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Research Article

Low Cost Construction Material for Concrete as Sawdust

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Abstract

In this Research paper, it was experimentally carried out to investigate the effects of introducing the cost between sand used concrete block and sawdust used concrete block. For making the concrete blocks we are using coarse aggregate, fine aggregate, cement, water and sawdust to mix it. Using some percentage of sawdust in place of sand in concrete is used. We replace replaces 10%, 15% and 20% of sawdust instead of sand while other things are same. After making the concrete blocks I am going to see the difference in weight between the originally concrete block and the sawdust concrete block. The unit density of the concrete block is tested also. Research paper has proved that saw dust Concrete can be used as a Structural Concrete at suitable replacement percentage .and also affects the cost of the construction.

Keywords: *Saw dust, structural properties, strength*

1. Introduction

Sawdust is a by-product of cutting, grinding, drilling, sanding, or otherwise pulverizing wood with a saw or other tool; it is composed of fine particles of wood. Certain animals, birds and insects which live in wood, such as the carpenter ant are also responsible for producing the saw dust. Sawdust has a variety of other practical uses, including serving as mulch, as an alternative to clay cat litter, or as a fuel. Until the advent of refrigeration, it was often used in icehouses to keep ice frozen during the summer. It has been used in artistic displays, and as scatter. It is also sometimes used to soak up liquid spills, allowing the spill to be easily collected or swept aside. As such, it was formerly common on barroom floors. Mixed with water and frozen, it forms pyrite, a slow-melting, much stronger form of ice. Sawdust can be used as alternative substitute for fine aggregate in concrete production. Before using the saw dust it should be washed and cleaned. because of large amount of barks are present which can affect setting time and heat of hydration of cement. 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. Sawdust concrete is light in weight and it has satisfactory heat insulation and fire resisting values. Nails can be driven and firmly hold in sawdust concrete compare to other lightweight concrete which nail can also easily drive in but fail to hold construction community might well be aware of, incorporating organic materials into solid concrete is not such a good idea to begin with. First of all, its loose molecular structure would cause the structure to fail at a certain stage and second, it would compete and retard the hydration process of cement. Also, presumptions indicate that if each sawdust particle took up enough water during hydration, they could aid the hydration process especially in the center parts of concrete that is impossible to cure with water thus eliminating the need of curing because water deposited in sawdust particles are being harvested by cement particles. The most important aspect and main target of the experiment are proving that sawdust-cement-gravel mixtures can prove to be more lightweight and cost efficient. Since sawdust is already waste then the cost would go down as well as weight cause of its extremely light unit weight. Sawdust is used in concrete more than 40 years.

Table.1. Chemical characteristics of Saw dust

S.N.	Constituents	Percentage (by weight)
1.	SiO_2	87
2.	Al_2O_3	2.5
3.	Fe_2O_3	2.0
4.	MgO	0.24
5.	CaO	3.50
6.	Loss on ignition (LOI)	4.76

Materials used

Saw dust: 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. Certain animals, birds and insects which live in wood, such as the carpenter ant are also responsible for producing the saw dust.

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Sawdust's are produced as a small discontinuous chips or small fragments of wood during sawing of logs of timber into different sizes. The chips flow from the cutting edges of the saw blade to the floor during sawing operation.

Table 2: Physical Characteristics of Saw dust

S.N.	Properties	Value
1.	Optimum moisture content (%) (OMC)	19.80
2.	Maximum dry density(g/cc) (MDD)	1.40
3.	Specific gravity (G)	2.15
4.	Cohesion C (KN/m^2)	7
5.	Angle of internal friction	30^0
6.	Un-soaked CBR (%)	5.2
7.	Soaked CBR (%)	2.95
8.	Free swell index	80
9.	Soil classification	ML

Fig.1. Saw Dust

Cement: Cement used in the experiment work is White Portland cement conforming to IS: 8042-1989.The properties of White cement are nearly same as OPC. A typical test result of Birla White Cement as given by manufacturer is shown in following Table.

Table.3. Chemical Properties of Cement

Characteristics	IS:8042:1989	Birla White Portland cement
Insoluble residue(%)	Max 2.0	0.60
Iron oxide(%)	Max 1.0	0.20
Magnesium oxide(%)	Max 6.0	0.80
Sulphur trioxide(%)	Max 3.0	2.90
Alumina/iron oxide(%)	Min 0.66	9.00
Lime saturation factor	0.66-1.09	0.90
Loss of ignition(%)	Max 5.0	<3.00

Table.4. Physical Properties of Cement

Characteristics		**IS:8042:1989**	**Birla White**
Degree of whiteness%		Min 70	88+
Fineness(m^2/kg)		Min 225	450
Setting time	Initial(min.)	Min 30	80
	Final(min.)	Max 600	120
Compressive Strength (cement and standard sand mortar 1:3)	3 days (MPa)	Min 14.4	45
	7 days (MPa)	Min 19.8	55
	28 days (MPa)	Min 29.7	67
Soundness	Lechateliers method(mm)	Max 10	1.0
	Autoclave expansion%	Max 0.8	Negligible
Retention on 63 micron sieve(%)		-	1.0

