

Greener Concrete Using Agro Industrial Waste of Sugarcane Bagasse Ash

P. Navya¹, Dr. B. Ramesh Babu², S. Nirmala³

M.Tech, Dept of CIVIL Engineering, ALITS College, Affiliated to JNTUA, AP, India¹

Principal, ALITS College, Affiliated to JNTUA, AP, India²

Associate Professor, Dept of CIVIL Engineering, ALITS College, Affiliated to JNTUA, AP, India³

ABSTRACT: At present researches in every single place the arena are focusing on approaches of utilizing either industrial or agricultural wastes as a supply of raw materials for the development industry. These wastes utilization would now not best be low cost, however might also help to create a sustainable and pollution free environment. The utilization of industrial and agricultural waste produced via industrial strategies has been the focus of waste reduction study for fiscal, environmental and technical reasons. Sugar-cane bagasse is a fibrous waste-made of the sugar refining industry, together with ethanol vapor. This waste product (Sugar-cane Bagasse Ash) is already inflicting serious environmental pollution, which requires urgent methods of dealing with the waste.

Bagasse has customarily contained silica and aluminum ion. On this mission, the Bagasse ash has been chemically and bodily characterized, and in part changed in the ratio of zero%, 5%, 10%, 15% and 25% with the aid of the burden of cement in concrete. The bagasse ash was once then ground unless the particles passing the 90 μm sieve measurement reach about 85% and the distinctive surface field about 4716 cm^2/gm . Normal Portland cement was replaced by floor bagasse ash at different percentage ratios. The compressive strengths of one-of-a-kind mortars with bagasse ash addition had been also investigated. M25 concrete mixes with bagasse Ash replacements of 0%, 5%, 10%, 15%, 20% and 25% of the average Portland cement have been ready with water-cement ratio of 0.42 and cement content of 469 kg/m^3 for the manage mix. I'll experiment fresh concrete tests like droop cone experiment where below taken as good as hardened concrete experiment like compressive strength, break up tensile force, flexural force on the age of 7days, 28 days and 90 days was once bought. The experiment outcome indicated that as much as 10% replacement of cement by way of bagasse ash results in better or equivalent concrete houses and extra environmental and economic advantages can also be exploited by means of utilizing bagasse ash as a partial cement alternative fabric..

I. INTRODUCTION

The commercial and financial development witnessed in recent many years has brought with it and expand in the new release of one-of-a-kind types of waste (city, industrial, building etc.) regardless of the waste administration policies which were adopted nationally and internationally the observe of dumping and/or the insufficient administration of waste from the more than a few manufacturing sectors have had a extremely good affect on the receiving environment. Even as, these practices characterize an monetary cost. Nevertheless if waste is managed appropriately it can be transformed into a useful resource which contributes to financial savings in raw substances, conservation of typical resources and the local weather, and promotes sustainable development.

Sugar cane is one of the fundamental agricultural crops that grown in India. Bagasse is a byproduct of the sugarcane enterprise. The burning of bagasse leaves bagasse ash as a waste, which has a pozzolanic property that might probably be used as a cement substitute material. It has been known that the international total construction of sugarcane is over 1500 million lots. Despite sort use of bagasse, for construction of timber, papers, animal meals, compost and thermal insulation, information show that about 1,000,000 tone additional of bagasse ash remains in the nation.

Sugarcane consists about 30% bagasse whereas the sugar recovered is about 10%, and the bagasse leaves about 8% bagasse ash (this determine depend upon the high-quality and kind of the boiler, latest boiler unlock scale down amount of bagasse ash) as a waste. Because the sugar production is increased, the range of bagasse ash produced may even be huge and the disposal will be a difficulty.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 12, December 2016

Sugarcane bagasse ash has just lately been tested in some constituents of the world for its use as a cement alternative material. The bagasse ash was once observed to beef up some homes of the paste, mortar and concrete together with compressive force and water tightness in detailed replacement percentages and fineness. The better silica content within the bagasse ash was once recommended to be the foremost cause for these improvements. Despite the fact that the silicate content material may fluctuate from ash to ash relying on the burning conditions and other residences of the raw substances including the soil on which the sugarcane is grown, it has been reported that the silicate undergoes a pozzolanic reaction with the hydration merchandise of the cement and results in a discount of the free lime in the concrete.

Development of new concrete additives would produce an improved, more plausible material while decreasing the amount of cement required and the ensuing CO₂ emissions. Concrete is used in such massive quantities due to the fact that it's, with ease, a remarkably just right constructing fabric now not just for basic road building but additionally for rather extra glamorous initiatives. Concrete creation is responsible for a lot CO₂ seeing that making Portland cement no longer only require tremendous quantities of energy to reach response temperatures of up to 1500oC, but additionally on the grounds that the important thing response itself is the breakdown of calcium carbonate into calcium oxide and CO₂. Of these 800kg of CO₂ round 530kg is released through the limestone decomposition reaction itself.

