

# Use of Discrete Waste Inclusions (DWI) In Improving Strength of Concrete

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**ABSTRACT:** The industrial and economic growth witnessed in recent decades has brought with it an increase in the generation of different types of waste (urban, industrial, construction etc.) despite the waste management policies which have been adopted nationally and internationally the practice of dumping and/or the inadequate management of waste from the various manufacturing sectors have had a notable impact on the receiving environment. At the same time, these practices represent an economic cost. However if waste is managed correctly it can be converted into a resource which contributes to savings in raw materials, conservation of natural resources and the climate, and promotes sustainable development.

Sugar cane is one of the most important agricultural plants that grown in India. Bagasse is a byproduct of the sugarcane industry. The burning of bagasse leaves bagasse ash as a waste, which has a pozzolanic property that would potentially be used as a cement replacement material. It has been known that the worldwide total production of sugarcane is over 1500 million tons. Despite variety use of bagasse, for production of wood, papers, animal food, compost and thermal insulation, statistics show that about one million tone extra of bagasse ash remains in the country.

**KEYWORDS:** . Bagasse , pozzolana, slump, Compressive Strength, SCBA.

## I. INTRODUCTION

The industrial and economic growth witnessed in recent decades has brought with it an increase in the generation of different types of waste (urban, industrial, construction etc.) despite the waste management policies which have been adopted nationally and internationally the practice of dumping and/or the inadequate management of waste from the various manufacturing sectors have had a notable impact on the receiving environment. At the same time, these practices represent an economic cost. However if waste is managed correctly it can be converted into a resource which contributes to savings in raw materials, conservation of natural resources and the climate, and promotes sustainable development.

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Sugarcane consists about 30% bagasse whereas the sugar recovered is about 10%, and the bagasse leaves about 8% bagasse ash (this figure depend on the quality and type of the boiler, modern boiler release lower amount of bagasse ash) as a waste. As the sugar production is increased, the quantity of bagasse ash produced will also be large and the disposal will be a problem.

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## Sugarcane Bagasse Ash

The sugarcane bagasse ash consists of approximately 50% of cellulose, 25% of hemicelluloses and 25% of lignin. Each ton of sugarcane generates approximately 26% of bagasse (at a moisture content of 50%) and 0.62% of residual ash and relatively small amounts of soluble solids. Nearly all bagasse produced in India is burnt for energy needed for sugar processing. The surplus energy is converted into electricity. The residue after combustion presents a chemical composition dominated by silicon dioxide (SiO<sub>2</sub>). In spite of being a material of hard degradation and that presents few nutrients, the ash is used on the farms as a fertilizer in sugarcane harvests. In this sugarcane bagasse ash was collected during the operation of boiler operating in the Nava Bharat Ventures Sugar Factory, located in the Samalkot, East Godavari District, and Andhra Pradesh.

The production of sugarcane varies from year to year, the main factor for such variations being climatic conditions, the average annual yield being about 5.6 million tons Bagasse. Bagasse ash is at present considered to be a waste product with little or no use. It has negative value, in that, the sugar factories have to spend money to dispose of it. Moreover, it is a potential environmental pollutant. It is estimated that about 20,000 tons of bagasse ash are produced every year. This represents about 0.3 per cent of cane crushed or about 2.8 per cent of the dry weight of bagasse.

The prime use of bagasse ash in concrete would be as pozzolana, that is, as a partial replacement for cement. Another possibility is its use as a fine aggregate, even though the quantities available are small compared with the national annual consumption of about 1.2 million tons of fine aggregate. The latter requirement is currently being satisfied by crushing basalt rock and quarrying in dwindling reserves of natural coral sand. Only a very small amount (about 3750 tons per year) is used for making resin-bonded boards.

Although India is sparing little effort in developing its industrial sector, its economy will continue to depend on sugar production for many years to come. The sugar factories on their side will continue to depend entirely on bagasse burning for energy. The supply of bagasse ash is, therefore, ensured for years ahead.



