

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly Peer Reviewed Journal)

Vol. 5, Issue 2, February 2016

Experimental Study on Partial Replacement of Cement using Bagasse Ash in Concrete

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ABSTRACT: This Study attempts to Identify the Alternate Material which can be used in Cement in Concrete and this Alternate material seems to give greteood results in Strength for Concrete at various grades and it helps me to have a detailed study on the properties of the material known as Bagasse ash. According by, data will be collected from respondents working in construction projects at various companies. Data collected aided to come out the factors in each stage that needs to be focussed for effective work.

From data collected from various stages of Project will be then the problem and factors that contribute for preparing training modules will also be identified. The project recommends that the Alternate material which is Bagasse ash is obtained from the Sugarcane waste in the manufacturing of sugar after undergoing several processes and this Bagasse ash is black coloured which is a sandy substance.

KEYWORDS: Bagasse ash, Alternate material, Cement, Concrete, grades, Sugarcane waste, black coloured sandy substance.

I. INTRODUCTION

Concrete is a Composite material which is composed of Cement, Fine Aggregate and Coarse Aggregate. These Cement and aggregate materials are mixed well along with water and they are applied over the reinforcement rod in the construction. Generally this concrete is used in the construction of Roof, Beams and Columns in the construction of Residential and Commercial Buildings. The various tests done for concrete are based on its Workability, Strength, Durability, etc. The Concrete has several grades such as M 15, M 20, M 25, M 30, M 40, M 50, etc which are classified based on the Properties of Cement, Fine aggregate and Coarse aggregate along with the water-cement ratio.

Generally normal concrete consists of the above three component materials. But the strength value of the concrete is not sufficient in some special cases. In order to overcome the loss in strength some materials cement and aggregate are replaced by some special materials which replaces either cement or aggregate. These materials give drastic changes in strength of the concrete. Hence these concretes are generally known as Special Concretes. One kind of Special material known as Bagasse ash is used in the concrete which partially replaces cement in several percentages. Bagasse ash is a material which is obtained from the Sugarcane during the manufacture and the final product which is obtained is known as Bagasse ash. It is generally used for filling the empty land. This material is collected from those industries and used in the concrete at various proportions of cement.

II. LITERATURE SURVEY

Bahurudeen et.al(2011), states that, Sugarcane bagasse ash is obtained as a by-product from cogeneration combustion boilers in sugar industries, and is reported to be a useful supplementary cementitious material in concrete. A clear evaluation of Pazzolanic activity of Sugarcane bagasse ash is imperative to achieve its effective utilixzatioin concrete instead of being disposed as a waste in enormous quantities. Pazzolanic activity of raw sugarcane bagasse ash and a

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processed sample of the same was assessed by five different standard methods in this study. The methods used were: strength activity index test, lime reactivity test, Frattini test, electrical conductivity test and lime saturation test. In addition, chemical and mineralogical analyses were also performed on the bagasse ash. Durability performance of concrete with bagasse ash has blended cement was evaluated and compared with fly ash-based concrete. The results from the studies indicate that raw bagasse ash has low pazzolanic activity due to presence of fibrous carbon particles. Removal of these fibrous particles from raw bagasse ash, which occurs during the processing methodology followed in this study, significantly improves its pazzolanic activity. The permeability of bagasse ash blended concrete was found to be significantly reduced compared to control and fly ash blended concrete, at an equivalent level of compressive strength. Assessment of Pazzolanic Performance of Sugarcane Bagasse ash.

Prashanth O.Modhani, Today researchers all over the world are focusing on ways of utilizing either industrial or agricultural waster as a source of raw materials for the construction industry. These wastes utilization would not be economical, but may also help to create a sustainable and pollution free environment. Sugarcane bagasse ash is one such fibrous waste product of the sugar refining industry, along with ethanol vapour. Bagasse ash mainly contains Aluminium ion and silica. In this paper, untreated bagasse ash has been partially replaced in the ratio of 0%,10%,20%,30% and 40% by volume of fine aggregate in concrete. Fresh concrete tests like compaction factor test and slump cone test were undertaken along with hardened concrete tests like compressive strength, split tensile strength and sorptivity. The result shows that bagasse ash can be a suitable replacement to Fine aggregate.

