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Compressive Strength Testing Using a Universal Testing Machine

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Abstract

Industrial and agricultural waste is being used in waste reduction initiatives. This waste utilisation should not only be cost effective, but also contribute to long-term growth. Over the years, there has been a lot of attention on sustainable development, with a particular emphasis on reducing environmental consequences and reusing garbage. Researchers have been looking for alternatives to cement in concrete due to the environmental impact of cement production facilities' carbon dioxide emissions. Several industrial and agricultural wastes have been identified as excellent eco-friendly binders. Sugarcane bagasse is one of the most major industrial waste products generated in India, and it is obtained by boiling sugarcane at extremely high temperatures. Because it includes amorphous silica, this commonly accessible ash may be substituted with concrete. In this investigation, solid ash from M20grade concrete is added by weight at 5%, 10%, 15%, and 20%. Concrete was prepared and evaluated for durability and compressive strength after 7 days and 28 days. 35 days, 56 days, and 90 days are all possible.

Keywords: *Split tensile strength, Sugarcane Bagasse Blended Concrete, Compressive strength*

INTRODUCTION

This project is being performed to investigate the qualities of Sugarcane Bagasse Blended Concrete, and an attempt has been made to investigate the consequence of cement substitution with SCBA and the performance of concrete

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utilising it. Among the objectives are the following:

- Study of the impact of SCBA, on substitution with cement used in diverse percentages on the physical properties of concrete.
- Evaluation of the properties of Concrete when SCBA is used in different percentages.

Keeping the above aims in mind, the goal of this work is to investigate and apply SCBA as a partial replacement for cement in concrete.

To achieve the outcome following tests were conducted:

- Compressive strength, split tensile strengths were carried at 7,28,35,56 and 90 days.
- Durability properties of various mixes was determined by immersing cube specimens in 5% NaCl solution and 5% MgSO4 solution to check strength loss and weight loss at 28+7 days, 28+28 days and 28+62 days.
- To develop Multi Regression equations from the data set using Data Set tool ofMicrosoft excel and then validation of the equation developed.
- To Carry out Cost Analysis of the M20 grade of mix of concrete.

CONTENT

The complete situation of bagasse ash mixed cement concrete is depicted in this. In addition, the physical and chemical characteristics were addressed. Various periodicals, books, review articles, and thesis are cited.

Physical Properties of Bagasse Ash

SCBA's fundamental properties, such as specific gravity, specific surface area, and mean particle size, are generally superior to regular Portland cement (OPC). These cement physical qualities also impact the mix proportions and various aspects of the blended concrete.

Specific Gravity

The specific gravity of a substance is a representation of its density. The specific gravity of the OPC is said to be lower. The reduced density of the bagasse ashparticles might be the cause.

Table 1:-Specific gravity by various authors was according to (ASTM C-2720 (part 3)

Author	Specific gravity
Ganesanet al.,(2007)	1.81
Montakarntiwonget al.,(2013)	1.91
Rukzon S et al.,(2015)	2.25
Apriantietal.,(2015)	1.90
Sua-iam G et al.,(2015)	2.35

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From the results it can be seen that the blain's air permeability of SCBA is higher than that of cement, and all the blended powders show a higher fineness than cement which is due to the lower density of the bagasse ash.[3] has reported that large surface area favors the pozzolanicre activity of amorphous silica and other minerals.

Table 2:-Blaine's specific surface area as reported by various authors

Authors	**Blaine's specific surface area(m^2/kg)**
Ganesanet al.,(2007)	943
Montakamtiwong et al., 2013	940
Rukzon S et al.,(2015)	1240
Apriantiet al.,(2015)	140 (Raw BA)
Suaiam G et al.,(2015)	274 (Raw BA)

Chemical Properties of Bagasse Ash

High surface area and chemical composition (SiO2+Al2O3+Fe2O3>70%) and CaO>10%suggested that it is a Pozzolanic and cementitious material according to ASTM C-618specifications. The loss on ignition (LOI) value for the bagasse ash as reported isapprox. 10.48% which was slightly higher than that specified by the same standard (10%)Moreover the bagasse ash was found to have high alkali content like K2O by [4] implyinghigh potential for alkali-silica reaction when used in concrete with silica reach aggregates. The chemical composition of bagasse ash by some of the authors are reported below.

CONCLUSION

Compressive Strength by UTM The compressive strength of several SCBA mixtures at 7, 28, 35, 56, and 90 days is shown in the graph. Table 3. Cube samples were immersed and cured in water and tested in compression testingmachine (CTM) at respective ages.

Table 3:-Compressive strength of SCBA

	Compressive strength (N/mm²)				
MIX	**7 days**	**28 days**	**35 days**	**56 days**	**90 days**
CM	19.65	28.46	28.62	30.37	35.05
M1	22.22	29.49	30.40	32.52	35.38
M2	23.96	30.59	31.21	33.62	36.53 . .
M3	24.46	32.27	33.05	34.24	37.28
M4	19.48	26.67	28.14	29.81	32.34

Compressive strength for various mixes increased with the curing age. Strength increasedwith increase in SCBA up-to 15% after which it decreased. Mix with 15% replacement ofSCBA, i.e. M3 reports highest strength as 24.46 MPa, 32.27 MPa 33.05 MPa, 34.24 MPa and37.28 MPa at 7, 28, 35, 56 and 90 days respectively.

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The indirect Split tensile test was carried out at 7 and 28 days compared with control mix(CM) to get variation of strength owing to the substitution of cement with SCBA by weightof cement. The splitting tensile strength was found using CTM. It depicts that splitting tensile strength at first increased with increase in SCBS for mixesM1 to M3 and then decreased for mix M4. For mix M2 (10% replacement level) there was anenhancement of about 27.128 % in the splitting tensile strength when compared to that ofcontrol mix (CM) after 29 days of curing. SCBA contains Al2O3, SiO2, CaO, Fe2O3 and TiO2which help in increasing the binding action and strength.

Table 4:-Split Tensile Strength of the Mixes

MIX DESIGNATION	**SPLIT TENSILE STRENGTH (N/mm²)**	
	7 DAYS	**28 DAYS**
CM	.693	1.526
M1	.79	1.64
M2	.97	1.94
M3	.80	1.7
M4	.65	1.34

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