Concrete is the sector's most utilized construction fabric. The need for infrastructure progress in both the constructing and developed international locations has placed satisfactory demand on usual Portland Cement (OPC), mostly, the essential binder within the manufacture of concrete. The production of Portland cement because the fundamental constituent of concrete requires a considerable stage and likewise releases a giant quantity of chemical carbon dioxide emissions and different greenhouse gasses (GHGs) into the surroundings. Hence seeking an eco-efficient and sustainable concrete maybe one of the most important roles that development industry should play in sustainable construction. Regardless of the advantages of concrete as a development material, the production of cement comes at a bigger rate to the atmosphere. The construction of cement requires excessive power input (850KCal/Kg of clinker) and implies the extraction of massive quantities of uncooked materials from the earth (1.7tones of rock to provide 1 tone of clinker). On the other hand, the production of 1 ton of cement generates 0.55 ton of chemical CO₂ and requires a further 0.39 tons of CO₂ in gasoline emissions, accounting for a whole of 0.94 tones of CO₂. As a result, the alternative of cement in concrete by means of bagasse ash represents a massive saving of power and has important environmental advantages. Besides, it'll also have a principal influence on reducing concrete expenses, when you consider that the fee of cement represents more than 45percentof concrete price, additionally the rate of deposition of bagasse ash in landfill might be saved.

Progress of latest concrete additives might produce a far better, extra possible material whilst decreasing the quantity of cement required and the ensuing CO₂ emissions. Concrete is utilized in such large quantities considering the fact that it's, quite simply, a remarkably just right constructing material no longer only for general street construction but also for as a substitute extra glamorous projects.

Bagasse is most commonly used as a most important gasoline source for sugar mills; when burned in wide variety, it produces adequate heat vigor to deliver the entire wants of a common sugar mill, with vigor to spare. To this finish, a secondary use for this waste product is in cogeneration, the use of a gasoline source to furnish both heat power and used in the mill, and electricity, which is often bought on to the client grid. The ensuing CO₂ emissions are equal to the quantity of CO₂ that the sugarcane plant absorbed from the surroundings throughout its developing section, which makes the method of cogeneration greenhouse fuel-impartial. In many countries similar to Australia, sugar factories significantly make contributions 'green' energy to the electricity deliver. Ethanol constituted of the sugar in sugarcane is a well known gasoline in Brazil. The cellulose-rich bagasse is being generally investigated for its talents for producing industrial quantities of cellulosic ethanol. For instance, BP is working a cellulosic ethanol demonstration plant centered on cellulosic materials in Jennings Louisiana.

Bagasse is as a rule used alternatively for timber in many tropical and subtropical countries for the construction of pulp, paper and board, reminiscent of India, China, Columbia, Iran, Thailand and Argentina. It produces pulp with physical homes which might be good suited for conventional printing and writing papers as good as tissue products but it is usually commonly used for boxes and newspaper construction. It can be used for making boards resembling plywood or particle board, referred to as Bagasse board and Xanita board, and is regarded a good replacement for plywood. It has extensive usage for making partitions, furnishings and many others.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 12, December 2016

II. RELATED WORK

R.Srinivasn, Vol. 5, 2010, worldwide Journal for service finding out in Engineering, examine a evaluate on “Experimental be trained on use of bagasse ash in concrete”. Bagasse ash most commonly involves aluminum ion and silica. On this paper, Bagasse ash has been chemically and bodily characterized, and partly changed in the ratio of zero%, 5%, 15% and 25% by using weight of cement in concrete. Contemporary concrete checks like compaction element scan and slump cone experiment have been undertaken used to be good as hardened concrete tests like compressive strength, split tensile force, flexural strength and modulus of elasticity on the age of seven and 28 days was once obtained. The outcome shows that the force of concrete expanded as percentage of bagasse ash alternative elevated. This paper reports the usage of bagasse ash as replacement of cement fabric in concrete.

Yashwanth M.Ok, Maharaja, Institute of science, Mysore, Vol.Three January 2014, global Journal of contemporary developments in Engineering and science (IJLTET). He examined that “An Experimental study on bagasse ash as replacement for cement in light weight concrete”. The present be trained is to investigate experimentally the fresh and hardened homes of light-weight concrete using sugarcane bagasse ash(SCBA) as replacement for cement by weight at zero%, 5%, 10%, 15% and 20% and multiplied polystyrene (EPS) beads as 100% alternative for coarse combination respectively. From the result it used to be located that there is marginal expand in workability with bagasse ash content material as much as 10% past that there is likelihood of discount in droop worth. The compressive force of light-weight concrete raises with bagasse content material up to 15% and beyond this there is likelihood of drastic discount in force and this 15% bagasse ash substitute force is fairly less than OPC founded light-weight concrete at 28 days but this worth is related.

