by weight of cement. The Fine Aggregate has been replaced by Saw Dust in the range of 0%, 10%, 20%, 30%, and 40% by weight of Sand. The strength is studied in this project. The most important properties of concrete are the compressive strength.

Keywords – Cement, Wood Ash, Fine Aggregate**,** Saw dust, Compressive Strength Test.

I. INTRODUCTION:

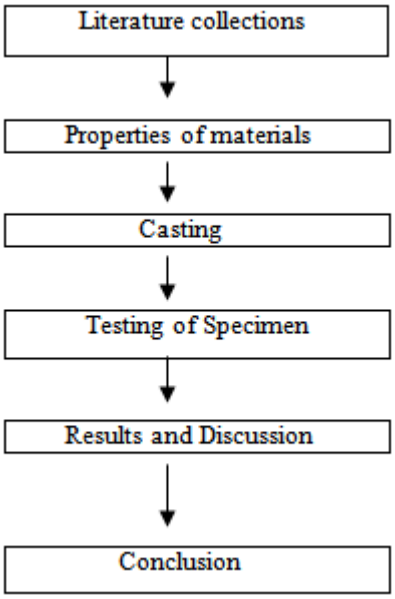
Wood ash in this study is an admixture: a pozzolana. A pozzolana is a material rich in silica and alumina which in itself has little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties. Sawdust is also known as wood dust. It is the by-product of cutting, drilling wood with a saw or any other tool; it is composed of fine particles of wood. Sawdust's are produced as a small discontinuous chips or small fragments of wood during sawing of logs of timber into different sizes. The Concrete obtained from sawdust is a mixture of sawdust, gravel with certain percentage of water to entrance the workability and full hydration of the cement which provide great in bonding of the concrete. Saw dust concrete is light in weight, cost efficient and it has satisfactory heat insulation and fire resisting values.

Objective:

1. To study the compressive strength of concrete, partial replacement of cement with wood ash and fine aggregate with saw dust.
2. To find which percentage replacement is much cost efficient without affecting its strength.

II. METHODOLOGY

The step by step process of this project is explained in the flow chart.



III. AIM OF THE PROJECT

The aim of our project is to study the compressive strength of concrete mix of M25 grade, with a partial replacement of cement with

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Wood ash with 0%, 5%, 10%, 15%, and 20% & fine aggregate with Saw dust with 0%, 10%, 20%, 30% and 40%.

IV. PROPERTIES OF MATERIALS

3.1 Cement

Ordinary Portland cement of 53 grade conforming to both the requirements of IS: 12269 and ASTM C 642-82 type-I was used.

S.No	Property	Result
1	Normal Consistency	36%
2	Initial setting time	≮44min
3	Final setting time	≯7hrs
4	Specific gravity	3.12

3.2 Wood Ash

Specific gravity of wood ash is 2.47

3.3 Fine Aggreagate

S.No	Property		Result
1	Specific gravity		2.58
2	Water Absorption		0.5

3.4 Saw Dust

Specific gravity of Saw Dust is 1.21

3.5 Coarse Aggregate

S.No	Property	Result
1	Specific gravity	2.78
2	Water Absorption	1

V. MIX DESIGN (M25)

TARGET STRENGTH FOR MIX PROPORTION

$f_{ck}' = f_{ck} + 1.65s$

f_{ck} = Target average compressive strength at 28 days

f_{ck} = Characteristic Compressive strength at 28 days

s = Standard deviation

From table 1, IS 10262:2009,s = 5N/mm^2

Target strength f_{ck}' = 31.6 N/mm^2

SELECTION OF WATER CONTENT

From table 5, IS 456:2000,

Maximum water-cement ratio = 0.45

Adopt water-cement ratio as 0.40 < 0.45, Hence OK

SELECTION OF WATER CONTENT

From table 2, IS 10262:2009

Maximum water content = 186 kg/m^3

Estimate water content for 0mm slump = 186litres

Adopted water content = 180 litres

CALCULATION OF CEMENT CONTENT

Water-cement ratio = 0.4

Cement content = $\frac{180}{0.40}$ = 450 kg/m^3

From table 5, IS 456:2000, minimum cement content for severe exposure condition = 360 kg/m^3

450 kg/m^3> 360 kg/m^3, hence OK

PROPORTION OF AGGREGATES

From table 3 IS 10262:2009

Volume of coarse aggregate corresponding to 20mm size aggregate & fine aggregate of W/C ratio

