ISSN XXXX XXXX © 2018 IJESC

Research Article Volume 8 Issue No.6

Use of Agricultural Waste Products in Concrete

Anilkumar N. S[1], Milan H.M [2], Rachel Sequeira[3], Akhil A[4], Lalkrishna[5]
Assistant professor[1], BE Students[2, 3, 4, 5]
Department of Civil Engineering
SCEM Mangalore, Karnataka, India

Abstract:
Due to the disposal problem of agricultural wastes and rapid urbanization, there has been a high demand of natural resources in developed countries, creating opportunities for the use of agro-wastes in construction industry. As replacement alternatives, different agricultural wastes have already been used in concrete for cement, coarse aggregate, fine aggregate and reinforcing materials. This paper reflects on some of the agro-waste materials, which are used as partial replacement of sand (fine aggregate) in concrete. Study based on the different properties of fresh as well as hardened concrete and their durability is done. It has been seen that the agro-waste concrete containing Agro waste concrete containing bagasse ash and sawdust ash achieved their required strength by 20% of replacement as fine aggregate, which were maximum among all agro-waste type concrete. Close relations were predicted among compressive strength of agro-waste concrete. After the review, it is taken into consideration that more research is to be done on all the fine aggregate replacing agro-waste, which can give more certainty on their utilization in concrete.

Keywords: Cement, Coarse Aggregate, Fine Aggregate, Bagasse Ash and Sawdust Ash

I. INTRODUCTION

Concrete is derived mainly from natural resources i.e. a mixture of fine aggregates, coarse aggregates, cement and water. There has been a demand in huge amount of natural resources in the construction industry due to increasing population, expanding urbanization and the climbing way of life due to the technological innovations. This has resulted in the scarcity of resources. This scarcity motivates researchers to utilize solid wastes generated by mining, industrial, domestic and agricultural activities. The Agricultural wastes used as fine aggregate in concrete are sugarcane bagasse ash and sawdust waste. The major dissimilarities of these agro-wastes are the place from where they collected and the processes to convert into a fine aggregate. It can be observed that sugarcane is produced worldwide and they are burnt to convert into sugarcane bagasse ash. These are used as partial replacement of fine aggregate which provide additional pozzolanic property in concrete. Sawdust is generated from mechanical processing of raw wood from saw mill industry. These are dried by leaving in sun and sieved properly before using in concrete. The shape, size and availability of mentioned agro-wastes are discussed below. The fibrous residue (about 40–45%) of sugarcane after crushing and extraction of its juice is known as ‘‘bagasse”. The bagasse are used again as fuel for heat generation which leaves behind 8–10% of ash, known as sugarcane bagasse ash (SCBA). Sugarcane bagasse consists of approximately 50% of cellulose, 25% of hemicellulose and 25% of lignin reviewed that a lot of sugarcane bagasse from the sugar factories accessible in Thailand. Sugarcane bagasse is somewhat consumed as fuel in sugar plant but the rest is treated as waste and unutilized. As production of sugar cane is more than1500 million tons in the world and in India, about 10 million tons of sugarcane bagasse ash are treated as a waste material, it can therefore be advantageous to use it as a fine aggregate replacement in concrete to mitigate the disposal problem as well as to minimize the use of natural aggregates. Sawdust is the main component of particleboard. It has a variety of other practical uses including serving as mulch, an alternative to clay cat litter, or as a fuel. It can present as a hazardous material in manufacturing industry, in terms of its flammability. The use of sawdust for making lightweight concrete has received some attention over the past years, that as a replacement material for natural sand, sawdust ash might be the right choice as fine aggregate in concrete. It can considerably decrease the dumping problem and concurrently helps the preservation of natural fine aggregate. Many researchers tested the behavior of sawdust ash in concrete and reported that sawdust possessed inimitable characteristics, which make it competitive among other construction materials.

Figure.1. Sugarcane converted and processed into Sugarcane bagasse ash

Figure.2. Sawdust in its raw state converted to Sawdust Ash

II. LITERATURE REVIEW

ACIU Claudiu, Nicoleta COBIRZAN (2013) The paper provides some examples of the way in which agricultural waste and natural products can be used in the building materials industry, with beneficial consequences for environmental protection and the preservation of natural resources. Thus, various thermal insulating materials derived from agricultural products and waste is presented, with their advantages compared to conventional thermal insulating materials.

Prashant O Modania, M R Vyawahareb (2013) In this paper, untreated bagasse ash has been partially replaced in the ratio of 0%, 10%, 20%, 30% and 40% by volume of fine aggregate in concrete. Fresh concrete tests like compaction factor test and slump cone test were undertaken along with hardened concrete tests like compressive strength, split tensile strength and sorptivity. The result shows that bagasse ash can be a suitable replacement to fine aggregate.

