Impact Factor (SJIF): 3.632

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444
Volume 3, Issue 5, May-2016

AN EXPERIMENTAL STUDY ON BAGASSE ASH IN HIGH STRENGTH CONCRETE

***Chintan.M. Patel*[1], *Prof. N.N. Chinwala*[2]**
(P.G Student-, Civil- Structures, Parul Institute of Engg.& Tech.)[1]
(Department of Civil Engineering, Parul Institute of Engg. & Tech., Limda, Baroda)[2]
E-mail: cmpokar@gmail.com

ABSTRACT

Now India is the second largest in major sugar producing countries after Brazil. Due to that there is increase in bagasse as a by product from the sugar mill. Bagasse is the fibrous residue of sugar cane after crushing and extraction of juice. Sugar cane bagasse ash is the waste product of the combustion of bagasse for energy in sugar factories. Sugar cane bagasse ash is disposed of in landfills and is now becoming an environmental burden.. Bagasse ash mainly contains aluminum ion and silica. In this paper, Bagasse ash has been chemically and physically characterized, and partially replaced in the ratio of 0%, 5% and 15% by weight of cement in M60 grade concrete. Fresh concrete tests like compaction factor test and slump cone test are undertaken as well as hardened concrete tests like compressive strength, flexural strength at the age of 7 and 28 days is obtained. From the results we can conclude that with the 5% of the replacement of the cement with SCBA, the required strength achieved.as the replacement of bagasse ash increasing in high strength, the compressive and flexural strength is decreased.

KEY WORDS: **Bagasse Ash, Pozzolan, High Strength Concrete**

INTRODUCTION

The conventional concrete is a mixture of cement, natural sand and coarse aggregate. Properties of aggregate affect the durability and performance of concrete and the fine aggregate is an essential component of concrete. The most commonly used fine aggregate is natural river or pit sand. Fine and coarse aggregate constitute about 75% of total volume. It is therefore, important to obtain right type and good quality aggregate at site.

The demand of natural sand is quite high in the developing countries due to the rapid infrastructural growth. In this situation developing country like India is facing shortage of good quality natural sand. In India natural sand deposits are being depleted and causing serious threat to environment as well as the society. Increasing extraction of natural sand from river beds causes many problems such as loosing water retaining sand strata, deepening of the river courses and causing bank slides, loss of vegetation on the bank of rivers, exposing the intake well of water supply schemes, disturbance to the aquatic life and affecting agriculture due to lowering of underground water table. In the past decade variable cost of natural sand used as fine aggregate in concrete has increased the cost of construction many folds. In this situation research began for inexpensive and easily available alternative material to natural sand.

Some alternative materials have already been used as a part of natural sand. Flyash, slag, limestone and siliceous stone powder were used in concrete mixtures as a partial replacement of natural sand. However, scarcity in required quality is the major limitation in some of the above materials. Now a day's sustainable infrastructural growth demands the alternative material that should satisfy technical requisites of fine aggregate and at the same time it should be available abundantly.

I. Sugarcane Bagasse Ash:

A. Sugarcane bagasse ash in India

Sugarcane is one of the major crops grown in over 110 countries and its total production is over 1500 million tons. In India sugarcane production is over 300 million tons/year that cause around 10 million tons of sugarcane bagasse ash as an un-utilized and waste material. After the extraction of all economical sugar from sugarcane, about 40-45 percent fibrous residue is obtained, which is reused in the same industry as fuel in boilers for heat or power generation leaving behind 8 -10 percent ash as waste, known as sugarcane bagasse ash (SCBA).

B. Advantages of using sugarcane bagasse ash

Land pollution: Primarily the ash disposal problem from sugar industry is reduced since it is usually disposed off in open land area. Economy: Due to the non-availability of fine aggregate, the price of natural sand which is used as fine aggregate has increased by three folds in the past few months. Hence the overall

Cost involved in the construction is reduced.Future demand: Partial replacement will also help in meeting the increasing demand for fine aggregate in future.

