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PARTIAL REPLACEMENT OF CEMENT BY SUGARCANE BAGASSE ASH AND THERE EFFECT ON CONCRETE

U.G.Harshali S. Hire[1], Prof. V.S. Bhalerao[2]

[1,2]Department of Civil engineering,

Guru Gobind Singh College of Engineering and Research Centre Nashik

ABSTRACT

*India produces around 24-25MT of sugar these days and also same is approximately the estimated sugar cane bagasse ash (SCBA) produce of India.Therefore it is essential that a useful method of utilization of this sugr factory waste should be found and gainfully used.As the demand and consumption of cement raising ,researchers and scientist are in search of developing alternates binders that are ecofriendly and contribute towards waste management .The utilization of industrial and agricultural waste produced by industrial processes has been focus of waste reduction research for economic ,environmental and technical reasons.Sugar cane bagasse ash is a fibrous waste product of the sugar industry ,along with ethanol vapor.This waste product is already causing serious environmental pollution ,which calls for urgent ways of handling the waste.Bagasse ash is mainly contains aluminium ion and silica. It has limited life spanand after use it s either stock piled or sent to landfills. In these project bagasse ashhas been chemically and physically characterized and partially replaced in the ratio of 0%,5%,10% and 15% by weight of cement fresh concrete that is slump cone test were undertaken as well as hardened concrete test is compressive strength and flextural strength at the age of 6 and 28 days was obtained.***Keywords*** *:PPC,SCBA partial replacement, concrete work ability, durability compressive strength, tensile and flexural strength.*

I. INTRODUCTION

Portland pozzolana cement is recognized as a major construction material throughout the world. Researchers all over the world today are focusing on ways of utilizing either industrial or agricultural waste, as a source of raw materials for industry. This waste, utilization would not only be economical, but may also result in foreign exchange earnings and environmental pollution control. Industrial wastes, such as blast furnace slag, fly ash and silica fume are being used as Supplementary cement replacement materials. Currently, there has been an attempt to utilize the large amount of bagasse ash, the residue from an in-line sugar industry and the bagasse-biomass fuel in electric generation industry. When this waste is burned under controlled conditions, it also gives ash having amorphous silica, which has pozzolanic properties. A few studies have been carried out on the ashes obtained directly from the industries to study pozzolanic activity and their suitability as binders, partially replacing cement. It is also used in concrete without adverse effects in concrete durability. Therefore it is possible to use Sugarcane Bagasse Ash (SCBA) as cement replacement material to improve quality and reduce

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the cost of construction materials such as mortar, concrete pavers, concrete roof tiles and soil cement interlocking block. The present study was carried out by Partial Replacement of Cement by SCBA of sugarcane bagasse. Our project analyzes the effect of SCBA in concrete at the ratio of 0%, 5%, 10% and 15% . The experimental study examines the compressive strength of hardened concrete. The main ingredients consist of Portland Pozzolana cement, SCBA, river sand, coarse aggregate and water. After mixing, concrete specimens were casted and subsequently all test specimens were cured in water at 7 and 28 Days.

1.1Chemical Properties of Sugar Cane Bagasse Ash

1. The sugarcane bagasse consists of approximately 50% of cellulose, 25% of hemicelluloses and 25% of lignin.
2. Each ton of sugarcane generates approximately 26% of bagasse (at a moisture content of 50%) and 0.62% of residual ash.
3. The residue after combustion presents a chemical composition dominates by silicon dioxide (SiO2).
4. 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 the sugarcane harvests.
5.(SCBA) Its Colour having Black & Specific Gravity- 1.306

Table 1.1: Chemical composition of SCBA

Sr.No.	Component	Mass%
1	Silica dioxide(SiO2)	*66.89*
2	Alumina oxide(AI2O3)+Iron Oxide(Fe2O3)	*29.181*
3	Calcium Oxide(CaO)	*1.952*
4	Magnesium Oxide(MgO)	*0.82*
5	Sulphur Tri Oxide(SO3)	*0.56*
6	Loss of Ignition	*0.72*

1.2 Research Significance

The construction of modern structures calls for materials with increasingly improved properties like strength, stiffness, toughness, ductility and last but not least durability. It is essential that when concrete is use for modern structures, then it should retain its original form, quality and serviceability throughout its lifespan without any deterioration that is, it should have long durability. Durability of concrete depends on strength of concrete also. Strength is defined as ability of concrete to carry load. Now-a-days concrete with varieties of strength are available as per requirements. Cost of concrete too varies with strength. Even though strength is a key factor, only limited studies are carried out to investigate the addition of Sugar Cane Bagasse Ash (SCBA). In this study, therefore we firstly an attempt has been to study the effect of addition of Sugar Cane Bagasse Ash and which gives the maximum strength on test result on compression strength of low grade concrete (M25).

