An Experimental Study on Partial Replacement of Cement by Using Sawdust Ash in Concrete

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ABSTRACT

Sawdust is used in the manufacture of charcoal briquettes. For using sawdust ash (SDA) as a construction material was experimentally investigated. Sawdust was burnt and the ash sieved using a 90-micron sieve. The setting time and mechanical properties depended upon the proportion and characteristic of raw material and water to binder ratio. In this study, replacement of OPC by 5%, 10 %, and 15%, by sawdust ash is proposed.

This mix design of concrete for M_{25} grade is done. Experimental investigation is carried out on concrete cubes, cylinder and prism specimens. To replace this cement with saw dust ash various tests are performed on the quality and various mechanical properties strengths like compression strength, split tensile strength will be assessed for all the mixes. Based on the strength properties of SA concrete optimum mix will be found.

keyword: saw dust ash, M25 mix design, compressive strength, split tensile strength

INTRODUCTION

General

Concrete is one of the most widely used construction material in the world. It is composed of coarse aggregate, fine aggregate, cement and water. It has been in used for over a century in all construction works. A new material in the field of concrete technology has been developed during the recent past with the ongoing demand of industries to meet the functional, strength economical and durability requirement.

In India, the production is 50 million m3 of logs in 2015. In the wood production

industry about 15 - 20 % waste is generated from total production although the reutilization of wood waste has been practiced.

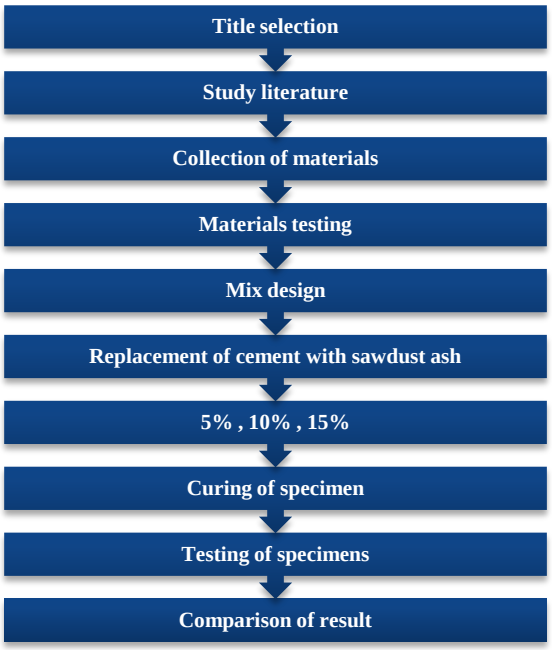
Scope

study covers compressive experimental laboratory examination on This the partial replacement of Portland cement with sawdust.Sawdust is a pollozonic material that can serve as partial replacement to cement due to siliceous.Aluminous material which, in themselves, posses little or no cementitious value but which will, in finely divided from and in the presence of waterReact chemically with calcium hydroxide at ordinary temperature to form compounds possessing cementitious properties

Advantages

Dry sawdust or planer shavings properly packed in the walls and attics of building afford excellent heat insulation. During construction the brickwork had been back-plastered and a space which had been left between the brick and the tiles was filled with sawdust insulation Combining sawdust with water, and freezing creates a better insulating barrier in an ice capsule

METHODOLOGY



STUDY ON MATERIALS

Cement

It constitutes only about 20 percent of the total volume of concrete mix; it is theactiveportionofbindingmediumandisthe onlyscientificallycontrolledingredient of concreteThe OPC is classified into three grades, namely 33 Grade, 43 Grade, 53Gradedependingupon the strength of 28days.

M Sand

Manufactured sand (M-Sand) is an additional of river sand for concrete structures. Manufactured sand is created as rigid granite stone by crushing.The crushed sand is of cubical form with grounded boundaries, washed and

classified as a building material. The extent of manufactured sand (M- Sand) is a reduced amount of 4.75 mm.

Coarse aggregate

Crushed graves or stone obtained by crushing of gravel or hardstone.Uncrushed gravel or stone resulting from the naturaldisintegration of rock.Partiallycrushedgravelobtainedasproduct ofblendingofabovetwotypes.

Sawdust ash

Sawdust is an organic waste resulting from the mechanical milling or processing of timber (wood) into various shapes and sizes. The dust is usually used as domestic fuel. Dry sawdust concrete weighs only 30% as much as normal weight concrete and its insulating properties approximate those of wood. Sawdust has been used in concrete for at least 30 years, but not widely.

Water

Water is the key ingredient, which when mixed with cement, forms a paste that binds the aggregate together.The water causes the hardening of concrete through a process called hydration.