Fig.1 Sugarcane Bagasse

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## II. EXPERIMENTAL WORK

Specimens	No. of specimen cured in water					
	NORMAL MIX	SCBA 5%	SCBA 10%	SCBA 15%	SCBA 20%	SCBA 25%
Cubes	9	9	9	9	9	9
Cylinders	9	9	9	9	9	9
Beams	9	9	9	9	9	9
Total	27	27	27	27	27	27

**Table 2.1 No. of specimens prepared for determining hardened properties.**

## III. OBSERVATIONS

### 1. Slump Cone Test:

This test is used extensively in site all over the world. The slump test does not measure the workability of concrete, but the test is very useful in detecting variations in the uniformity of a mix of given nominal proportions.

The apparatus for conducting the slump test essential consists of a metallic mould in the form of a cone having the internal dimensions as under

Bottom diameter : 200 mm

Top diameter : 100 mm

The mould for slump is a frustum of a cone, 300 mm high. It is placed on a smooth surface with the smaller opening at the top, and filled with concrete in three layers. Each layer is tamped twenty five times with a standard 16 mm diameter steel rod, rounded at the end, and the top surface is struck off by means of sawing and rolling motion of the tamping rod. The mould must be firmly fixed against its base during the entire operation; this is facilitated by handles or foot-rests brazed to the mould. Immediately after filling, the cone is slowly lifted vertically up, and the unsupported concrete will now slump – hence the name of the test. The difference in level between the height of the mould and that of highest point of subsided concrete is measured. This difference in height in mm is taken as slump of concrete.

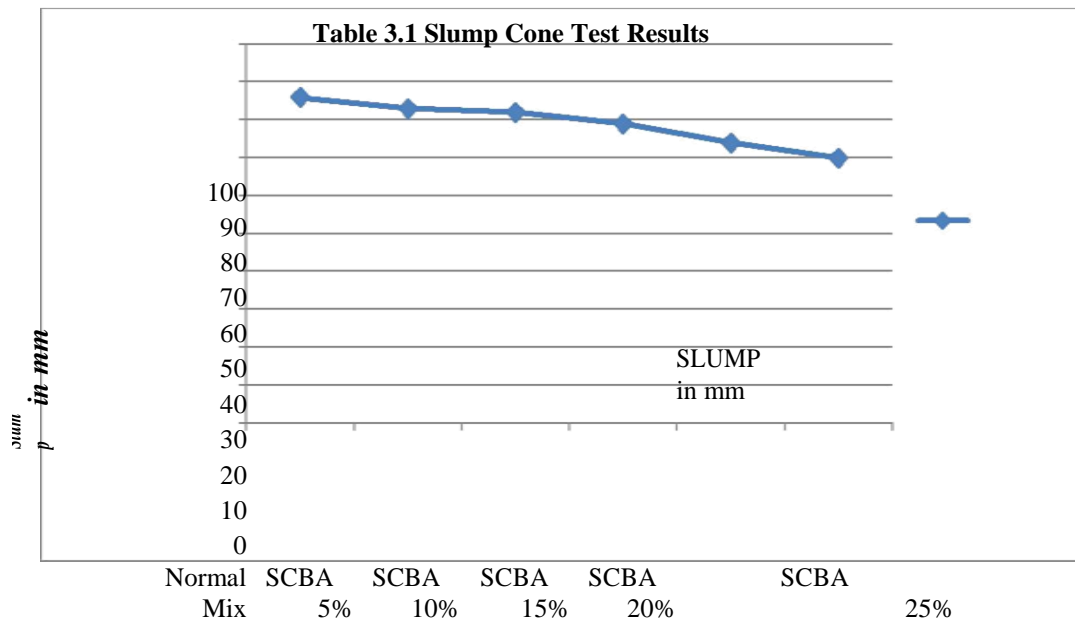
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The slump cone test was conducted for all the six mixes. Slump for different mixes are shown below.

