EXPERIMENTAL STUDY ON INFLUENCE OF ALCCOFINE AND SUGARCANE BAGASSE ASH AS PARTIAL REPLACEMENT OF CEMENT IN TERNARY BLENDED CONCRETE

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ABSTRACT
There are lots of environmental impacts of cement on our ecology. Cement industry creating environmental problem by emission of CO_2 during manufacturing of cement. Today researchers are more focusing towards the environment issue globally. On the other side Sugar cane bagasse ash generated in sugar mill creating environment issue as most of the part is used as a land fill. Alccofine is a new generation material that will increases the strength in concrete. Alccofine is finer material than hydraulic materials like cement, fly ash etc, the alccofine is developed in control conditions with specified equipments to get make finer particles.
In the present study an experimental investigation of M30 grade concrete is considered to study the behavior of concrete. The workability, strength of the concrete values are studied by using slump cone test and compaction factor test as workability. The strength values are determined by using compressive strength test, split tensile strength test and flexural strength test. The percentage of alccofine and SCBA used as 0%+0%, 2.5%+5%, 5%+10%, 7.5%+15%, 10%+20%, 12.5%+25%, and 15%+30%, in M30 grade concrete. Along with strength characteristics the acid resistance values are determined with different percentages of sugarcane ash and robo sand.
Key words: emission of CO_2, sugarcane ash, alccofine, workability, strength.

1. INTRODUCTION
General
Concrete plays a major role in the construction industry. It is made up of different types of Materials like cement, fine aggregate and coarse aggregate all together forms concrete and gives the strength to the material. Increasing the population and changing the life style and development of the city are in large scale, so requirements of the building have Increasing day by day so therefore civil engineers are focusing on the agricultural materials and construction materials. Sugarcane bagasse ash is one of the crops growing in India.
Generally sugarcane bagasse ash (SCBA) bagasse is formed after the extraction of the juice the bagasse is remained the farmer won't waste the Bagasse again they use the bagasse for fire purpose, At last ash is formed they used for plants and also they refill in the land. So to reduce the land filling and pollution to the Atmosphere here we are using the ash in place of cement which works as Pozzolanic cement and with various strengths. SCBA doesn't require any super plasticizers and also it gives excellent workability results for fresh concrete as well as hardened concrete. Robo sand is formed by crushing of gravel and stone. It is manufactured in stone quarries. Generally it is replaced with river sand and also to reduce the river sand consumption and also it has same properties. Generally using robo sand gives the high compressive strength values.

Objectives of work
From this project the following objectives were made
1. To study the workability of concrete with various percentage combination of alccofine and sugarcane baggage ash.
2. To study the mechanical properties of concrete with various percentage combination of alccofine and sugarcane baggage ash.
3. To determine the optimal percentage of the concrete.

ISSN: 2278-4632
Vol-12 Issue-09 No.02 September 2022

2. LITERATURE REVIEW

Mahim Mathur, Ashish Mathur (2018)[1], conducted experimental work on concrete with alccofine-1203 as partial replacement to cement. In this study M20 grade of concrete was used by partially replacing OPC 43 grade cement with alccofine-1203 in different proportions such as 1%, 2%, 3%, 4%, 5%, 10%, 15% and 20%. Slump cone and compressive strength tests have been carried out. Total 33 numbers of cubes were casted, cured and tested to study the effect of alccofine-1203 on concrete. Compressive strength test was carried out after 3 days, 7 days and 28 days of curing. Upon the addition of alccofine-1203 in different proportions to the mix, slump gradually increased when compared with slump of conventional mix. Highest slump of 127 mm slump was observed at 10% replacement of alccofine-1203, 118 mm slump for conventional mix. Maximum compressive strength was 17.33 N/mm^2 for 3 days of curing when cement is replaced with alccofine at 5%. Maximum compressive strength was 29.11 N/mm^2 for 7 days of curing at 20% replacement of cement with alccofine.

Keyur S Jasani, et.al (2018)[2], performed experiment on the combined effect of alccofine-1203 and recycled aggregate on the properties of concrete. M40 mix design was used. Cement is replaced by alccofine-1203 in various proportions such as 0%, 5%, 10%, 15%, 20%, 25% and coarse aggregate by recycled aggregate in different proportions such as 0%, 30%, 50% and 100%. Specimens for compressive strength, split tensile strength, flexural strength tests were casted and tested after 7 and 28 days of curing. Maximum compressive strength, split tensile and flexure strength was observed for 20% replacement of cement by alccofine and 30% replacement of coarse aggregate by recycled aggregate.