Fine Aggregates: Fine aggregate was purchased which satisfied the required properties of fine aggregate required for experimental work and the sand conforms to zone III as per the specifications of IS 383:1970.
a) Specific gravity = 2.7
b) Fineness modulus = 2.71

Coarse Aggregates: Crushed granite of 20 mm maximum size has been used as coarse aggregate. The sieve analysis of combined aggregates confirms to the specifications of IS 383: 1970 for graded aggregates.
a) Specific gravity =2.64
b) Fineness Modulus = 6.816

Water: Water is an important ingredient of concrete as it actively participates in the chemical reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water is required to be looked into very carefully. Mixing water should not contain undesirable organic substances or inorganic constituents in excessive proportions. In this project clean potable water is used.

Mix design for M-20 Grade Concrete

Design Stipulations

Characteristic Compressive Strength required at the end of 28 days: 20 N/mm^2
Maximum size of Aggregate: 20mm (Angular)
Type of Exposure: Moderate
Degree of Quality Control: Good

Test Data for Materials

Specific Gravity of Cement: 3.15
Specific Gravity of Coarse Aggregate: 2.64
Specific Gravity of Fine Aggregate: 2.70

Target Mean Strength of Concrete

For a tolerance factor of 1.65, the obtained target mean strength for the given grade of concrete = 27.6 N/mm^2

Selection of Water Cement Ratio

The free water cement ratio for the obtained target mean strength is 0.50.This is equal to the value prescribed for Moderate conditions in IS 456.

Table.5 The mix proportion

Water	Cement	Fine aggregate	coarse aggregate
0.5	1.0	1.5	3.0
210kg	420kg	630kg	1260kg

Note-In this experiment, we prepared 6 test specimens of control concrete & 10%, 15%, & 20% fine aggregate replaced by saw dust by volume each.

Table.6 The results of the compressive strength of saw dust Concrete

	Age (Days)	Control concrete	Percentage Replacement with saw dust		
			10%	15%	20%
Average Compressive strength (N/mm^2)	7	18.59	22.66	21.48	19.62
	14	20.59	18.15	18.30	20.50

Table.7 Strength at 7 And 14 days with respect to % replacement of saw dust

	Ages (Days)	Percentage Replacement with saw dust		
		10%	15%	20%
Increase(+) or decrease (-) strength %	7	21.89	15.54	5.54
	14	-11.85	-11.12	-0.437

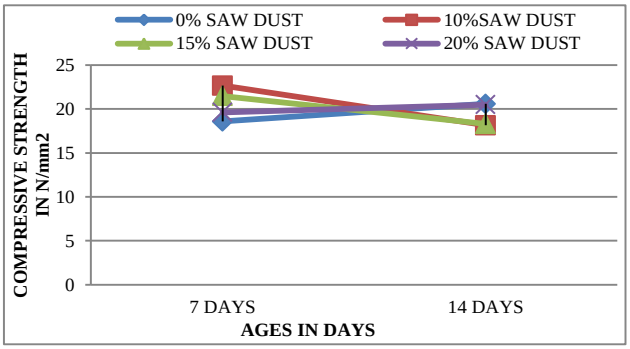

Fig.2 Variation of Compressive strength with age and percentage of saw dust

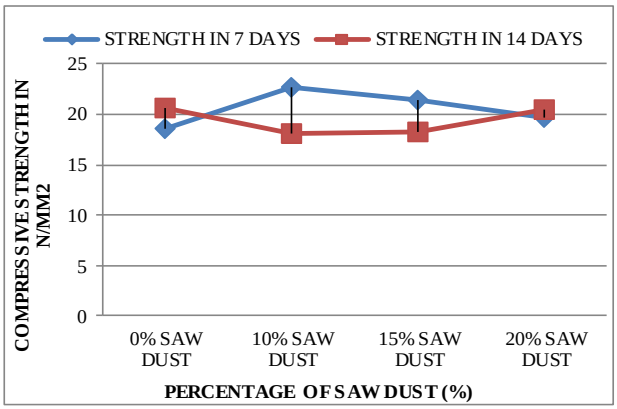

Fig.3 Percentage of saw dust v/s Compressive strength

Conclusion

Based on the limited study carried out on the strength behaviour of saw dust the following conclusions are drawn:

- At the initial ages, with the increase in the percentage replacement of saw dust, the strength as well as compressive strength increases.
- Moreover with the use of saw dust, the weight of concrete reduces, thus making the concrete lighter which can be used as a light weight construction material in many civil engineering purposes.

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