

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 9, September 2017

Effect on Properties of Concrete by Using Saw Dust Ash as Partial Replacement of Cement

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ABSTRACT : Saw dust is also known as wooden dust. It is the remains of cutting & drilling wood. It is composed of fine particles of wood, certain inserts which live in wood such as carpenter out. It is produced as small irregular chips or small garbage of wood during sowing the logs of wood into different sizes. In this study, saw dust ash prepared from uncontrolled burning of saw dust is evaluated for its suitability as partial cement replacement in concrete. The strength parameters i.e. compressive strength of concrete with blended saw dust ash cement are evaluated & studied by replacing cement by 5%, 10%, 15%, 20% by wt. to OPC Slump Test was carried out on fresh concrete & compressive strength test was carried out on hardened concrete. Several cubes were tested at 7 and 28 day. The result showed that saw dust ash is good replacement material for cement with SiO_2 , Al_2O_3 & Fe_2O_3 of 72%. The slump value decreased with increase in saw dust ash. The compressive strength increased up to 10% SDA content and then decreased with further increase of SDA content.

KEYWORDS: Concrete, cement, saw dust ash, compressive strength, workability.

I. INTRODUCTION

Generally concrete is composite construction material composed of cement and other filler material like coarse aggregates, fine aggregates, chemical admixtures & water for mixing. Depending upon nature of work the cement, fine aggregates, coarse aggregates & water are mixed in specific proportion to produce fresh & plain concrete. The aim of mix design is to achieve max. durability, workability and compressive strength as far as possible without compromising with quality. Engineers are trying to increase the limits of concrete with help of some innovative chemical admixture along with modified manufacturing technique.

The use of concrete is increased & the rate of construction is increased. Concrete is used in construction of different structures with long life. In a survey conducted few years ago it was found that million tons of waste material is produced & burned every year like saw dust ash. Appropriate utilization of such waste materials brings ecological & economical benefits.

Saw dust ash is a waste material produced by timber industry. It is produced as timber is sawn into planks at saw mills. This causes heaps of saw dust to be generated each day. So to use this waste material as replacement of cement is the focus of study. This study examined the use of saw dust ash as partial replacement for Ordinary Portland Cement (OPC) in concrete. It was observed that when fine aggregates were partially replaced with 10%, 15%, 20%, 25% waste material there was some effect on workability and compressive strength of concrete. It involved determination of workability and compressive strength of concrete.

II. LITERATURE REVIEW

Mahmoodh (2002) considered ash from timber waste as cement replacement method. Elilnwa and Ejeh (2004) considered the effect of incorporation of waste of fly ash in cement paste mortar. Elilnwa (2008) assessed the fresh concrete properties of self compacting concrete containing SDA. Cheah and Remli (2011) investigated the implementation of wood waste & partial cement replacement material in production of structural grade concrete & mortar.

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III. OBJECTIVES

- The main objective of this study is proper utilization of waste material (saw dust ash) as fine aggregates which is mixed with OPC to investigate the effect of this saw dust ash on properties of concrete of M25 grade.
- To evaluate and compare the result of workability and compressive strength of M25 grade concrete by using wooden dust ash with standard concrete.
- To ensure optimum use of domestic and industrial waste & reduce carbon footprints.
- To generalize the properties of concrete with use of saw dust ash.

IV. MATERIALS USED AND METHODOLOGY

(i). Saw dust ash

A waste material from timber industry having following characteristics:-

Oxide	% (by wt.)
SiO ₂	68.30
Al ₂ O ₃	3.5
Fe ₂ O ₃	2.23
MgO	5.4
CaO	5.0

(ii). Cement

Cement, ordinary Portland cement of grade 43 was used (Jaypee cement), with following physical properties :-

Characteristics	Value
Sp. Gravity	3.15
Consistency %	33%
I.S. Time	105 (min)
F.S. Time	260 (min)

(iii). Aggregates

20mm size of aggregates was used as coarse aggregates and 4.75mm size of aggregates was used fine aggregates as per IS 383:1970.