Prashant O Modania, M.R Vyawahareb, Vol.4 2013 Procedia Engineering. He examined “Utilization of bagasse ash as a partial substitute of great aggregate in concrete”. In this paper, untreated bagasse ash has been in part replaced within the ratio of zero%, 10%, 20%, 30% and 40% via quantity of best aggregate in concrete. Recent concrete exams like compaction component scan and hunch cone test have been undertaken together with hardened concrete assessments like compressive strength, split tensile strength and sorptivity at the age of seven days and 28 days. The influence indicates that bagasse ash could be a suitable substitute to quality aggregate up to 20%.

III. DESIGN METHODOLOGY

Raw materials required for the concrete use in the present work are

- Cement
- Coarse Aggregates
- Bagasse ash
- Fine aggregate
- Water

IV. TEST RESULTS

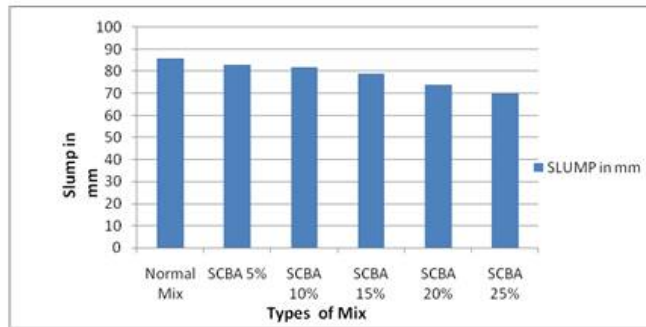
Table 1. Slump cone test results

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

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 12, December 2016

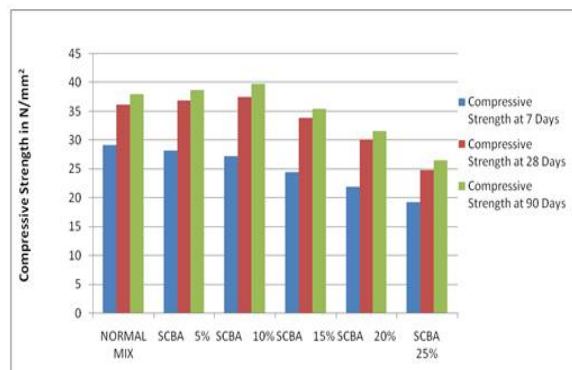


Graph 6.1 Slump test vs mixes

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 improve the slumps use the chemical admixture like super plasticizer.

Table 2. Compressive strength test results

S.No	Mix id	Compressive Strength (N/mm ²)		
		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
6	SCBA 25%	19.26	24.85	26.52



Graph 2 Compressive Strength vs age

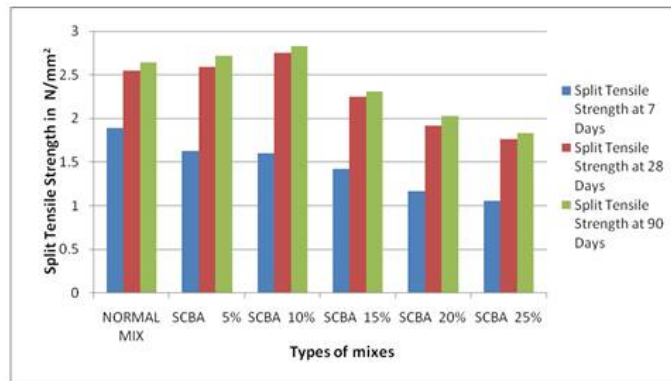
International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 12, December 2016

Table 3 Split tensile strength test results

S.No	Mix id	Split Tensile Strength (N/mm ²)		
		7 Days	28 Days	90 Days
1	NORMAL MIX	1.89	2.55	2.64
2	SCBA 5%	1.63	2.59	2.72
3	SCBA 10%	1.60	2.75	2.83
4	SCBA 15%	1.42	2.25	2.31
5	SCBA 20%	1.17	1.92	2.03
6	SCBA 25%	1.06	1.76	1.83