II. Materials Used:

A. Cement

Portland-Pozzolana cement of grade 53 was used for casting the specimens confirming to IS 1489 (Part 1): 1991. Portland-pozzolana cement can be produced either by grinding together Portland cement clinker and pozzolana with addition of gypsum or calcium sulphate, or by intimately and uniformly blending Portland cement and fine pozzolana. Portland pozzolana cement produces less heat of hydration and offers greater resistance to the attack of aggressive waters than normal Portland cement. Moreover, it reduces the leaching of calcium hydroxide liberated during setting and hydration of cement. Specific gravity and fineness modulus of the cement is 3.15 and 7.5 respectively.

B. Fine aggregate

Clean and dry river sand available locally was used. Sand passing through IS 4.75 mm sieve was used for casting all the specimens. Specific gravity and fineness modulus are 2.64 and 2.79 respectively.

C. Coarse aggregate

Coarse aggregate passing through 20 mm sieve and retained on 12.5 mm sieve as given in IS 383 – 1970 was used for all the specimens. In addition to cement paste- aggregate ratio, aggregate type has a great influence on concrete dimensional stability. Specific gravity and fineness modulus are 2.60 and 5.96 respectively.

D. Sugarcane bagasse ash

Sugarcane bagasse ash was collected from : Shree Khedut Sahkari Khand Udhyog Mandli limited at Baben,Ta-BARDOLI, Dist-SURAT.

Specific gravity and fineness modulas of SCBA are 1.63 and 1.42 respectively.And Chemical properties of sugarcane bagasse ash are as shown below table.

S.N	COMPONENT	MASS%
1	Silicon Dioxide(SiO_2), %	62.43
2	Aluminum Oxide(Al_2O_3), %	4.38
3	Iron Oxide(Fe_2O_3), %	6.98
4	Calcium Oxide(CaO), %	11.8
5	Sulphur Trioxide(SO_3), %	1.48
6	Loss of Ignition, %	4.73

Figure 1 Sugarcane bagasse ash

E. Water

In this project, casting and curing of specimens were done using potable water free from deleterious materials. Water plays an important role in concrete production (mix). It starts the reaction between the cement and aggregates. It helps in hydration of the mix.

III. Mix Design:

For high strength concrete there is no specific method of design mix. In the present investigation ACI method and as also the available literatures on high strength concrete are used. In order to achieve high strength lower w/b ratio is adopted and to achieve good workability superplasticizer is used. In the present investigation w/b ratio used is 0.29 and dosage of Superplasticizer is 5.11 Kgs/Cum and 28 days target mean strength for all mixes was 65 Mpa.

EXPERIMENTAL WORK

I. Compressive strength test

Compressive strength was performed on cube specimens of size 150 mm x 150 mm x 150 mm. Compressive strength measured for concrete with replacement of cement with bagasse ash of 0%,5%,10% and 15% at the age of 7 and 28 days in compression testing machine.

Figure 2 Comression testing mechine

II. Flexural strength test

Beam specimens of size 100 mm x 100 mm x 500 mm was casted to test the flexural strength of the concrete. After casting the test specimen it was cured for 7 days and 28 days and tested for maximum load in universal testing machine.

Figure 3 Universal testing machine

III. Durability test

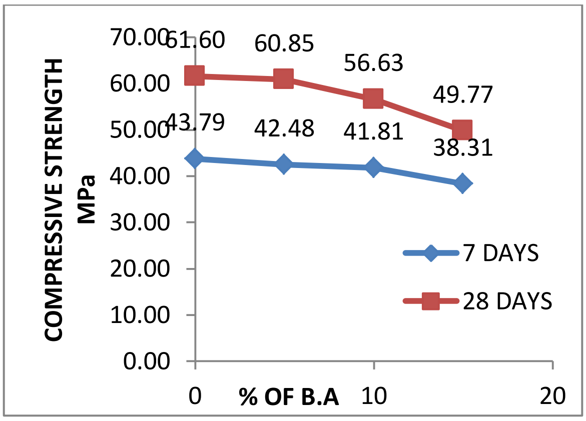
Resistance against acid attack

This test was carried out on the 150*150*150 mm Concrete cube. Cubes are casted and demoulded after 24 hours and at the ends of 28 days of normal curing period tested. The specimens were taken out from the curing tank and initial weight was taken. 5% sulphuric acid by weight of water was added with water as per earlier investigators. The concentration of the solution was maintained throughout this period by changing the solution periodically. The specimens were taken out from the solution after 28 days of continuous soaking. The surface of the Cube were cleaned, weighed & then tested in the compressive testing machine under the uniform rate of loading of 120 kg/cm2/min. The changes in strength of the concrete cube were calculated as per IS: 516-1959.