Tomas U. Ganiron Jr (2014) This experimental study aimed to develop an acceptable concrete mixture with sawdust particles as substitute to fine aggregate that can be used for building construction particularly in residential class concrete slab and analyze the effect of sawdust concrete mixture in terms of adhesion of aggregates, thermal insulation, workability and surface quality. This also aims to determine the factors affecting the performance of sawdust concrete mixture in terms of humidity and temperature and design a sawdust concrete mixture as an alternative fine aggregates for residential class concrete slab that will meet the (American Society for Testing and Materials (ASTM) requirements in order to help contribute to the industry in saving the environment, to provide new knowledge to the contractors and developers on how to improve the construction industry methods and services by using sawdust concrete mixture, and sustain good product performance

III. METHODOLOGY

To study the fresh and hardened property of agricultural wastes (sugarcane ash and saw dust). The study work includes the following procedure:

The mix design for M25, M30 and M35 were prepared as per IS 10262:2009 codal provisions. The concrete mixes are prepared varying the bagasse and saw dust content as 0%, 10%, 15%, 20%, 25% and 30% by weight with replacement of fine aggregate. The following table gives the casting of number of concrete specimen in laboratory.

Table.1. Tabulation of cubes for different grades of concrete

% Replacement		0%	5%	10%	15%	20%	25%	30%	Total
Cube (28 Days) Bagasse	M25	3	3	3	3	3	3	3	21
	M30	3	3	3	3	3	3	3	21
	M35	3	3	3	3	3	3	3	21
Cube (28 Days) Sawdust	M25	3	3	3	3	3	3	3	21
	M30	3	3	3	3	3	3	3	21
	M35	3	3	3	3	3	3	3	21

IV. RESULTS AND DISCUSSION

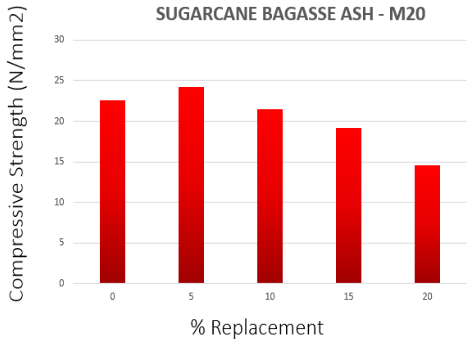
1. Compression Test

Compression testing is a very common testing method that is used to establish the compressive force or crush resistance of a material and the ability of the material to recover after a specified compressive force is applied and even held over a defined period of time.

A. Compression strength results for M20 grade concrete (bagasse ash)

Table.2. Compression strength results for M20 grade concrete (bagasse ash)

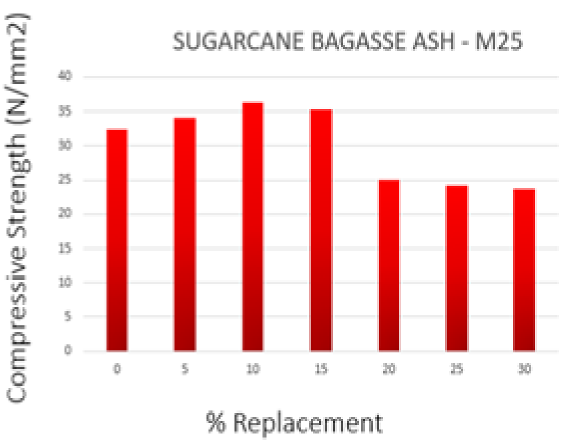
M20	
% REPLACEMENT	COMPRESSIVE STRENGTH (N/mm2)
0	22.6
5	24.2
10	21.5
15	19.2
20	14.6



B. Compression strength results for M25 grade concrete (bagasse ash):

Table.3. Compressive Strength results for M25 grade concrete (bagasse ash)

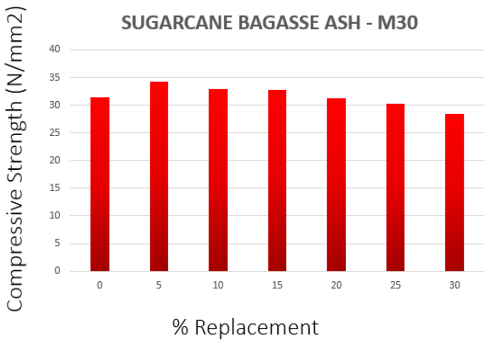
M25	
% REPLACEMENT	COMPRESSIVE STRENGTH (N/mm2)
0	32.3
5	34.1
10	36.3
15	35.2
20	25
25	24.2
30	23.6



C. Compression strength results for M30 grade concrete (bagasse ash):

Table.4. Compression strength results for M30 grade concrete (bagasse ash):

