International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.11, pp 91-94, 2017

An Experimental Study of Concrete by Partial Replacement of Cement By Bagasse Ash And Coarse Aggregate By Recycled Aggregate

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Abstract : Increasing demand and consumption of cement investigators, researchers and scientist made in examination of alternate binders that are biodegradable and contribute towards waste management. The construction industry is the foremost consumer of natural resources which led to exhaustion of good quality natural aggregate (coarse aggregate). This situation constrains us to explore alternative materials for cement and coarse aggregate. Sugarcane bagasse ash (SCBA) is a left-over industrial by-product which is used as a replacement for cement. This research scrutinizes the possibility of using sugarcane bagasse ash as partial replacement of specific ingredients in concrete. In this paper SCBA has been chemically and substantially categorized and partially replacing cement in the ratio of 10% by the weight of cement in concrete. RA has been partially replacing coarse aggregate in the ratio of 15%, 20%, 25% and 30% by the weight of the coarse aggregate in concrete. The mix proportion for M_{25}grade concrete was derived.
Keywords : Sugarcane bagasse ash, Recycled aggregate, Physical and Chemical properties**.**

1. Introduction

Initiatives are emerging worldwide to control and regulate the management of sub-products, residuals and industrial wastes in order to preserve the environment from contamination. A good solution to the problem of recycling agro industrial residue would be by burning them in a controlled environment and use the ashes for more noble means. But these ashes are produced under uncontrolled and non-uniform burning conditions with temperatures rising above 1000°C resulting in a crystallization of the matter. In this study the bagasse ash is planned to use as the partial replacement for cement and fine aggregate in-order to utilize the wastages and to protect the environment from the hazards.

1.1 Sugarcane Bagasse Ash (SCBA)

Sugarcane is one of the major crops grown in over 110 countries and its total production is over 1500 million tons. After the extraction of all economical sugar from sugarcane, large fibrous residue is obtained. When bagasse is burnt in the boiler of cogeneration plant under controlled conditions, reactive amorphous silica is formed due to the combustion process and is present in the residual ashes known as Sugarcane Bagasse Ash.

1.2 Recycled Aggregate (RA)

Recycled Coarse aggregate is generally produced by crushing of demolished concrete, screening and removal of contaminants such as reinforcement, wood, plastic etc. Concrete made with such aggregates is called as Recycled Aggregate Concrete. Recycled concrete aggregates are not derived from any natural source, but are derived from construction and demolished wastes.

2. SCBA PROPERTIES

It contains high volume of SiO_2. Therefore it is classified as a good pozzolanic material SCBA can be used as a supplementary cementitious material due to its pozzolanic property. Sugarcane bagasse ash was collected from Sakthi Sugars Ltd., Appakudal, Erode District of Tamil Nadu.

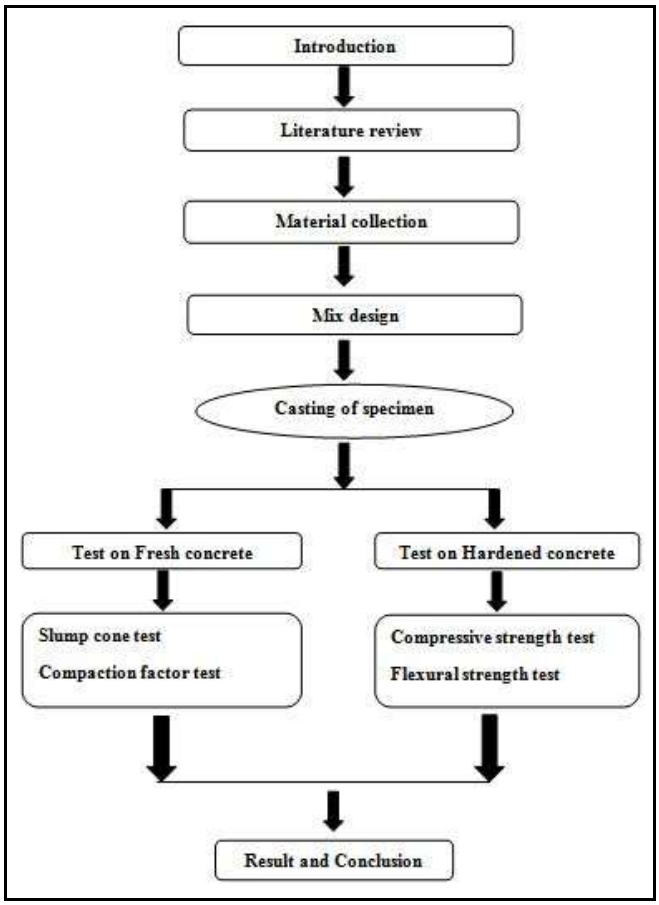
OXIDES	SCBA MASS %
Silica (SiO_2)	68
Alumina (Al_2O_3)	3.05
Ferric Oxide (Fe_2O_3)	3.72
Calcium Oxide (CaO)	5.10
Magnesium Oxide (MgO)	1.15
Sulphur Tri Oxide (SO_3)	0.67
Loss of Ignition	4.50

