PARTIAL REPLACEMENT OF CEMENT WITH BAGASSE

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Abstract:

We are aware that a lot of damage is done to environment in the production of cement. It includes a lot of carbon emission associated with chemicals. The researches have shown that every one ton of cement manufacture emits half ton of carbon dioxide, so there is an immediate need to control the usage of cement. On the hand materials wastes such as Bagasse Ash, E-waste, Plastic, Paper waste etc. Nowadays the main focus of research is to reduce the industrial and agricultural waste for eco-friendly environment. Sugar-cane bagasse ash (SCBA) is a fibrous waste product obtained from sugarcane factory. After extracting juice from the sugarcane, the remaining of sugarcane waste known as bagasse is burnt at high temperature in uncontrolled condition to produce the ash. This waste product which I causing serious environmental effects. In the present study the effect of bagasse ash on the strength of concrete is investigated. The addition of bagasse ash not only helps in reducing pollution but also leads to sustainable development of the country. This project mainly deals with the replacement of cement with Bagasse ash in fixed proportions and analyzing the effect of Loads on SCBA blended concrete. The concrete mix designed by varying the proportions of Bagasse ash & the cubes are been casted and cured in normal water for ages of 7,14 & 28 days. The test result indicates that the strength of concrete increase up to 15% Sugar cane bagasse ash replacement with cement.

Key Words: bagasse ash, compression test, properties, workability, agricultural waste.

I. INTRODUCTION

Ordinary Portland cement is the commonly used building material throughout the world and it will retain its status in future also because of demand and cost of construction industry all over the world. Future the biggest challenge before the concrete construction industry is to serve the two pressing needs of human society, namely the protection of environment and meeting the infrastructure requirements of our increasing population structures which are constructed in aggressive environments are liable to be subjected to acidic attack. Hence, the concrete cubes lose their strength and life span. To prevent those failure, we are adopting the technique of partially replacement of ce-ment with bagasse. Now a days the main focus of research is to reduce the industrial & agricultural waste for eco-friendly environment. SCBA is a fibrous waste product coming from sugarcane industry. In the present study the effect of bagasse ash on the strength of concrete is inves-tigated. The addition of bagasse ash not only helps in de-creasing pollution but also leads to sustainable develop-ment of the country.

II. MATERIALS

Different types of materials used in this project are as fol-lows,

1) Cement.
2) Fine aggregate.
3) Coarse aggregate.
4) Bagasse ash.
5) Water.

A. Cement

A cement is a binding material, the substance used for construction purpose that sets, hardened when reacts with water, & adheres to other materials to bind them together. Cement mixed with fine aggregate gives mortar for masonry, or with sand and gravel, gives concrete. Cement is the mostly used material in existence and is only behind water as the planets most consumed resource.

B. Fine aggregate

Fine aggregate used as small size filler materials in construction purpose. It is defined as rock particles with diam-eter having below 4.75mm, usually called sand, river sand or machine sand, crushed stone sand are the major sources of fine aggregate.

C. Coarse aggregate

Coarse aggregates used as larger size filler materials in construction purpose. Coarse aggregate is defined as rock particles with dia having above 4.75mm, usually called gravels. Generally used coarse aggregates in concrete are gravels and pebbles. dolomite aggregates, crushed gravel or stone, natural disintegration of rock are the major sources of coarse aggregate.

D. Bagasse ash

Sugarcane bagasse ash is a waste product of sugar facto-ries found after burning sugarcane bagasse which itself is left after the extraction of all economical sugar from sug-arcane. The disposal of this material is already affecting environment around the sugar factories. Bagasse ash as a waste, which is having a pozzolanic nature that can be used as a cement replacement material. It is known that the worldwide total production of sugarcane is over 1500 mil-lion tons. it has been known that the silicate undergoes a pozzolanic reaction with the hydration products of the ce-ment and results in a reduction of the free lime in the con-crete. We found that bagasse ash improves some proper-ties of the concrete including compressive strength in cer-tain replacement percentages and fineness. The silica con-tent which is present in the Bagasse ash was recommended to be the main cause for these developments.