(iv). Water

Clean & portable water was used for mixing and curing purpose

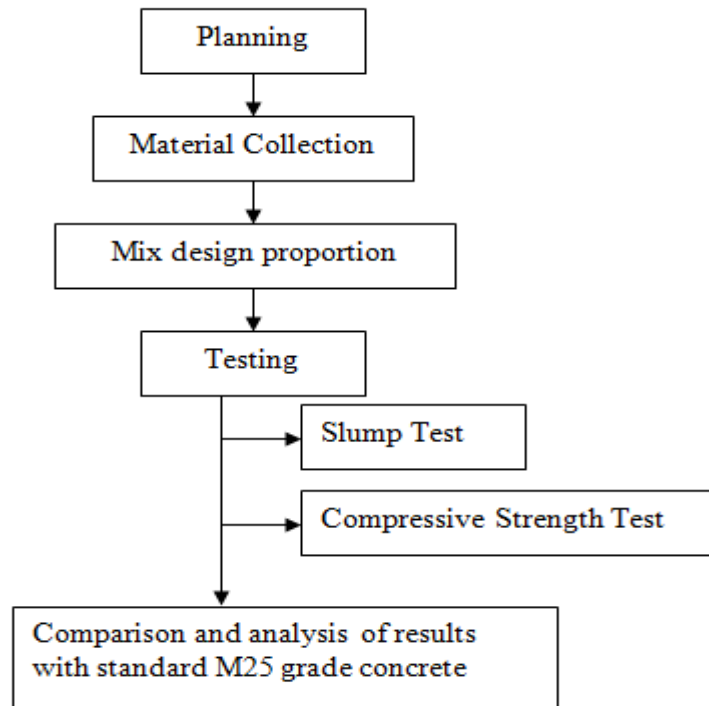
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Methodology



V. SPECIMEN PREPARATION AND EXPERIMENTAL INVESTIGATION

Saw Dust ash was used to replace OPC at 5,10,15,20% by wt. of cement. The mix ratio used was 1:1:2 with water to binder ratio of 0.45. Table shows the mix proportion for each category of saw dust ash concrete.

Sr. No.	SDA (%)	Cement (kg/m ³)	Fine aggregates (Kg/m ³)	Coarse Aggregate (Kg/m ³)	Water (Kg/m ³)
1.	0%	420.6	601.51	1190	190
2.	5%	402.42	601.51	1190	190
3.	10%	381.24	601.51	1190	190
4.	15%	360.09	601.51	1190	190
5.	20%	340.89	601.51	1190	190

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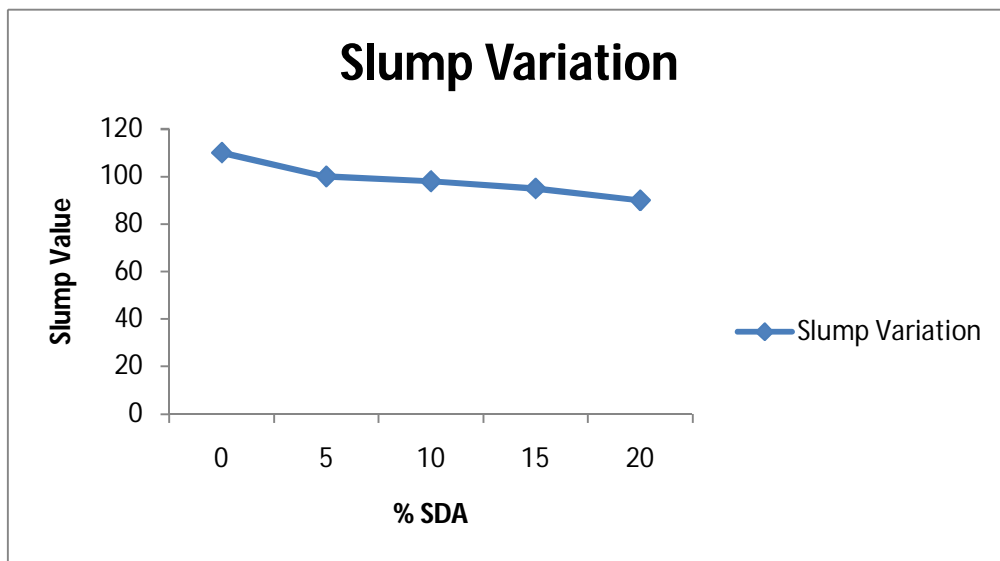
(i). Slump Test and Values