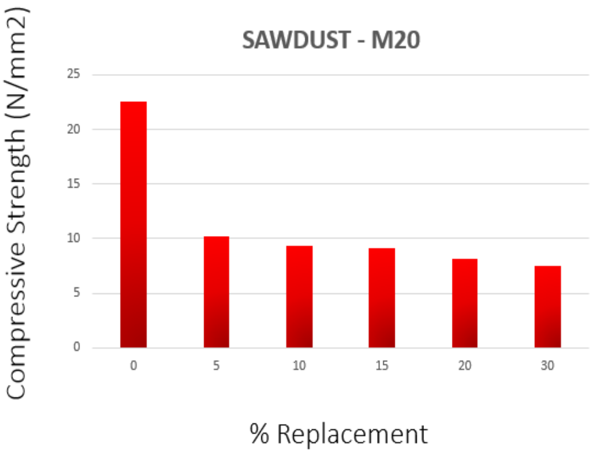
M30	
% REPLACEMENT	COMPRESSIVE STRENGTH (N/mm2)
0	31.4
5	34.2
10	33
15	32.8
20	31.3
25	30.2
30	28.5



D. Compressive strength result for M20 grade concrete (saw dust):

Table.5. Compressive strength result for M20 grade concrete (saw dust):

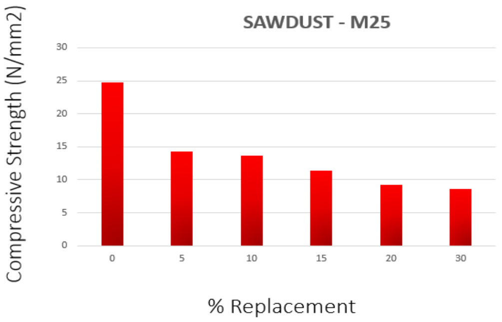
M20	
% REPLACEMENT	COMPRESSIVE STRENGTH (N/mm2)
0	22.6
5	10.2
10	9.3
15	9.1
20	8.1
30	7.5



E. Compressive strength result for M25 grade concrete (saw dust):

Table.6. Compressive strength result for M25 grade concrete (saw dust)

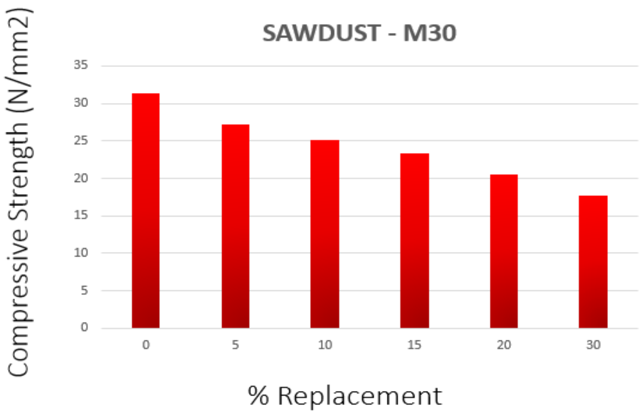
M25	
% REPLACEMENT	COMPRESSIVE STRENGTH (N/mm2)
0	24.7
5	14.23
10	13.6
15	11.4
20	9.2
30	8.6



F. Compressive strength result for M30 grade concrete (saw dust):

Table.7. Compressive strength result for M30 grade concrete (saw dust):

M30	
% REPLACEMENT	COMPRESSIVE STRENGTH (N/mm2)
0	31.4
5	27.2
10	25.1
15	23.3
20	20.5
30	17.7



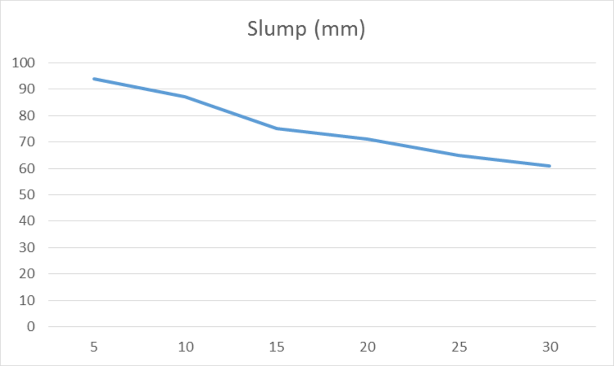
2. Slump test

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.