E. Water

Water is a material which is not having any colour & it is a transparent material which is available in liquid state. In this project we are using water which is having a PH range of 6.5 to 7.

III. TESTS

1. Tests on cement
2. Tests on aggregates
3. Tests on bagasse
4. Tests on concrete

A. Tests on cement

i. Initial & final setting time

Initial setting time is the time taken to loose the cement their plasticity nature while mixing with the water. Final setting time is the time taken to completely loose the plasticity nature of cement &hardened of cement. And it is approximately 600 minutes.

ii. Specific gravity test

It is the ratio of density of any substance to the density of standard substance. And the specific gravity of ce-ment is 3.15 in general conditions.

iii. Compression test

It is used to determine the compression strength of the cement and it shows the results to know the bearing capacity of cement.

B. Tests on aggregates

1. Sieve analysis

It is one of the most important tests because we need a well grade aggregate for mixing of concrete. Sieve analy-sis helps us to separate the zone of aggregate and to know the size of the particle.

2. Specific gravity

It is the ratio of density of any substance to the density of standard substance. And the specific gravity of fine aggre-gate is 2.65-2.75 in general conditions. and the specific gravity of coarse aggregate is 2.75-2.95 in general condi-tions.

3. Aggregate impact (for coarse)

The aggregate impact value gives the resistance capacity of an aggregate due to sudden loads &shocks.

4. Aggregate crushing (for coarse)

It gives the resistance strength of an aggregate crushing under gradually acting compressive loads.

C. Tests on bagasse

1.specific gravity test

It is the ratio of density of any substance to the density of standard substance. And the specific gravity of bagasse is 2.2 in general conditions.

2.chemical composition(study)

S. No	Component	Symbol	%
1.	Calcium Oxide	CaO	0.48
2.	Silica	Sio_2	63
3.	Ferric Ox-ide	Fe_2O_3	1.79
4.	Manganese Oxide	MnO	0.004
5.	Alumina	Al_2O_3	31.5
6.	Loss on Ig-nition	LOI	0.71
7.	Magnesium Oxide	MgO	0.39

D. Tests on concrete

1.slump cone test

It is used to determine the workability of concrete. It helps to know the selected water -cement ratio is good or not.

IV. MIX DESIGN

It is the process of finding the required amount of propor-tions of concrete mixes in terms of ratios of cement, fine aggregate coarse aggregate.
It including mainly the following
steps, 1.target strength

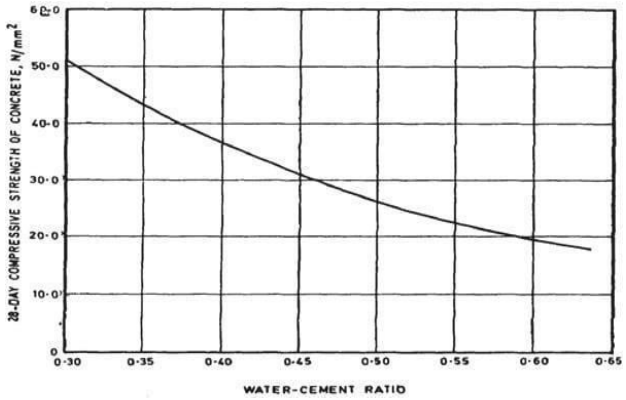
$$F_t=f_{ck}+1.65s$$

Where;

F_{ck}=characteristic strength
S= standard deviation.
and it is selected from IS456:2000.

2.selection of water-cement ratio

It is selected from graph but Generally it is selected by ex-perience.



3.aggregate air content

Air content is determined by nominal aggregate size used. And it is,

10mm-5%
20mm-2%
40mm-1%

4.water content for concrete

Water content is useful to get required workability& generally it is adopting through experience& from IS code456:2000.