0.50 = 0.60

0.40 = 0.62

Volume of coarse aggregate = 0.62

Volume of fine aggregate = 1-0.62 = 0.38

MIX CALCULATION

a. Volume of concrete = 1m3

b. Volume of cement = $\frac{\text{mass of cement}}{\text{specific gravity of cement}} X \frac{1}{1000}$

= 0.144m^3

c. Volume of water = $\frac{\text{mass of water}}{\text{specific gravity of water}} X \frac{1}{1000}$

= 0.18m^3

d. Volume of all in aggregate = [a-(b+c)]= 0.676m^3

e. Mass of coarse aggregate = d X Volume of C.A

X sp.gr of C.A X 1000

= 1165.15kg/m^3

f. Mass of fine aggregate = d X Volume of F.A

X Sp.gr of F.A X 1000

= 662.75kg/m^3

MIX PROPORTIONS

Cement = 450kg/m^3

Water = 180kg/m^3

Fine aggregate = 662.75kg/m^3

Coarse aggregate = 1165.15kg/m^3

Water-cement ratio = 0.40

MIX RATIO = 1: 1.47: 2.5

VI. COMPRESSIVE STRENGTH TEST

In compressive strength test the cube specimen was placed with the cast faces of the cube at right angles to that as cast in the compressive testing machine. According to standard constant rate up to the failure of the specimen and the ultimate load was noted. Cube compressive strength was tested and results were tabulated in table.

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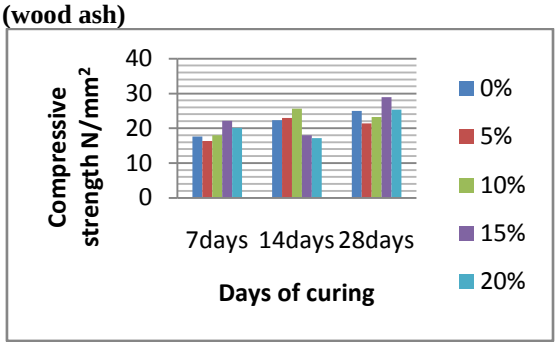
Compressive Testing Machine

Compressive strength result Days vs Percentage of Wood ash

Days	0%	5%	10%	15%	20%
7	17.66	16.37	18.05	22.18	20.14
14	22.3	23.01	25.66	18.04	17.24
28	25	21.45	23.28	29	25.37

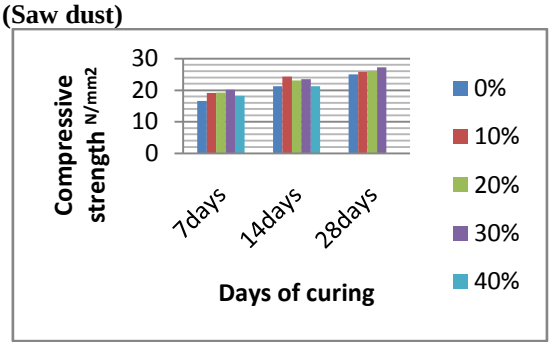
Comprising graph between Days Vs Percentage (wood ash)



Compressive strength results with Days vs Percentage of Saw dust

Days	0%	10%	20%	30%	40%
7	16.66	19.16	19.23	20.13	18.23
14	21.3	24.32	23.1	23.56	21.27
28	25	25.89	26.14	27.23	23.08

Comprising graph between Days Vs Percentage (Saw dust)



VII. CONCLUSIONS:

Following points are observed in the current study:

1. Wood ash chemical characteristic differs with species of wood but chiefly contains lime and silica.
2. The particles of wood ash are coarser than that of cement and have higher specific surface as compared to cement due to porous nature and irregular shape.
3. Incorporation of wood ash as partial replacement of cement adversely decreases the slump of concrete.
4. There was an increase in water absorption with increase in wood ash percentage.
5. Wood ash at replacement percentage up to 15% of the weight of binder can be successfully used as addictive in place of cement to produce structure grade concrete.
6. The utilization of saw dust in concrete provides additional environmental as well as technical benefits for all related industries.
7. Partial replacement of saw dust reduces the cost of making concrete.
8. It has been observed that when we increase the saw dust percentage the compressive strength of the concrete decrease.
9. To achieve a better result saw dust, replace with fine aggregate by 30%.

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