RESULTS

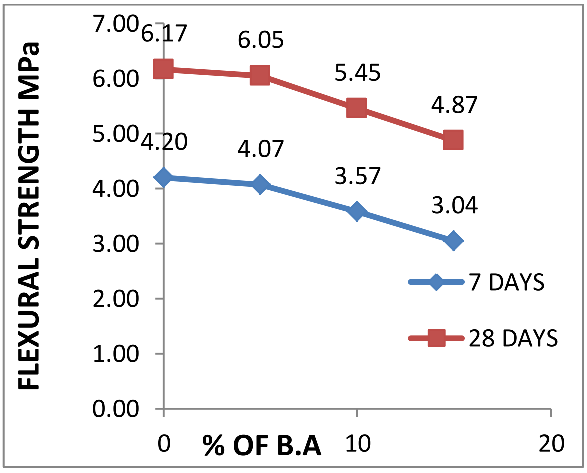
Compressive Strength

COMPRESSIVE STRENGTH(N/mm^2)		
% BA	7 DAYS	28 DAYS
0	43.79	61.60
5	42.48	60.85
10	41.81	56.63
15	38.31	49.77



Flexural Strength

FLEXURAL TEST(N/mm^2)		
%BA	7 DAYS	28 DAYS
0	4.20	6.17
5	4.07	6.05
10	3.57	5.45
15	3.04	4.87



Durability

DURABILITY TEST(5%H2SO4 SOLUTION)	
	% LOSS IN WEIGHT (kg)
CM	5.3
5% B.A.	5.7
10% B.A.	6.2
15% B.A.	8.6

% LOSS IN COMPRESSIVE STRENGTH	
CM	11.6
5% B.A.	14.2
10% B.A.	19.9
15% B.A.	23.3

CONCLUSIONS

As the increasing the percentage of bagasse ash in concrete, the compressive strength of concrete will be decreases.With the 5% of the replacement of the cement with bagasse ash, the required strength is achieved. Flexural strength is decreased with the percentage increasing of bagasse ash.It is concluded that only 5% replacement of bagasse ash is preferable.Greater than 5% replacement of bagasse ash is not preferable.The percentage loss in weight and compressive strength is increases with increament of bagasse ash in high strength concrete.

REFERENCES.

1) Abdolkarim Abbasi and Amin Zargar **"Using Bagasse Ash In Concrete As Pozzolan"** Middle-East Journal Of Scientific Research 13(6):716-719,2013 ISSN 1990-9233

2) Jayminkumar A. Patel &Dr. D. B. Raijiwala**"Use of Sugar Cane Bagasse Ash as Partial replacement of Cement in Concrete – An Experimental Study"** Global Journal of Researches in Engineering: (General Engineering Volume 15 Issue 5 Version 1.0 Year 2015)

3) Sagar W. Dhengare**"Investigation into Utilization of Sugarcane Bagasse Ash as Supplementary Cementitious Material in Concrete"** IJEERT 2015.

4)Sudarsana Rao.Hunchate **"Mix Design of High Performance Concrete Using Silica Fume and Superplasticizer"** ijirset 2014, ISSN: 2319-8753

5) ACI 211.4R-93Guide for Selecting Proportions for High Strength Concrete with Portland Cement and Fly Ash", 1998.

6) IS 456 -2000 "Code of Practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi.

7) ACI, 234R-96, "guide for the use of silica fume in concrete," Reported by ACI, Committee, 234, pp.1-51, 1996.

8) IS: 516-2004, "Methods for Tests for Strength of Concrete", ISI, New Delhi.