10mm-208lit
20mm-186lit
40mm-165lit

Conditions and adjustments are done by the following steps,

Sub angular aggregate-reduce by 10%
Gravel with crushed stone-reduce by20Kg
Rounded gravel-reduce by 25Kg
Using plasticizers-decrease by5 to 10%
Using super plasticizers-decrease by 20 to 30%
For each rise of 25mm slump-increase by 3%

5.cement content for concrete

Cement content is obtained from the water-cement ratio. And it has some adjustments,
For plain concrete,

Condition	min. Cement content	Max.W/C ratio	Min. grade
Mild	220	0.6	-
Moderate	240	0.6	M_{15}
Severe	250	0.5	M_{20}
Very severe	260	0.45	M_{20}
extreme	280	0.4	M_{25}

For reinforced concrete,

Condition	min. Cement content	Max.W/C ratio	Min. grade
Mild	300	0.55	M_{20}
Moderate	300	0.5	M_{25}
Severe	320	0.45	M_{30}
Very severe	340	0.45	M_{35}
extreme	360	0.4	M_{40}

6.calculation of aggregate ratio

Based upon the zone the aggregate volumes are adopted.

Size of aggregate	Ratio of volume of CA and volume of total aggregate for varies zones of FA			
	Zone-1	Zone-2	Zone-3	Zone-4
10mm	0.44	0.46	0.48	0.50
20mm	0.6	0.62	0.64	0.66
40mm	0.69	0.71	0.73	0.75

7.aggregate content for concrete

We determined the volume of CA ratio in the volume of total aggregate in the previous steps. By using the formula given below,
Mass of FA,
$V=[W+(C/G_c)+(F.A/(1-P)*G_f)]*(1/1000)$
Mass of CA,
$V=[W+(C/G_c)+(C.A/(P)*G_{c.a})]*(1/1000)$

8.trial mixes for testing strength.

By the values obtained from the above we will mix the trails and casting it curing and then after completion of curing time those will be tested for obtained strength results.

V.EXPERIMENTAL INVESTIGATION

Introduction: In the present experimental investigation sugar cane Bagasse ash has been used as partial replacement of cement in concrete mixes. On replacing cement with different weight percentage of SCBA the compressive strength is studied at different ages of concrete cured in different environments like normal water. the details of experimental investigations are as follows.

Procedure

MIXING

In This Experiment Two Types of mixings are pre-pared,

1. Normal cement Mix
2. Cement with Bagasse Mix.

Normal Cement Mix:

Mixing of ingredients is done in pan mixer of capacity 40 litters. The cementitious materials are thoroughly mixed and then the aggregate is added and mixed followed by gradual addition of water and mixing.

Cement with addition of Bagasse:

Mixing of ingredients is done in pan mixer of capacity 40 litters. The cementitious Materials are thoroughly mixed and then the aggregate is added and mixed followed by gradual addition of water and adding the admixture(bagasse) which is used in this experiment. The admixture is added to the ce-ment with a range of 5%,10%,15%,20% respec-tively and the test procedure is followed continu-ously.

The two wet mixing is done until a mixture of uniform colour and consistency are achieved which is then ready for casting. workability of the mixes was found by compaction factor test just before casting the specimens.

PREPARATION OF SPECIMENS

The iron moulds are cleaned of dust particles with oil on all sides before concrete is placed in to the moulds. The moulds are placed on a level platform. The mixed concrete is filled in to the moulds and kept on vibration plate. By removing excess concrete, top surface is levelled & smoothen.

CURING OF THE SPECIMENS

The specimens are removed from the moulds undisturbed at room temperature up to 24 hours after casting. The specimens are then removed from the moulds and Transferred to the curing tubs i.e. cubes are cured in water.

TESTING OF SPECIMENS

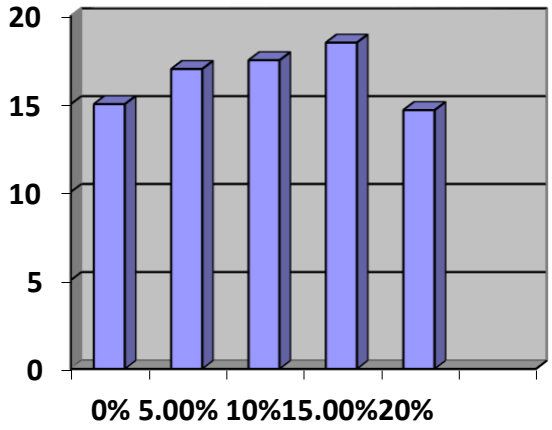
A time for testing of specimens is maintained to ensure their proper testing on the due date & time. The cast spec-imens are tested as per standard procedures, after they are removed from curing tubs and wiped off the surface wa-ter.by using the compression testing machine we are test-ing the cubes. And finally recorded the strength values ob-tained from the tests and plotted the graphs.