Khurshid Ali(2012), states that, Bagasse sah from the local sugar mills of NWFP(Pakistan) has been analyzed both physically and chemically. The moisture, ash contents, loss on ignition(LOI), volatile matter and calorific value have been determined. The qualittative and quantitative analysis was carried out by X-ray fluorimeter(XRF). And carbon sulfur detector. The physical parameters were determined by thermogravimetric analyzer(TGA) and bomb calorimeter. The bagasse ash also analyzed for ash and moisture contents which were found to be 3.66 and 9.47% respectively. The bagasse ash was found to consist of 86.69% ash, 13.45% loss on ignition(LOI) and 50kcal/kg calorific value. The chemical constituents of bagasse ash were found to comprise of SiO₂, Al₂O₃, Fe₂O₃, CaO, MgO, Na₂O, K₂O, carbon and sulfur.

III. MATERIALS AND METHODOLOGY

Methodology can be defined as the way in which the project objectives can be achieved. The explanation of mass behaviour often requires mass attitude data that can only be obtained by a survey. The people who provide information for the study are referred to as subjects, study participants or informants in qualitative survey. Data may take the form of narrative information (qualitative data) or numerical values (quantitative data). Quantitative survey is objective in nature. It is defined as an inquiry into a social human problem, based on testing a hypothesis or a theory composed of variables, measured with members, and analysis with statistical procedures. Quantitative study is an objective measurement of the problem.

In this project both qualitative and quantitative approaches are used. The questionnaire of this study is designed to get the factual information about local practices of managing construction materials in building projects as well as the opinions of Project managers about these practices.

IV. TESTS CONDUCTED

1)SPECIFIC GRAVITY TEST

Specific gravity test is done to find out gravitational value of the sample material and the test helps out to compare the property of the cement and the sample material. The result values of the sample material is found out and given below.

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Test	W1 Gm	W2 Gm	W3 Gm	W4 Gm	G
1	33	39	73	67	1
2	33	38	73	67	1.2
3	33	38	73	67	1.2

W1- Empty Weight

W2- Weight of Material and kerosene along with Apparatus

W3- Weight of Apparatus and kerosene

$$G = (W3 - W4) / (W2 - W1)$$

$$\text{Final Value} = (1 + 1.2 + 1.2) / 3$$

2) FINENESS TEST

Fineness test is done to find out the fine nature of the sample material where we can compare the fineness test of the sample is found out and given below. The result value of the fineness test of the sample is found out and given below. The Fineness test is done using Sieve of size 18 microns in size and the values calculated is given in table below.

W1	W2	W3	W2-W3
100	91	9	82
100	92	8	84
100	93	7	86

W1- Weight of Unseived sample

W2- Weight of Seived sample retained at top

W3- Weight of Seived sample retained at the bottom

$$\text{Fineness Value} = W2 - W3$$

$$\begin{aligned} \text{Average Value} &= (82 + 84 + 86) / 3 \\ &= 84 \end{aligned}$$

V. MIX DESIGN OF CONCRETE

Design of M25 grade Concrete from IS 10262,

Type of cement – OPC 53grade

Maximum Normal aggregate size-20mm

Maximum Cement Content - 310kg/m³

Maximum Water-cement ratio - 0.45

Workability – 50-75 mm

Exposure condition – Normal

Degree of supervision – Good

Type of Aggregate – Crushed Angular Aggregate

Maximum Cement content – 540kg/m³

CEMENT AND AGGREGATE SIZE

Cement used – Coromandal King

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Specific gravity of cement – 3.15

Specific gravity of aggregates – 2.884

Specific gravity of sand - 2.605

Water Absorption-for 20mm aggregate- 0.97%

-for10mmaggregate-0.83%

TARGET STRENGTH OF MIX PROPORTIONING:

Target Mean Strength – 36N/mm^2

Characteristic Mean Strength- 25N/mm^2

PROPORTIONS OF VOLUME OF COARSE AND FINE AGGREGATE CONTENT:

Volume of Coarse aggregate as per IS10262 table 3 = 62%

Absorbed volume of coarse aggregate = 62%

Absorbed volume of fine aggregate = 38%

MIX CALCULATIONS:

Volume of concrete in $\text{m}^3 = 1\text{m}^3$

Volume of cement in $\text{m}^3 = 0.10\text{m}^3$

Volume of fine aggregate = 0.10m^3

Volume of Coarse aggregate = 0.2m^3

MIX PROPORTIONS:

The general mix proportions of M25 grade concrete is 1:1:2

According to Mix proportions,C:FA:CA

= 427:682:1106.8 = 1:1.6:2.6

i)CUBE:

Weightof cement = $427 \times 0.15^3 = 1.44\text{kg}$

Weight of fine aggregate = $682 \times 0.15^3 = 2.3\text{kg}$

Weightof coarse aggregate = $192 \times 0.15^3 = 3.98\text{kg}$

Quantity of water = $192 \times 0.15^3 = 0.65\text{lit}$

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ii) BEAM:

Weight of cement = $427 \times 0.10 \times 0.10 \times 0.5 = 2.315 \text{ kg}$

Weight of fine aggregate = $682 \times 0.10 \times 0.10 \times 0.5 = 3.41 \text{ kg}$

Weight of coarse aggregate = $1106.8 \times 0.1 \times 0.1 \times 0.5$
= 5.53 kg

Quantity of water = $192 \times 0.10 \times 0.10 \times 0.50$
= 0.96 lit

iii) CYLINDER:

Weight of cement = $427 \times 0.15 \times 0.15 \times 0.3 \times 0.3$
= 0.864 kg

Weight of fine aggregate = $682 \times 0.15 \times 0.15 \times 0.3 \times 0.3 = 1.38 \text{ kg}$

Weight of Coarse aggregate = $1106.8 \times 0.15 \times 0.15 \times 0.3 \times 0.3 = 2.84 \text{ kg}$

Quantity of water = $192 \times 0.15 \times 0.15 \times 0.3 = 0.389$

VI. 7TH DAY COMPRESSIVE STRENGTH OF CUBE AT VARIOUS PROPORTIONS

i) 0%:

S.NO	LOAD(N)	AREA(mm ²)	COMPRESSIVE STRENGTH (N/mm ²)
1	0.560	0.0225	24.89
2	0.536	0.0225	23.8
3	0.545	0.0225	24.22

Average Compressive Strength = $(24.89 + 23.8 + 24.22) / 3$

= 24.30 N/mm²

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ii)5%:

S.NO	LOAD(N)	AREA(mm ²)	COMPRESSIVE STRENGTH (N/mm ²)
1	0.565	0.0225	25.11
2	0.540	0.0225	24
3	0.551	0.0225	24.5

Average Compressive Strength = $(25.11+24+24.5)/3$

= 24.53N/mm²

iii)10%

S.NO	LOAD(N)	AREA(mm ²)	COMPRESSIVE STRENGTH (N/mm ²)
1	0.569	0.0225	25.3
2	0.563	0.0225	25
3	0.555	0.0225	24.67

Average Compressive Strength = $(25.3+25+24.67)/3$

= 24.99 N/mm²

iv)15%:

=

S.NO	LOAD(N)	AREA(mm ²)	COMPRESSIVE STRENGTH(N/mm ²)
1	0.570	0.0225	25.33
2	0.566	0.0225	25.15
3	0.558	0.0225	24.8

25.09 N/mm²

Average Compressive Strength = $(25.33+25.15+24.8)/3$

v)20%:

S.NO	LOAD(N)	AREA(mm ²)	L/A(N/mm ²)
1	0.576	0.0225	25.6
2	0.569	0.0225	25.3
3	0.560	0.0225	24.89

Average Compressive Strength = $(25.6+25.3+24.89)/3$

= 25.26 N/mm²

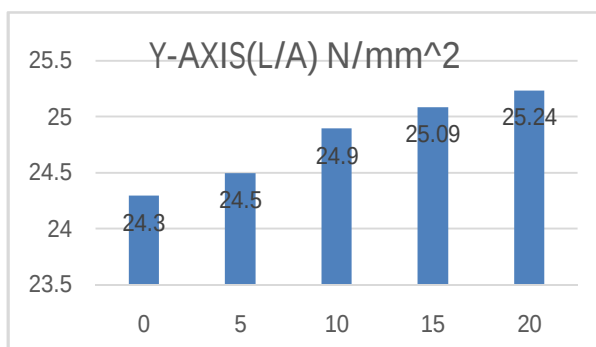
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VI) COMPARISON OF THE COMPRESSIVE STRENGTH IN BARCHART AT VARIOUS PROPORTIONS:

S.NO	VARIOUS PROPORTIONS OF BAGASSE ASH(%)	LOAD APPLIED (AVERAGE VALUE)	AREA mm ²	COMPRESSIVE STRENGTH N/mm ²
1	0	0.547	0.0225	24.03
2	5	0.552	0.0225	24.05
3	10	0.562	0.0225	24.09
4	15	0.564	0.0225	25.09
5	20	0.568	0.0225	25.24



VII. CONCLUSION

From the above results it is clearly found that the Compressive Strength value of the concrete with Bagasse ash content is more when compared to the Conventional concrete. According to the increase in proportion from 5 to 20 percentage the compression strength value also increases. Thus it is clearly found that the strength value of Bagasse ash is more when compared to cement. Hence it is a perfect alternate material for cement and we can use it in future when there is a demand for the cement.

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