To find consistency of concrete, slump test is the best method. It can be done in lab as well as in field. It is performed on fresh concrete. The result of slump indicates that workability of saw dust ash concrete decreases as saw dust ash content increases. The table shows slump value variation with percentage of SDA used.

% of SDA	Slump (mm)
0%	110
5%	100
10%	98
15%	95
20%	90

From these result it was notified that concrete becomes less workable as SDA percentage is increased that means more water is required to make mix more workable.

This was due to increased amount of Silica in the mixture. The graph shows the variation of slump value.



(a)

FIG. 1 : (A) VARIATION IN SLUMP VALUE

(ii). Compressive Strength Test and values

For this study, 15 cubes of size 150×150×150mm were tested of design mix of M25 grade. The specimens were tested after curing period of 7 and 28 test. The first three normal concrete cubes were used for comparison with partial replacement of cement with saw dust ash. The saw dust ash was used in various proportions of 5%, 10%, 15%, 20% with replacement of cement and casted three cubes for each proportion. Concrete design mix was prepared as per Indian standards with water to binder ratio of 0.45.

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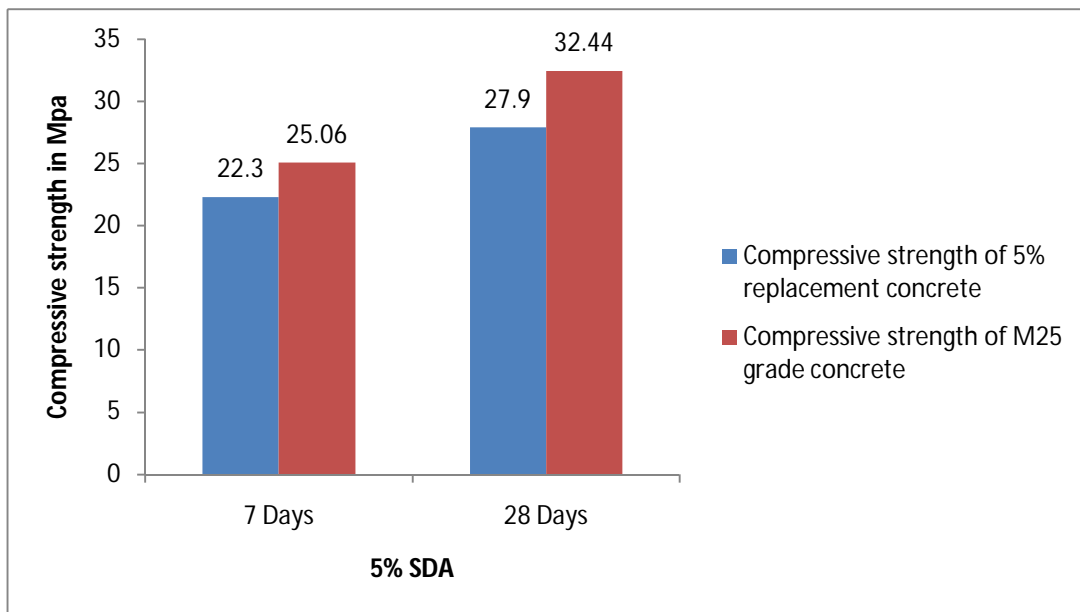
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The result of compressive strength test are shown in these tables :-

Strength →	M25 grade concrete
Days ↓	Compressive strength in MPa
7	22.30
28	27.90