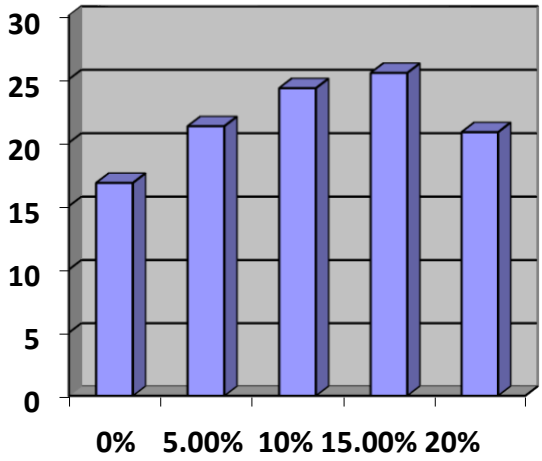
VI. RESULTS

Table: Compressive Strength Results (M30 in water)

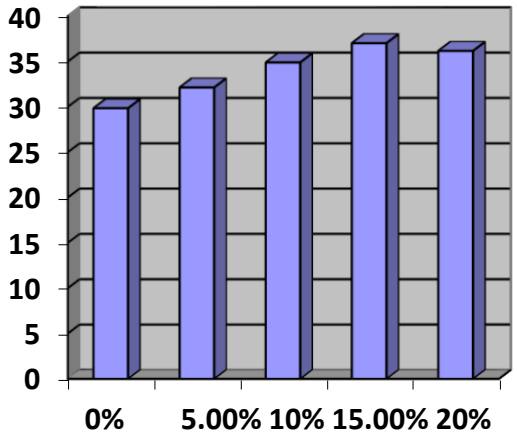
Sam-ple	% Re-place-ment of SCBA in Ce-ment	Com-pressive Strength at 7 days (σcu)	Com-pressive Strength at14 days (σcu)	Com-pressive Strength at28 days (σcu)
C_0	0	15	16.83	29.84
C_1	5	17	21.3	32.14
C_2	10	17.5	24.3	34.9
C_3	15	18.5	25.5	37.03
C_4	20	14.66	20.83	36.18

Graphs: for 7 days





Graph: Compression test results for 14 days in normal wa-ter.



Graph: Compression test results for 28 days in normal wa-ter

VII. CONCLUSION

SCBA concrete performed better when compared to ordinary concrete up to 15% replacement of sugar cane bagasse ash. Increment of strength is mainly due to the presence of high amount of Silica in sugarcane bagasse ash. Compressive strength is increased for 7, 14 and 28 days when cured in normal water. It is observed that effect of

loads decreasing on concrete as while using the bagasse ash as an admixture. It is greater than the ordinary cement cubes. Utilization of the waste material Sugar Cane Ba-gasse ash can be advantageously used as a replacement of cement in the preparation of concrete.

As the percentage of sugarcane bagasse ash increases the compressive strength of concrete tends to increase up to certain percentage and then start's decreasing with the increase of ash content.

The strength of 15% sugarcane bagasse ash concrete is more than 10% sugar cane bagasse ash concrete and strength of 10% sugarcane bagasse ash concrete is more than 5% sugar cane bagasse ash concrete and is more than normal concrete. This shows that till 15% sugarcane ba-gasse ash concrete the strength increases while percentage of sugarcane bagasse ash increases.

The strength of cubes having 15% sugar cane bagasse ash is almost equal to 20% sugar cane bagasse ash concrete. This increase in strength in Sugar cane bagasse ash concrete is due to presence of Silica in Sugar cane bagasse ash. Silica in Sugar cane bagasse ash react with residual CH after the formation of C-S-H gel, and increase the amount of C-S-H gel and results in increase the strength.

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