TEST	RESULTS
Fineness Modulus	0.5%
Specific gravity	1.7

3. Literature Review

- "An Experimental Study on Strength Properties of Concrete when Cement is Partially Replaced with Sugar-Cane Bagasse Ash" – G. Sireesha, M. Kanta Rao, P. Kanta Rao 2013
- "Utilization of Demolished Concrete Waste for New Construction''-Asif Husain and Majid Matouq Assas 2013
- "Use of selected waste materials in concrete mixes" - Malek Batayneh, Iqbal Marie, Ibrahim Asi 2006
- "Use of aggregates from recycled construction and demolition waste in concrete"- Akash Raoa, Kumar N. Jhab, Sudhir Misraa 2006
- "Experimental Investigation Of Using Concrete Waste And Brick Waste As A Coarse Aggregate"- T.Subramani , S.Kumaran 2015
- "Evaluation of bagasse ash as supplementary cementitious material"-K.Ganesan, K.Rajagopal and K.Thangavel 2007

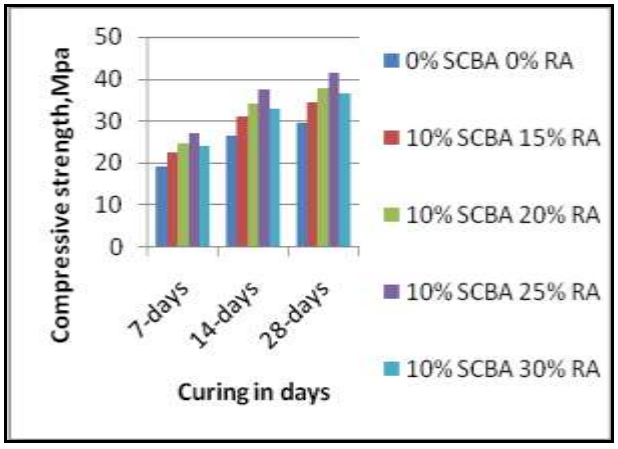
4. Methodology



5. Results and Discussion

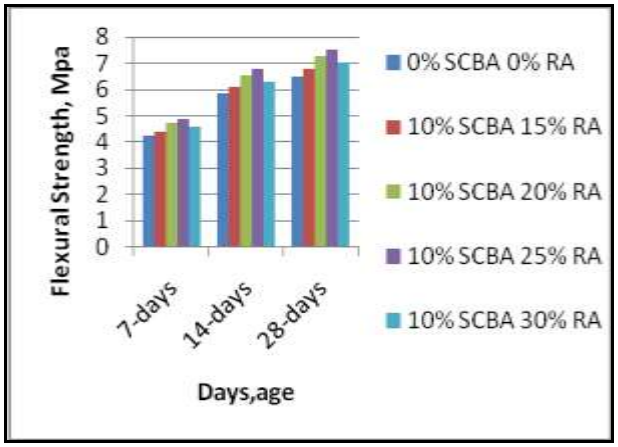
5.1 Compressive Strength Test

Cubes of size 15 x 15 x 15 cm (as per IS: 10086 – 1982) should be cast. The specimen should be given sufficient time for hardening and then it should be cured for 28 days. After 28 days, it should be loaded in the compression testing machine and tested for maximum load.



5.3 Flexural Strength Test

The Flexural strength of concrete is determined as per BIS: 516-1959 at the age of 28 days using 10 x 10 x 50 cm prisms.



6. Conclusions

Due to non-availability of natural resources at sensible cost as cement and coarse aggregate in concrete for various motives, search for alternate material like SCBA and recycled aggregates which succeeds itself as a suitable standby for cement and coarse aggregate at low cost.

1. The average Compressive strength at 28th day for the mix containing 10% SCBA and 15%, 20%, 25%, 30% of RA are increased by 16.5%, 28.5%, 40.8% and 24.3% respectively.
2. The average Flexural strength at 28th day for the mix containing 10% SCBA and 15%, 20%, 25%, 30% of RA are increased by 3.8%, 11.5%, 15.4% and 7.7% respectively.
3. SCBA and RA can increase the complete strength of the concrete. Optimum percentage of replacement is obtained as 10% of Cement by SCBA and 25% of Coarse Aggregate by RA with W/C ratio of 0.50.

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