Strength →	5% saw dust ash replacement
Days ↓	Compressive strength in MPa
7	25.06
28	32.44



(a)

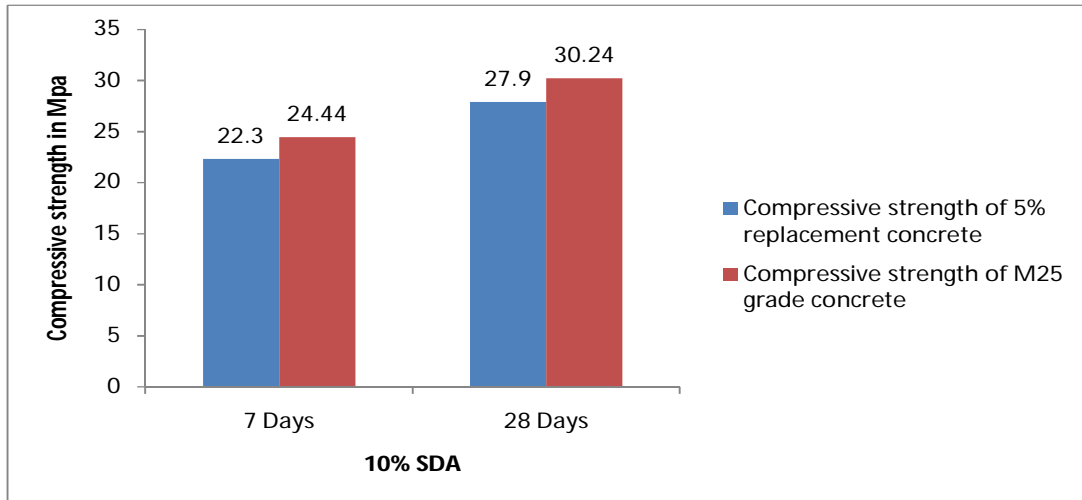
Strength →	10% saw dust ash replacement
Days ↓	Compressive strength in MPa
7	24.44
28	30.24

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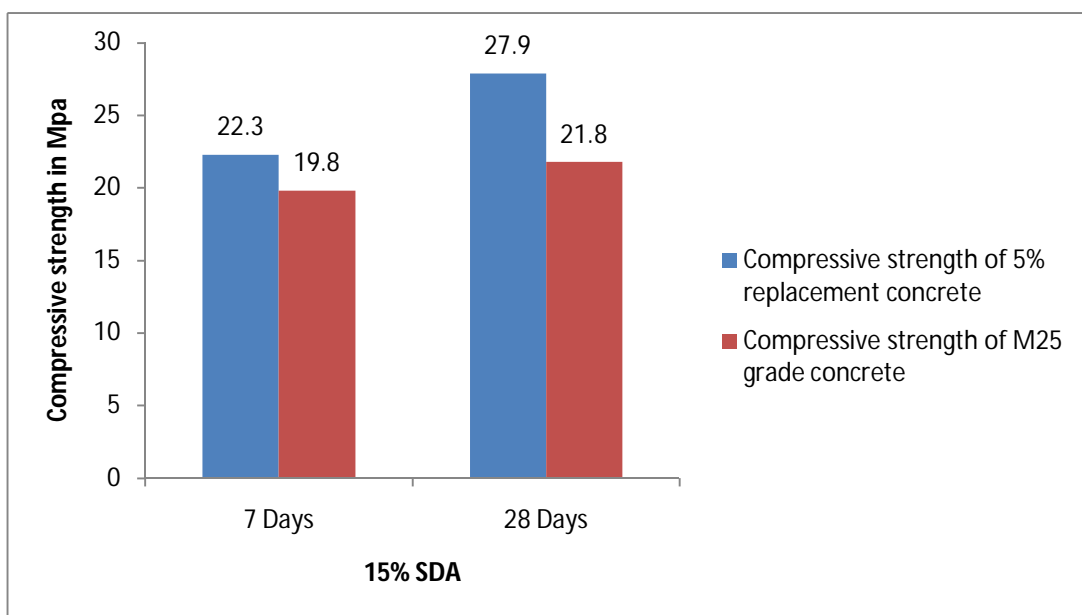
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(b)