S.No	Mix Id	Slump (mm)
1	NORMAL MIX	86
2	SCBA 5%	83
3	SCBA 10%	82
4	SCBA 15%	79
5	SCBA 20%	74
6	SCBA 25%	70



**Graph 3.1 Slump test vs mixes**

### Types of Mix

From the above graph the slump for SCBA 5% has decreased 4.7% when compared with the Normal Mix. The slump for SCBA 10%, SCBA 15%, SCBA 20% and SCBA 25% has reduced by 6.9 %, 10.5%, 16.3% and 21% when compared with Normal mix. The slump value was gradually decreases when compared with normal mix. To get the required slump we can use the chemical admixture.

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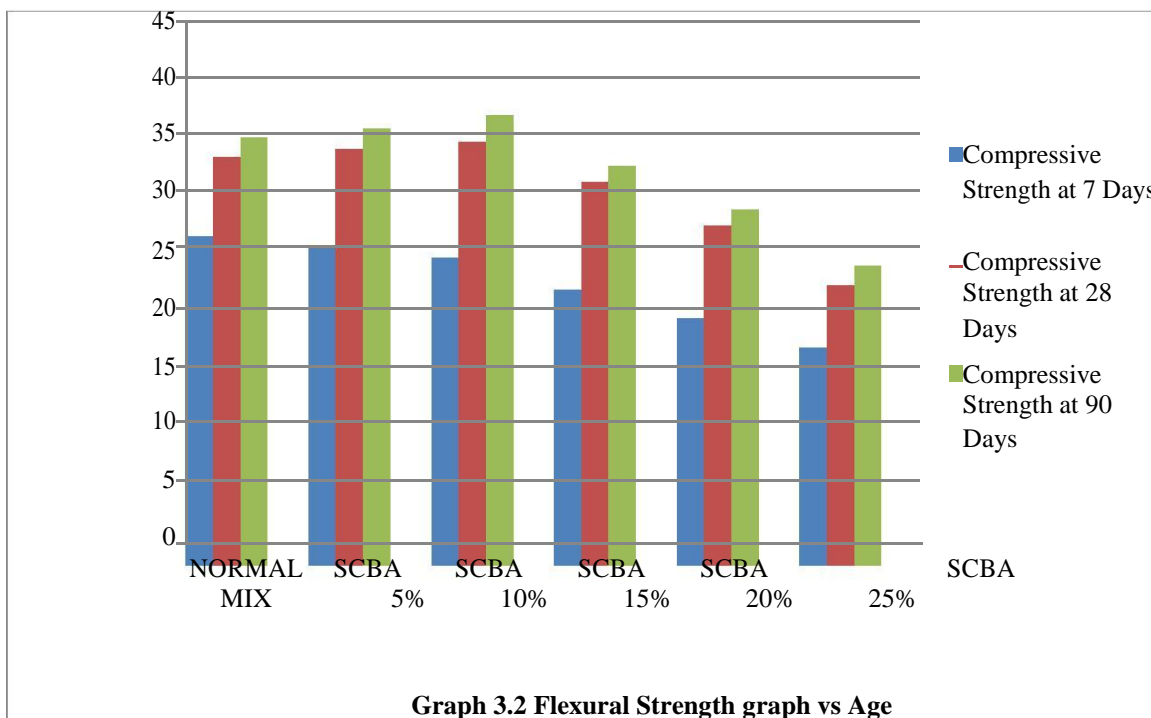
## 2. Compressive Strength:

The compressive strength of the concrete was done on 150 x 150 x 150 mm cubes. A total of 54 cubes were cast for the five mixes. i.e., for each mix 9 cubes were prepared. Testing of the specimens was done at 7 days, 28 days and 90 days, at the rate of three cubes for each mix on that particular day. The average value of the 3 specimens is reported as the strength at that particular age

The compressive strength test was conducted for all the mixes and the results are shown in the table below.

