The International Journal of Engineering and Science (IJES)
ISSN (e): 2319 – 1813 ISSN (p): 23-19 – 1805
|| Pages || PP 76-81 || 2018 ||

Experimental Study on Use of Scba in Concrete by Partially Replacement of Cement

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ABSTRACT :*Nowadays, the main focus of research is to reduce industrial and agricultural waste for eco-friendly environment. This experimental study investigates the strength performance of concrete using Portland pozzolana Cement and Sugarcane Bagasse Ash. Initially, bagasse ash samples were collected and its properties were investigated. Normal consistency and setting time of the pastes containing Portland pozzolana cement and sugarcane bagasse ash at 5%, 10%, 15% & 20% replacement were investigated. The compressive strength of concrete block containing Portland pozzolana cement with bagasse ash at 5%, 10%, 15% & 20% replacements were also investigated. The Compressive strength was evaluated for 7, 14, and 28 days of curing period. The effect of SCBA %, curing period , mix ratio on concrete block compressive strength, were studied and results are incorporated in the paper . The test result shows that sugarcane bagasse ash (SCBA) can be used as a partial replacement of cement upto 10% by weight of cement without any major loss in strength. Compressive strength was calculated for 7, 14 and 28 days.*

KEYWORDS - *Sugarcane bagasse ash (SCBA), Portland pozzolana cement (PPC), Eco-friendly.*

I. INTRODUCTION

Concrete is second most used material after water. Cement is the important constituent of concrete. During the production of cement, one of the greenhouse gasses namely carbon dioxide is emitted which is responsible for causing global warming [1]. Currently, some of the agro waste such as rice husk ash, sugarcane bagasse ash, etc has been used as an admixture. This one of the effective ways to reduce its impact on environment [2].In the current study, an attempt has been made in order to use bagasse ash as partial replacement of cement. This waste usage can be economical and also have An Experimental Study On Partial Replacement of Cement with Bagasse Ash in Concrete Mix positive impacts in minimizing environmental pollution. Sugarcane is grown in around 110 countries of about 1500 million tons [3]. In India, more than 300 million tons of sugarcane is grown [4, 5]. Bagasse is the residue left after extraction of juice from sugarcane [6, 7.]Nearly 30% of bagasse is obtained. . Much of the raw mass of sugarcane becomes waste during the refining process. Since refineries are normally built in locations where commercial power is unavailable, the factories generate their own electricity by burning bagasse to provide steam for back pressure steam turbine generators as well as process heating. The resulting bagasse ash represents approximately 0.62% of the sugarcane weights. The main composition of bagasse ash is siliceous oxide Sio2 that react with free lime from cement hydration. When this bagasse is burned underneath controlled temperature it gives ash having high amorphous silica and alumina oxides [8.9].

In this experimental study, an attempt of replacement of cement with bagasse ash partially in concrete mix is made for M20 grade with ratios of 0%, 5%, 10%, 15%, and 20%.

MATERIAL USED

2.1 Cement

Cement is a material that has cohesive and adhesive properties in presence of water. There are different types of cement, out of that the cement used for this project was Portland Pozzolana cement. The physical properties of cement is given in table no 1.

Table No. 1: The physical property of cement

Sr. No	Test	Results
1.	Fineness	5 %
2.	Soundness	4 mm
3.	Specific gravity	3.15
4.	Normal consistency	32%
5.	Initial setting time	98 min
6.	Final setting time	320 min

2.2 Fine aggregate:

The fine aggregate used in the concrete productions is natural sand of river. The most common constituent of sand is silica, usually in the form of quartz, which is chemical inert and hard. Hence used as a fine aggregate in concrete. In order to investigate its properties for the required application different tests were carried out which include: sieve analysis and fineness modules, specific gravity and absorption capacity, moisture content and unit weight as per specification laid down in IS: 383-1970. The physical property of fine aggregate is shown in table no 2.

Table No. 2 : Physical property of fine aggregate

Sr. No	Test	Results
1.	Moisture contents	0.18 %
2.	Water absorption	0.21%
3.	Specific gravity	2.56

2.3 Coarse Aggregate:

Coarse aggregate is the main constituent of concrete, it provide main body of concrete. Approx. 70% volume of concrete is occupied by coarse aggregate. Crushed Stone of maximum size of 20 mm has been used as coarse aggregate. The physical property of course aggregate is given in table no 3.

Table No. 3: The physical property of course aggregate

Sr. No	Test	Results
1.	Moisture content	0.22 %
2.	Water absorption	0.52 %
3.	Specific gravity	2.66

2.4 Water:

Water plays an important role in the formation of concrete as it participates in chemical reaction with cement. Due to the presence of water the gel is form which helps in increase of strength of concrete. Almost any natural water that is drinkable and has no pronounced taste or odour can be used as mixing water. Water from lakes and streams that contain marine life are also usually suitable.