Mr. G. Siva Kumar et al. (2013)[3] had studied on "Preparation of Bio-cement using Sugarcane bagasse ash and its Hydration behavior". In this study they had used as partial Replacement in ordinary Portland Cement (OPC) by 10% weight. Compressive strength of the sample was carried out and reported that the cementitious material in sugar cane bagasse ash is responsible for early hydration. The pozzolanic activity of bagasse ash results in formation of more amount of C-S-H gel which results in enhances the strength, and hence bagasse ash is a potential replacement material for cement.

Mr. Lavanya M.R et al. (2012) [4] had studied on "A Experimental Study on the Compressive Strength of Concrete by Partial replacement of Cement with Sugar cane bagasse ash". The Feasibility of using sugar cane bagasse ash, a finely grounded waste product from the sugarcane industry, as partial replacement for cement in conventional concrete is examined. The test were conducted as per Bureau of Indian Standard (BIS) codes to evaluate the stability of SCBA for partial replacement up to 30% of cement with varying water cement (W/C) ratio. They showed that addition of SCBA results in improvement of strength in all cases and according o the results obtained, it can be concluded that Bagasse 16 ash can increase the overall strength of concrete when used up to a 15% cement replacement level with W/C ratio of 0.35, bagasse ash is a valuable pozzolanic material and it can potentially be used as a partial replacement for cement.

Mr. R. Srinivasan et al. (2010) [5] has investigated on "Experimental Study on Bagasse Ash in Concrete". They had observed that Sugar Cane bagasse is fibrous waste Product of sugar refining industry, and causing serious environmental problem which mainly contain aluminum ion and silica. Hear bagasse ash has been chemically and physically characterized, and partially replaced in the ratio of 0%, 5%, 15%, and 25% by weight of cement in concrete. Fresh concrete tests like compaction factor test and slump cone test were undertaken, as well as hardened concrete test like compressive strength , split tensile strength, flexural strength and modulus of elasticity at the age of seven and 28 days was don. The results show that the SCBA in blended concrete had significantly higher compressive strength, tensile strength, and flexural strength compare to that of the concrete without SCBA. It is found that cement could be advantageously replaced with SCBA up to maximum limit of 10%. Partial replacement of cement by SCBA increases workability of fresh concrete; therefore use of super plasticizer is not substantial. The density of concrete decreases with increase in SCBA content.

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3. METERIAL CHARACTERIZATION

This chapter deals about the materials used in the present study. The materials used are cement, alccofine-1203, fine aggregate,robo sand, coarse aggregate and water. Detailed information about the materials used is discussed below.

Cement:

In this experimental study ACC cement is used of grade 53 and the specific gravity is calucated to be 3.24 and fineness as 2.4%.

Alccofine-1203:

For the present study Alccofine-1203 ispurchased from Counto Microfine Products Pvt. Ltd., Goa. Physical properties and chemical composition are given below.

Figure Alccofine-1203

Physical properties of Alccofine-1203

Bulk density	680 kg/m^3
Specific gravity	2.88
Marsh cone flow	29 seconds
Particle Size Distribution	**µm**
d10	1.3
d50	4.1
d90	9.0

Chemical composition of Alccofine-1203

Constituents	%
SiO_2	34.8
Al_2O_3	22.4
Fe_2O_3	0.9
CaO	33.9
SO_3	0.12
MgO	6.6

The values of the above tabular columns are given by Counto microfine products Pvt,Ltd.,

Sugarcane baggage ash

Bagasse ash being a waste material of sugar manufacturing industry. Ground bagasse ash have low specific gravity comparative to cement i.e. 2.31–2.68. Its density varies from 1.85–2.65 g/cm^3. Particles of bagasse ash are irregular and rough textured. Particle size distribution of bagasse ash were similar to ordinary Portland cement. Particle size of bagasse ash lies between 0-100 mm.

Sugarcane baggage ash

Fine Aggregate:

Fine aggregate refers to natural available sand at the water bodies or artificially crushed stonesand. Fine aggregate can be differentiated by proper sieving. Particle passing through 4.75 mm IS sieve is termed as fine aggregate. Size, shape, texture, surface area influences the properties of concrete. For the concrete applications we use smooth and rounded aggregate. In this study fine aggregate

ISSN: 2278-4632
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used is locally available sand conforming to IS 383-1970. The fineness modulus for this sand is 3.09

Coarse Aggregate:

Particles which are retained on 4.75 mm IS sieve and passing through 20mm IS sieve are used.