Strength →	15% saw dust ash replacement
Days ↓	Compressive strength in MPa
7	19.80
28	21.80



(c)

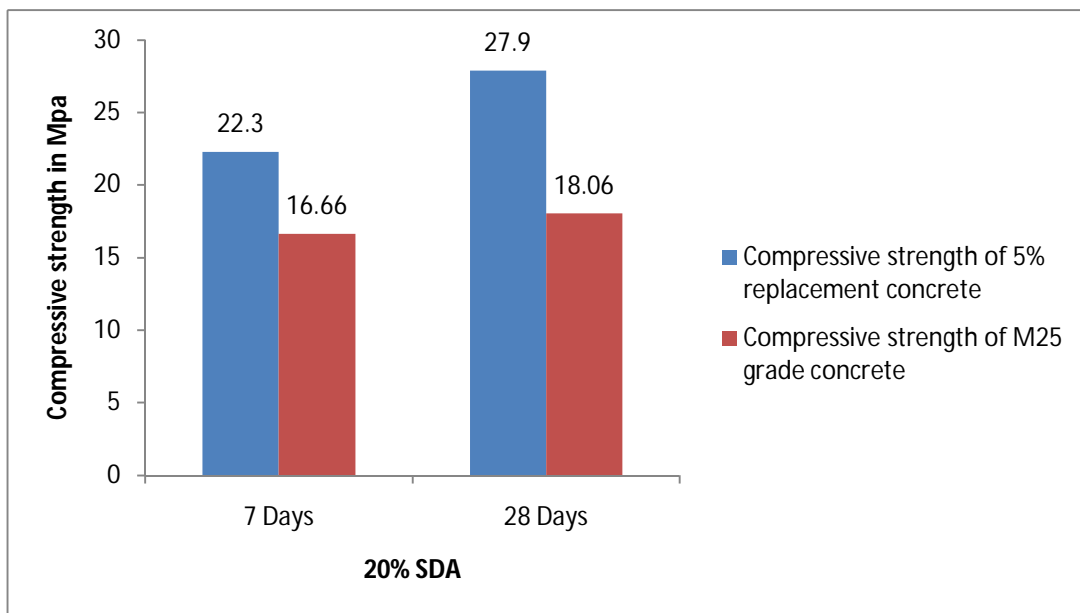
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Strength → Days ↓	20% saw dust ash replacement Compressive strength in MPa
7	16.66
28	18.06



(d)

FIG. 2 : COMPRESSIVE STRENGTH (A) AT 5% SDA (B) AT 10% SDA (C) AT 15% SDA (D) AT 20% SDA

The Tables and Graphs show the variation in compressive strength of 5%, 10%, 15%, 20% replacement concrete with M25 grade standard concrete.

VI. CONCLUSION

- At 5% replacement of SDA gives 12.30% and 16.20% increase in compressive strength at 7 & 28 days respectively.
- At 10% replacement of SDA gives 9.59% & 8.38% increase in compressive strength at 7 & 28 days respectively.
- At 15% replacement of SDA gives 11.20% & 21.80% decrease in compressive strength at 7 & 28 days respectively.
- At 20% replacement of SDA gives 25.20% & 35.26% decrease in compressive strength at 7 & 28 days respectively.

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- Concrete becomes less workable as SDA percent increases, that means more water is required to make mix more workable i.e. SDA has high water demand.
- Use of SDA can prove to be economical as it is a waste and free of cost
- SDA will preserve the resources particularly cement and thus makes construction industry sustainable.
- It will solve the problem of disposal of saw dust and will prove to be environmental friendly.

VII. ACKNOWLEDGEMENT

The author thankfully acknowledge to Er. Isha Verma, Assistant Professor, U.I.E.T., M.D. University, Rohtak for her motivation and infrastructural support to carry out this research.

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