Graph 3 Split Tensile Strength graph vs age

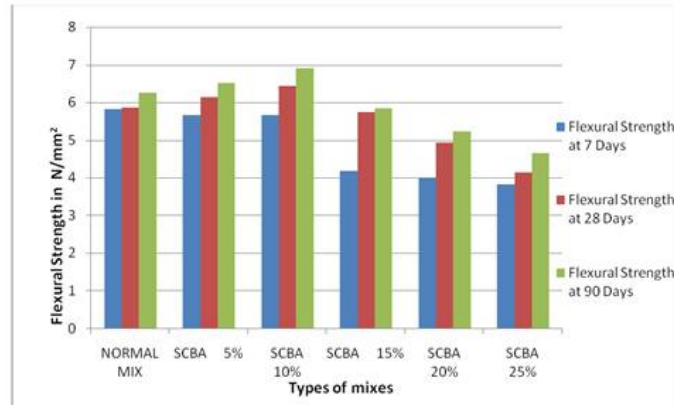
Table 4 Flexural strength test results

S.No	Mix id	Flexural Strength (N/mm ²)		
		7 Days	28 Days	90 Days
1	NORMAL MIX	4.67	5.87	6.25
2	SCBA 5%	4.53	6.13	6.52
3	SCBA 10%	4.53	6.43	6.92
4	SCBA 15%	3.33	5.75	5.85
5	SCBA 20%	3.20	4.93	5.22
6	SCBA 25%	3.07	4.13	4.66

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 12, December 2016



Graph 4 Flexural Strength graph Vs Age

VI. CONCLUSION

Based on the study, following conclusions can draw.

- i. There is a change in slump for SCBA 5% has decreased 3.5% when compared with normal mix.
- ii. 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.
- iii. The compressive strengths of SCBA mixes at the age of 7 days was gradually decreases its strength when compared with normal mix.
- iv. 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.
- v. It was observed that the compressive strength of SCBA 15%, SCBA 20% and SCBA 25% at the age of 28 days has decreases its compressive strength by 6.15%, 16.92% and 34.13% respectively when compared with the normal mix.
- vi. 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.
- vii. The split tensile strength of mix SCBA 15%, SCBA 20%, SCBA 25% at the age of 28 days has decreases it strengths by 11.8%, 24.8% and 32.7% when compared with the normal mix.
- viii. The flexural strength of SCBA 5%, SCBA 10% at the age of 28 days has increases its strength by 4.42%, 9.5% when compared with the normal mix.
- ix. Cement can be replaced with bagasse ash up to 10% without much loss in compressive strength.
- x. Considerable decrease in compressive strength was observed from 15% cement replacement.
- xi. It has been shown in this study that 10% sugarcane bagasse ash can be used as a partial cement replacement material with technical and environmental benefits. Concerned stakeholder, such as sugar industries, cement industries and relevant government institutions, should be made aware about this potential cement replacement material and promote its standardized production and usage.

REFERENCES

1. Ganesan, K., Rajagopal, K., &Thangavel K., 2007. "Evaluation of Bagasse Ash as Supplementary Cementitious Material", Journal of Cement and Concrete Composites
2. R. Srinivasan, K Sathiya, 2010. "Experimental study on bagasse ash in concrete", International Journal of Service Learning in Engineering 5(2), p. 60.
3. Payá,J.,et. al., 2002. Sugarcane bagasse ash (SCBA): "Studies on its properties for reusing in concrete production", Journal of Chemical technology and Biotechnology 77, p., 321.
4. N. B. Singh, V. D. Singh and SaritaRai, 2000. Hydration of Bagasse Ash-Blended Portland cement, Journal of Cement and Concrete Research 30, p. 1485.
5. SumrerngRukzon, PrinyaChindaprasirt, 2012. Utilization of Bagasse Ash in High Strength Concrete, Journal of Materials and Design 34, p. 45.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 12, December 2016

6. V. S. Aigbodion, S. B. Hassan, T. Ause and G.B. Nyior, 2010. Potential Utilization of Solid Waste (Bagasse Ash), Journal of Minerals & Materials Characterization & Engineering 9, p.67-77.
7. Ganesan, K., Rajagopal, K., &Thangavel, K. 2007. "Evaluation of bagasse ash as supplementary cementitious material". Cement and Concrete Composites, 29, 515-524.
8. Committee Board of sugar cane and sugar (2004). Summary of sugar cane and sugar industry in Thailand in 2003/2004, Division of sugar cane and sugar industry Policy, Ministry of Industry, Vol.2 Bangkok Thailand (in Thai).
9. Baguant,K., Properties of concrete with bagasse ash as fine aggregate, In Proc 5th CANMET/ACI Intl. conf. on fly ash, silica fume, slag and natural pozzolans in concrete, Ed by Malhotra VM, USA, ACI SP, (1995)153(18), 315-337.
10. 5. Payá,J.,et. al.,Sugarcane bagasse ash (SCBA): studies on its properties for reusing in concrete production, Journal of Chemical technology and Biotechnology, (2002)77, 321-325. 6. IS 383 -1970 "Specifications for Coarse and Fine Aggregates from Natural Sources for Concrete", Bureau of Indian Standards, New Delhi.