Water:

For the present experimental study water with pH value of 6.5 is used.

4. EXPERIMENTAL WORK & RESULTS

Concrete is, undoubtedly the extremely extensively exploited facetious building components. Adaptability of concrete is responsible to the intention that it is precise in the frequently procurable components, cement, aggregate and water. Inflated exercise of concrete may detritus in paucity of the matter.

MIX DESIGN OF CONCRETE

Concrete mix configuration is a method of choosing the appropriate elements of cement and their relative extents with a target to get ready cement of certain minimum strength, wanted functionality and solidness as monetarily (esteem designed) as would be prudent.

This study is crucially based on the advancement of ordinary quality M30 grade of Sugarcane baggage ash and Alccofine sand of regular building improvements.

CURING

The solid samples were restored utilizing six unique procedures until when their compressive strengths were resolved at ages 7, 14 days and 28 days.

TEST RESULTS

A. Slump Cone test

The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used as an indicator of an improperly mixed batch. The test is popular due to the simplicity of apparatus used and simple procedure. The slump test is used to ensure uniformity for different loads of concrete under field conditions.

S.No	Percentage of Alccofine and SCBA	Mix ID	Slump cone test values
1	0%+0%	M0	90
2	2.5%+5%	M1	80
3	5%+10%	M2	80
4	7.5%+15%	M3	75
5	10%+20%	M4	50
6	12.5%+25%	M5	30
7	15%+30%	M6	30

Here the samples of Mix ID M0,M1,M2 and M3 are sorted as they pocess the required slump value.

B. Compaction factor test

Compaction factor test is the workability test for concrete conducted in laboratory. The compaction factor is the ratio of weights of partially compacted to fully compacted concrete. The compaction factor test is used for concrete which have low workability for which slump test is not suitable.

S.No	Percentage of Alccofine and SCBA	Mix ID	Compaction factor
1	0%+0%	M0	0.76
2	2.5%+5%	M1	0.8
3	5%+10%	M2	0.8
4	7.5%+15%	M3	0.84
5	10%+20%	M4	0.88
6	12.5%+25%	M5	0.92
7	15%+30%	M6	0.96

ISSN: 2278-4632
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The above tabular shows compaction factor values of sample Mix ID's concrete.

C. Compressive strength of concrete

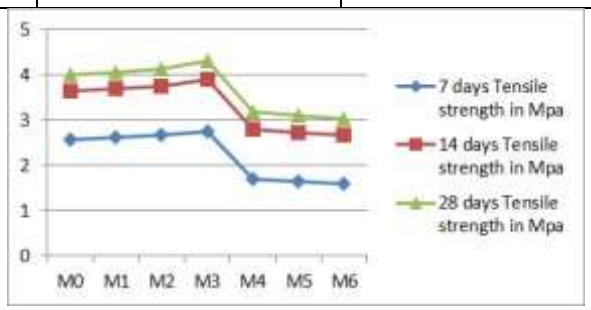
Compressive strength testing procedure from IS516-1959:

The bearing surface of the testing machine will be wiped perfect and any free sand are other material expelled from the surface the example which are to be in contact with the pressure platens. On account of solid shapes, the examples will be put in the machine in such a way, to the point that the heap will connected two inverse sides of the cubes as cast, that isn't to the best and base. The pivot of the example will be precisely lined up with of push of the roundly situated platen.

Compressive strength testing machine

Comparison of Compressive Strength Values

Mix ID	Percentage of Alccofine and SCBA	7 days compressive strength in Mpa	14 days compressive strength in Mpa	28 days compressive strength in Mpa
M0	0%+0%	23.74	33.4	36.78
M1	2.5%+5%	24.12	33.88	37.32
M2	5%+10%	24.44	34.36	37.38
M3	7.5%+15%	25.28	35.74	39.64
M4	10%+20%	14.8	24.88	28.42
M5	12.5%+25%	14.36	24.28	27.74
M6	15%+30%	13.94	23.7	27.08



The above lines represents 7, 14 & 28 days compressive strengths in Mpa respectively. Here we can see that all the values gradually increased until the max strength was25.28 , 35.74 & 39.64 at mix 3 from which there was sudden fall in compressive strength values

D.Split tensile strength of concrete

This test was directed according to IS516-1959. The barrels of standard size 150mmx300mm were utilized discover the quality of cement. Examples are put on the bearing surface of CTM, of limit 200T without capriciousness and a uniform rate of stacking is connected till the disappointment of barrel. The greatest load was noted and the quality was computed.