1.3 Objectives of work

1. The present study aims at mix design of M25 grade of concrete and to find required constitutes of it.
2.The study the effect of replacement of cement in concrete by pozzolonic material that is Bagasse Ash.
3. To study the effect of addition of Sugar Cane Bagasse Ash (0%, 5%, 10%, and 15%) on compressive strength of low grade concrete (M25).

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4. To study the effect of addition of Sugar Cane Bagasse Ash (0%, 5%, 10%, and 15%) on tensile strength of low grade concrete (M25).

5. To find out the optimum percentage of Bagasse Ash that can effectively replaces the cement by weight without **any** adverse effect on properties of hardened concrete.

II. LITERATURE REVIEW

IJCSE-International Journal of Civil & Structural Engineering ResearchPiyushkumar ,Anil pratapsingh(2015);they studied on " Effect ofuse of Bagasse Ash on Strength of Concrete",with increasing demand and consumption of cement ,researchers and scientist are in search of deveoping alternate binders that are eco friendly and contributes towards waste management .In these paper SCBA has been chemically and physically characterized and partially repaced in the ratio of 0%,5%,10%,15%&20% by weight of cement in concrete.The properties for fresh concrete are tested like slump cone test and for hardened concrete compressive strength at the age of 7&28 days by using grade M30.The test result indicate that the strength of concrete increase upto 10% SCBA replaced with cement.

IJSLE-International for Service Learning In Engineering

R Shrinivasan and K. Sathiya (2010); they studied on "Experimental Study on Bagasse Ash in Concrete". The utilization of industrial and agricultural waste produced by industrial processes has been the focus of waste reduction research for economic, environmental, and technical reasons. Sugar-cane bagasse is a fibrous waste-product of the sugar refining industry, along with ethanol vapor. This waste product (Sugar-cane Bagasse ash) is already causing serious environmental pollution, which calls for urgent ways of handling the waste. Bagasse ashmainly 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%, 15% and 25% by weight of cement in concrete. Fresh concrete tests like compaction factor test and slump cone test were undertaken was well as hardened concrete tests like compressive strength, split tensile strength, flexural strength and modulus of elasticity at the age of seven and 28 days was obtained. The test result indicate that the strength of concrete increase up to 15% SCBA replacement with cement.

SiriratJanjaturaphan and SupapornWansom (2010);they studied on, "The Pozzolonic Activities of Industrial Sugar Cane Bagasse Ash". They find out the chemical composition of the Sugarcane Bagasse Ash and compared them with the other pozzolonic material that is, rice husk ash and concluded that the SCBA is suitable for the partial replacement of cement.

D. Mukharjee (2011)has Study made on "Utilization of SCBA". They described the various uses of SCBA in agriculture, construction, use of bagasse as fertilizers; in horticulture etc. their chemical and other fertilizing properties etc. also gave various options for utilizing bagasse ash in various fields. Ashes obtained after control burning of SCB at 600oC/5hour were reasonably reactive given by the fact that little crystallization of minerals occurred. Morphological, XRD and TGA/DTA study of the blended pastes confirmed the hydration reaction of SCBA within the cement gel. Compressive and flexural strength tests confirmed the actual behavior of SCBA blended mortars and it suggested that up to 15% substitution of OPC with SCBA can be made with better strength results than that with pure cement.

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Sagar W. Dhengare, Dr.S.P.Raut, N.V.Bandwal, AnandKhangan(2015);they Studied on, "Investigation into Utilization of Sugarcane Bagasse Ash as Supplementary Cementations Material in Concrete". This paper presents the use of sugarcane bagasse ash (SCBA) as a pozzolanic material for producing high-strength concrete. The utilization of industrial and agricultural waste produced by industrial processes has been the focus on waste reduction. Ordinary Portland cement (OPC) is partially replaced with finely sugarcane bagasse ash. The concrete mixtures, in part, are replaced with 0%, 10%, 15%, 20%, 25% and 30% of SCBA respectively. In addition, the compressive strength, the flexural strength, the split tensile tests were determined. The bagasse ash was sieved through No. 600 sieve. The mix design used for making the concrete specimens was based on previous research work from literature. The water –cement ratios varied from 0.44 to 0.63. The tests were performed at 7, 28, 56 and 90 days of age in order to evaluate the effects of the addition SCBA on the concrete. The test result indicate that the strength of concrete increase up to 15% SCBA replacement with cement.

Jayminkumar A. Patel, Dr. D. B. Raijiwala(2015);they studied on, "Experimental Study on Use of Sugar Cane Bagasse Ash in Concrete by Partially Replacement with Cement". In this paper sugar cane bagasse ash which is taken from one of the sugar mill of south Gujarat (INDIA) used in M25 grade of concrete by replacing cement 5% by weight and compare with normal M25 grade of concrete to check the feasibility of sugar cane bagasse ash in concrete.