S.No	Mix id	Compressive Strength (N/mm <sup>2</sup> )		
		7 Days	28 Days	90 Days
1	NORMAL MIX	29.13	36.18	37.93
2	SCBA 5%	28.15	36.89	38.67
3	SCBA 10%	27.26	37.52	39.85
4	SCBA 15%	24.44	33.93	35.41
5	SCBA 20%	21.93	30.07	31.56

**Table 3.2 Compressive Strength Test Results**





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## Observations:

From the above graph, the flexural strength values obtained by testing standard cubes made with different SCBA mixes of 0-25%. The normal mix has strength above 30Mpa in compression as well as in flexure which is required strength. It was observed that the Flexural strength of SCBA 5% at the age of 7 days has decreased by 3% when compared with normal mix. It was observed that the Flexural strength of SCBA 5% at the age of 28 days has increased by 4.42% when compared with normal mix. It was observed that the Flexural strength of SCBA 5% at the age of 90 days has increased by 4.32% when compared with normal mix.

It was observed that the Flexural strength of SCBA 10% at the age of 7 days has decreased by 3% when compared with normal mix. It was observed that the Flexural strength of SCBA 10% at the age of 28 days has increased by 9.5% when compared with normal mix; it was observed that the Flexural strength of SCBA 10% at the age of 90 days has increased by 10.72% when compared with normal mix.

It was observed that the Flexural strength of SCBA 15% at the age of 7 days has decreased by 28.7% when compared with normal mix. It was observed that the Flexural strength of SCBA 15% at the age of 28 days has decreased by 2.4% when compared with normal mix. It was observed that the Flexural strength of SCBA 15% at the age of 90 days has decreased by 6.4% when compared with normal mix.

It was observed that the Flexural strength of SCBA 20% at the age of 7 days has decreased by 31.5% when compared with normal mix. It was observed that the Flexural strength of SCBA 20% at the age of 28 days has decreased by 16.1% when compared with normal mix. It was observed that the Flexural strength of SCBA 20% at the age of 90 days has decreased by 14.88 % when compared with normal mix.

It was observed that the Flexural strength of SCBA 25% at the age of 7 days has decreased by 34.32% when compared with normal mix. It was observed that the Flexural strength of SCBA 25% at the age of 28 days has decreased by 29.35% when compared with normal mix. It was observed that the Flexural strength of SCBA 25% at the age of 90 days has decreased by 26% when compared with normal mix.



Fig 2: Crack width of beams

## Closure

In this paper experimental work results are presented. Workability of fresh concrete and testing of hardened concrete procedures are explained in detail. The observations on test results were presented and will be used to study the behavior of fresh and hardened concrete properties. In the next chapter conclusions and scope of future research work were presented.

## IV. CONCLUSION

Based on the study, following conclusions can draw.

1. There is a change in slump for SCBA 5% has decreased 3.5% when compared with normal mix.

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2. The slump for SCBA 10%, SCBA 15%, SCBA 20% and SCBA 25% has reduced by 4.7%, 8.2%, 14% and 18.7% respectively when compared with the normal mix.
3. The compressive strengths of SCBA mixes at the age of 7 days was gradually decreases its strength when compared with normal mix due to pozzolanic activity.
4. It was observed that the compressive strength of SCBA 5% and SCBA 10% at the age of 28 days has reached its target mean strength; however the compressive strength was increased by 2.04% and 6.55% when compared with normal mix.
5. The split tensile strength of mixes SCBA 5% and SCBA 10% at the age of 28 days has increases its strengths by 4.42% and 9.5% respectively when compared with the normal mix.
6. The flexural strength of SCBA 15%, SCBA 20% and SCBA 25% at the age of 28 days has decreases it strength by 2.4%, 16.1% and 26.5% when compared with normal mix.

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