CHARACTERISTICSOF MATERIALS

Cement

Characteristics	ValuespecifiedbyIS
SpecificGravity	3.13
Standardconsistency(%)	33 %
InitialSettingTime	30 (minutes)
FinalSetting Time	600 (minutes)

M Sand

Characteristics	Value specified by IS
Bulk density	1.78 Kg/m^3
Fineness modulus	2.10
Specific gravity	2.34

Coarse aggregate

Characteristics	Value specified by IS
Size	20mm
Shape	Angular
Specific Gravity	2.74

Sawdust ash

Moisture content	10.8
Apparent specific gravity	0.14
Porosity %	84
Water retention	50

TESTING

COMPRESSIVE STRENGTH FOR SAW DUST ASH

Compressive strength after 7 days for cube

S. No	Mix Description	Compressive strength (N/mm²)	Average Compressive
1	CM	11.70	12.1
		12.5	
2	5%	13.2	13.58
		13.94	
3	10%	14.89	14.41
		13.94	
4	15%	11.73	12.67
		13.62	

Compressive strength after 28 days for cube

S. No	Mix Description	Compressive strength (N/mm²)	Average Compressive
1	CM	17.98	19.25
		20.52	
2	5%	24.52	23.42
		22.32	
3	10%	28.72	26.67
		24.62	
4	15%	21.41	22.33
		23.25	

SPLIT TENSILE STRENGTH FOR SAW DUST ASH

Table Split tensile strength of cylinder for 7 days

Mix (%)	Split tensile strength(N/mm2) after 7 days		Average compression strength after 7 days
	Specimen 1	Specimen 2	
CM	2.42	2.82	2.26
5%	2.72	2.96	2.84
10%	3.92	3.98	3.95
15%	3.69	3.23	3.45

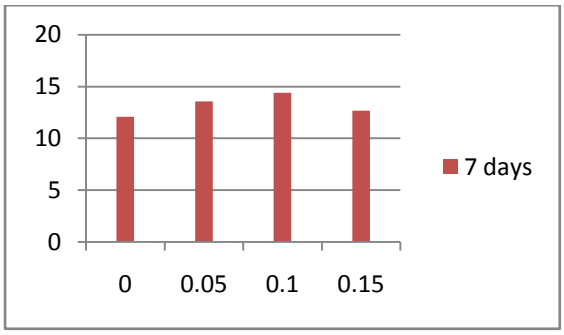
Split tensile strength of cylinder for 28 days

Mix (%)	Split tensile strength(N/mm2) after 28 days		Average compression strength after 28 days
	Specimen 1	Specimen 2	
CM	4.47	4.76	4.71
5%	4.81	4.68	4.75
10%	4.92	4.89	4.91
15%	4.74	4.56	4.65

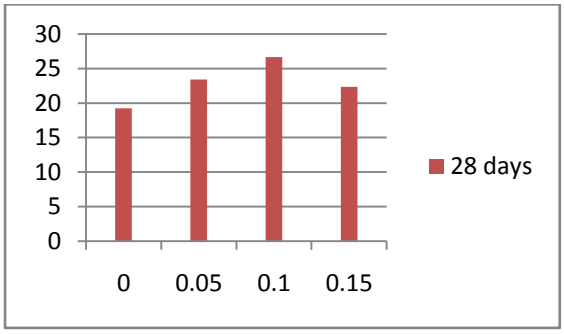
RESULT

COMPRESSIVE STRENGTH FOR SAW DUST ASH

Compressive strength after 7 days for concrete

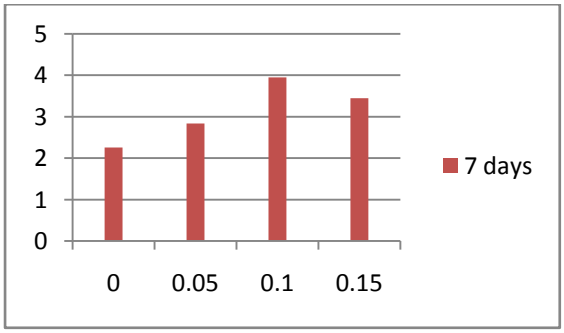


Compressive strength after 28 days for concrete

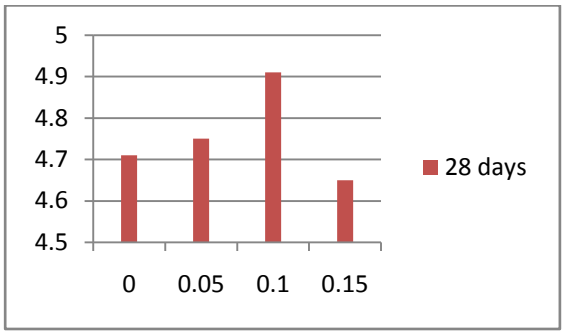


SPLIT TENSILE STRENGTH FOR SAW DUST ASH

Split tensile strength of cylinder for 7 days



Split tensile strength of cylinder for 28 days



CONCLUSION

The compressive strength of conventional concrete at 28 days is 19.25 MPa and 10% sawdust ash concrete is 26.67 MPa, it shows the 10.34 % improvement form conventional concrete. For other present age of SDA (sawdust ash) the strength is below 20 MPa, thus optimum present age of SDA is 10%. The split tensile strength of conventional concrete for 28 days is found to be 4.71 MPa and that for 10% sawdust ash concrete is 4.91 MPa. It shows the 34.41% improvement from conventional concrete. The optimum use of sawdust ash is 10%. Finally, from the experimental analysis we have found that 15% replacement of sawdust ash with cement in cement concrete is beneficial replacement. And we go beyond this for further replacement in percentage of cement we will see decrease in strength of concrete.

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