A. Slump test results for Bagasse ash:

Table. 8. Slump test results for Bagasse ash:

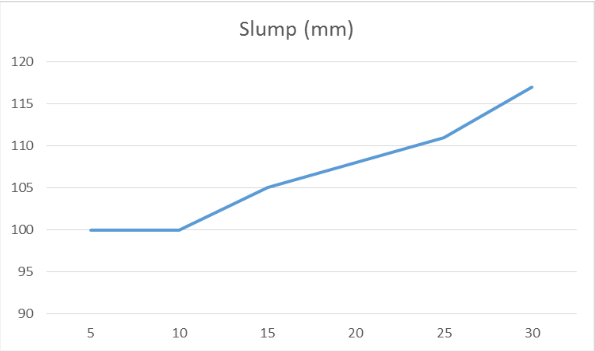
% Replacement	5	10	15	20	25	30
Slump (mm)	94	87	75	71	65	61



B. Slump test results for Saw dust:

Table. 9. Slump test results for sawdust

% Replacement	5	10	15	20	25	30
Slump (mm)	100	100	105	108	111	117

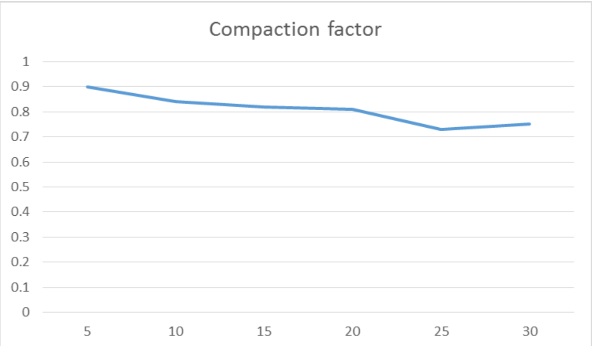


3. COMPACTION FACTOR TEST

A. Compaction factor test results for Bagasse ash:

Table. 10. Compaction factor test results for Bagasse ash:

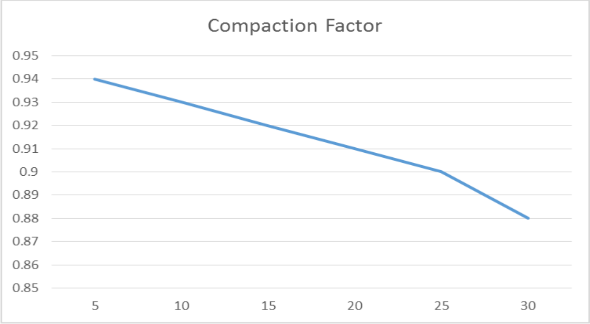
% Replacement	5	10	15	20	25	30
Compaction factor	0.90	0.84	0.82	0.81	0.73	0.75



B. Compaction factor test results for Saw dust:

Table.11. Compaction factor test results for Saw dust:

% Replacement	5	10	15	20	25	30
Compaction Factor	0.94	0.93	0.92	0.91	0.90	0.88



VI. CONCLUSIONS

1. The use of agricultural products and waste in the building materials industry is an efficient modality for implementing sustainable development in the construction industry, due to the multiple possibilities for recovering materials and at the same time for reducing energy consumption, which ensures environmental protection.
2. For waste generators, it guarantees the complete, relatively inexpensive elimination of waste, under environmentally safe conditions, as well as the avoidance of environmental problems and attendant penalties.
3. Sawdust concrete can potentially be used in situations where compressive strength is not a major requirement.
4. Experimental results show that there is increase in the strength of concrete with the use of sugar cane bagasse ash. Therefore with the use of sugarcane bagasse ash in partially replacement of sand in concrete, we can increase the strength of concrete with reducing the consumption of sand. Also it is the best use of sugarcane bagasse ash instead of land filling and making environment clean.

VII. REFERENCE

[1]. ACIU Claudiu, Nicoleta COBIRZAN - "Use of Agricultural Products and Waste in the Building Materials Industry", Technical University of Cluj-Napoca, Romania, ProEnvironment 6 (2013) 472 – 478

[2.] Prashant O Modania, M R Vyawahareb – "Utilization of Bagasse Ash as a Partial Replacement of Fine Aggregate in Concrete", Nirma University International Conference on Engineering,(2013)

[3]. Tomas U. Ganiron Jr-"Effect of Sawdust as Fine Aggregate in Concrete Mixture for Building Construction", Civil Engineering Department, University of the East, Caloocan City College of Architecture, Qassim University, Buraidah City,(2014)

[4]. Yong Cheng, Wen You, Chaoyong Zhang, Huanhuan Li, Jian Hu – "The Implementation of Waste Sawdust in Concrete", Sichuan Agriculture University, Ya'an, China, (2013)

[5]. Dilip Kumar, Smita Singh, Neetesh Kumar and Ashish Gupta- "Low Cost Construction Material for Concrete as Sawdust", International Journal of Current Engineering and Technology ,Vol.4, No.5 (Oct 2014)

[6]. F.A. Olutoge – "Investigations On Sawdust And Palm Kernel Shells As Aggregate Replacement", ARPN Journal of Engineering and Applied Sciences, VOL. 5, NO. 4, APRIL 2010