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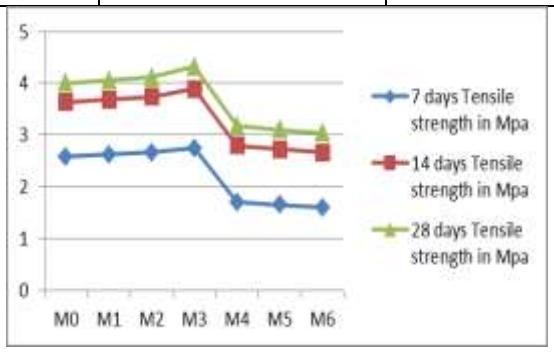
Split Tensile Strength Testing

Comparison of split tensile strength of concrete

Mix ID	Percentage of Alccofine and SCBA	7 days Tensile strength in Mpa	14 days Tensile strength in Mpa	28 days Tensile strength in Mpa
M0	0%+0%	2.58	3.64	4
M1	2.5%+5%	2.62	3.69	4.06
M2	5%+10%	2.66	3.74	4.12
M3	7.5%+15%	2.75	3.89	4.32
M4	10%+20%	1.7	2.8	3.18
M5	12.5%+25%	1.65	2.73	3.1
M6	15%+30%	1.6	2.66	3.04



The 7, 14, and 28 days split tensile strengths are shown above in Mpa, respectively. Here, we can observe that every value climbed progressively until the maximum strength was2.75, 3.89 & 4.32 attained at mix 3, after which the tensile strength numbers gradually decreased.

E.Flexural strength of concrete

The bearing surfaces of the supporting and loading rollers wiped clean, and any loose sand or other material removed from surface of the specimen where they are to may contact with the rollers. along two line spaced 13.3cm apart the axis of the specimen shall be carefully aligned with the axis of loading devices. The appearance of the fractured faces of concrete and any unusual features in the type of failure shall be noted.

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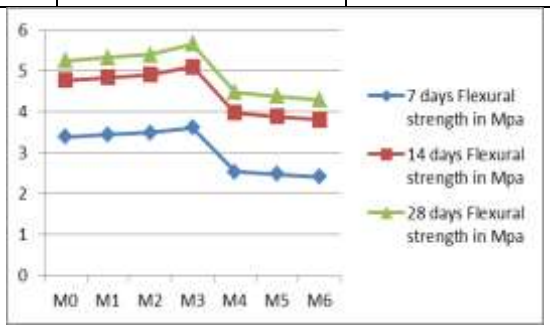
Flexural strength of concrete

Comparison of flexural strength of concrete

Mix ID	Percentage of Alccofine and SCBA	7 days Flexural strength in Mpa	14 days Flexural strength in Mpa	28 days Flexural strength in Mpa
M0	0%+0%	3.38	4.76	5.24
M1	2.5%+5%	3.43	4.83	5.32
M2	5%+10%	3.48	4.9	5.39
M3	7.5%+15%	3.6	5.094	5.65
M4	10%+20%	2.53	3.97	4.47
M5	12.5%+25%	2.47	3.88	4.378
M6	15%+30%	2.4	3.8	4.28



The flexural strengths in Mpa for the 7, 14, and 28 days are displayed above. Here, we can see that every value increased steadily until the flexural strength was 3.6 , 5.094 & 5.65 at mix 3 reached its maximum value, after which the values gradually fell.

6. CONCLUSIONS

From the above experimental study the following conclusions are made for the concrete using sugarcane baggage ash as well as alccofine as the partial replacement for the cement.

1. The intensity of slump cone value decreases with increase in the percentage of sugarcane baggage ash as well as alccofine in M30 grade concrete.
2. The intensity of compaction factor value increases with increase in the percentage of sugarcane baggage ash as well as alccofine in M30 grade concrete.
3. The optimal value of all the strength values related to the compressive strength, split tensile strength and flexural strength and obtained at M3 mix which is of 7.5 percentage of sugarcane baggage ash and 15% of alccofine at 7days, 14days ad 28days curing period.
4. So the optimal strength value is achieved at 7.5% baggage ash and 15% alccofine in the case of M30 grade standard.
5. The sugarcane baggage ash is used to reduce the land filling and pollution to the Atmosphere here we are using the ash in place of cement which works as Pozzolanic cement.
6. Alcofine sometimes used in the concrete to achieve better strength in M30 grade concrete provisions.

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ISSN: 2278-4632
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