K Meeravali, K V G D Balaji, T. Santhosh Kumar (2014);they studied on, "Partial Replacement of Cement in Concrete with Sugar Cane Bagasse Ash-Behaviour in Hcl Solution". In this paper concrete cubes are casted with different percentages of Sugarcane Bagasse ash replaced with cement by weight (i.e. 0%, 5%, 10%, 15%, 20%, and 25%), and this cubes are exposed to 5% HCL environment. Compressive strength of cubes for 7days, 28 days and 60days are observed. Having gone through above literatures, it has been found that several researchers studied the effect of SCBA with their thermal and mechanical properties on concrete. Higher grade of concrete was considered as a base sample for above all research. So an attempt has been made to find out the % of SCBA to be added to M20 grade concrete in order to increase its strength and make it competition with higher grade concrete with maintaining the economy of work.

III. METHODOLOGY

Step I: Introduction of Materials used and Preliminary investigations of materials: *Concrete is a* composite material composed of coarse granular material (the aggregate or filler) embedded in a hard matrix of material (the cement or binder) that fills the space between the aggregate particles and glues them together. We can also consider concrete as a composite material that consists essentially of a binding medium within which are embedded particles or fragments of aggregates. The simplest representation of concrete is:

Concrete = Filler + Binder.

For this kind of concrete, the composition can be presented as follows

Cement → Cement paste + Water + → mortar +aggregate → concrete

The material using in this investigtionare

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Cement:Mostly used cement in concrete is PortandPozzolanaCement.These cement gains compressive strength with age.[1489-1991]

Coarse Aggregate : The crushed aggregate used were 20mm and 10mm nomnal maximum size &testedas per Indian Standard andresult are within permissiibe limit(IS:10262,IS:383)

Specific gravity =2.71 ,Fineness Modulus = 6.814)

Fine aggregate are purchased which satisfied the required properties of fine aggregate required for experimental work and the sand conforms to zone II as per the specifications of IS 383:1970.

Specific gravity = 2.63, Fineness modulus = 2.84, Silt content=2.63

Water: Mixing water should not contain undesirable organic substances or inorganic constituents in excessive proportions. In this project clean potable water is usedand curing as per IS: 456-2000.

Bagasse Ash : The sugarcane bagasse consists of approximately 50% of cellulose, 25% of hemicellulose and 25% of lignin. This material contains amorphous silica which is indication of cementing properties.

StepII : Mix design of concrete mixes with varying percentage of SCBA :

Mix design is the process of selecting suitable ingredient if concrete and determines their relative proportions with the object of certain minimum strength and durability as economically as possible.

Factors To Be Considered In Mix Design

1. Grade of concrete
2. Type of cement
3. Type & size of aggregate
4. Type of mixing & curing
5. Water /cement ratio
6. Degree of workability
7. Density of concrete
8. Air content

Test For a one concrete mould of M25 preparation (concrete cube of size 150x150x150mm) following quantity of material are required. M25 = 1:1:2 proportions ,Volume = 0.15x0.15x0.15 = 3.375 x10-3 m3

Bagasse ash= 0%, 5%, 10% and 15% of cement adopted Slump Cone Testing ,Compression Testing ,Splitting Tensile Strength Testing ,Flexural Strength Testing.

Step III IV: Casting & Curing of PCC cubeslump cone testing

We are going to cast standard cube of size 150x150x150mm.Casting will be done by varying percentage of SCBA.After casting, curing will be done.Testing of cube after 7days and 28days will be done.

Step V: Testing of cast specimen to obtain compressive strength

After curing, testing on the cubes will be in two stages i.e.Stage 1: After 7 days of casting.Stage 2: After 28 days of casting.

Test adopted

Slump Cone Testing ,Compression Testing , Flexural Strength Testing.

1) Slump Cone Testing

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Degree of workability	Slump	Compacting factor
Very low	0 - 25 mm	0.78
Low	25 - 50 mm	0.85
Medium	50 - 100 mm	0.92
High	100 - 175 mm	0.95
Very High	Collapsed	Not applicable

SLUMP CONE EQUIPMENT

2) Compressive Strength Test:

The concrete block specimen we are using :-

Grade of Concrete : M25 (1:1:2), Size of block : 150 x 150 x 150 (mm), Curing : 7days, 28days, No of Blocks : 3 Blocks.

COMPRESSION STRENGTH EQUIPMENT

2)Flexure Strength Test: Concrete specimen we are using

Grade of Concrete : M25(1:1:2), Size of specimen : 150 x 150 x 700 (mm).

DESIGNED BEAM

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IC. CONCLUDING REMARK

- Replacement of cement by bagasse ash reduce industrial waste and to save cement. By saving cement reduced greenhouse gases emission and makes environmental green.
- As the percentage of sugarcane bagasse ash increases the compressive strength of concrete tends to increase up to certain percentage and then start's decreasing with the increase of ash content.
- Water requirement increased as the percentage of BA increased.
- Bagasse ash is a valuable pozzolanic material and it can potentially beused as a partial replacement forcement.And make construction cheaper.
- This could reduce the environmental problems and minimize the requirement of land fill area to dispose BA.

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