2.5 Sugarcane bagasse ash :

Bagasse is a cellulose fiber remaining after the extraction of the sugar-bearing juice from sugarcane. Bagasse ash is one of the biomass sources and valuable byproducts in sugar milling that often uses bagasse as a primary fuel source to supply all the needs of energy to move the plants. The bagasse ash is about 8-10% of the bagasse and contains unburned matter, silica and alumina. Bagasse ash has been a problem to the environment due to its disposal. The most significant pollutant emitted from the boilers being a particulate matter, caused by the turbulent movement of combustion gases with respect to the burning bagasse and resulting ash. Sometimes some auxiliary fuels typically fuel or natural gas may be used during startup of the boiler or when the moisture content of the bagasse is too high to support combustion, in such cases the emissions of SO_2 and NO_2 will increase. Sugarcane bagasse ash has also been found to have such pozzolanic property hence it can be used for partial replacement of cement. For this research sugarcane bagasse was taken from wardha district. The physical property of SCBA is given in Table no. 4.

Table No. 4 : The physical property of SCBA

Sr. No	Test	Results
1.	Fineness	0.8 %
2.	Unit weight	0.80 gm/m3
3.	Specific gravity	1.89

II. EXPERIMENTAL PROGRAM

Compressive Strength test were carried out to investigate compressive strength of concrete blocks made with partially replacement of cement with SCBA with different mix proportion for curing periods of 7, 14 and 28. Table no. 5 shows the no. Of specimens for each mix ratio.

Table no 5. No of Specimens for each mix ratio

Days	Conventional Concrete	SCBA			
		5%	10%	15%	20%
7	3	3	3	3	3
14	3	3	3	3	3
28	3	3	3	3	3

After weighing all the material required for preparing the concrete using an electronic weighing balance SCBA, sand, aggregate and cement were blended thoroughly to make uniform mass. The required amount of water was added gradually to make SCBA cement mixture required quantity were added mixing was continued. The mixture was casted into square mould with help of trowel and allowed for 24 h for initial setting. The specimens were removed after initial setting period from the mould and then kept in water tank for curing. Fig. 1 shows mixing of material to prepare the specimens and curing of specimens in tank. Experimental program had curing periods of 7 14 and 28 days.

Fig. 1: Mixing of material to prepare the specimens and curing of specimens in tank

The first paragraph under each heading or subheading should be flush left, and subsequent paragraphs should have a five-space indentation. A colon is inserted before an equation is presented, but there is no punctuation following the equation. All equations are numbered and referred to in the text solely by a number enclosed in a round bracket (i.e., (3) reads as "equation 3"). Ensure that any miscellaneous numbering system you use in your paper cannot be confused with a reference [4] or an equation (3) designation.

3.1 TEST PROCEDURE:

By using an electronic weighing balance, each specimen was weighted after air drying compressive strength was measured by compression test on specimen with the help of compressive testing machine. Three number of specimen where prepared and tested for each mix ratio and for particular SCBA%. A total number of 45 specimen where prepared and tested for the compressive strength and the results are incorporated in the paper.

III. RESULT AND DISCUSSION

4.1 Failure Pattern :

The Failure Pattern of concrete block with SCBA under the Action of compressive load was observed. Before failure vertical and diagonal crack were observed in the specimen. The failure pattern of concrete block in SCBA as shown in the Fig.2.

Fig. 2: Failure Pattern

4.2 Slump cone test

A high quality concrete is one which has appropriate workability (around 65 mm slump height) in the fresh condition. Basically , the greater the measured height of slump , the improved the workability will be , indicating that the concrete flows easily but at the same time is free from segregation the slump achieved at the rate of 65mm to 85mm for the different mix of SCBA . It is found that workability of concrete increases by increasing the percentage of replacement of SCBA in concrete.

4.3 Compressive strength

After 7, 14, 28 days of curing period, the compression test on specimen was conducted Fig.3 shows the effect of curing period on compressive strength. The result shows that sugarcane bagasse ash (SCBA) can be used as a partial replacement of cement upto 10% by weight of cement without any major loss in compressive strength. As SCBA is agro waste, so it is economical to use. The minimum and maximum compressive strength of conventional concrete is 17.33 MPa and 29.60 MPa respectively. The minimum and maximum compressive strength of concrete mixed with SCBA is 20 MPa and 30.66 MPa respectively. Fig 3 shows the effect of curing period on compressive strength. Fig. 4 shows the effect of SCBA on compressive strength for 7 days, 14 days, and 28 days curing period. Fig 6 Shows Characteristic strength of concrete at w/c 0.50 after 7, 14 and 28 Days.

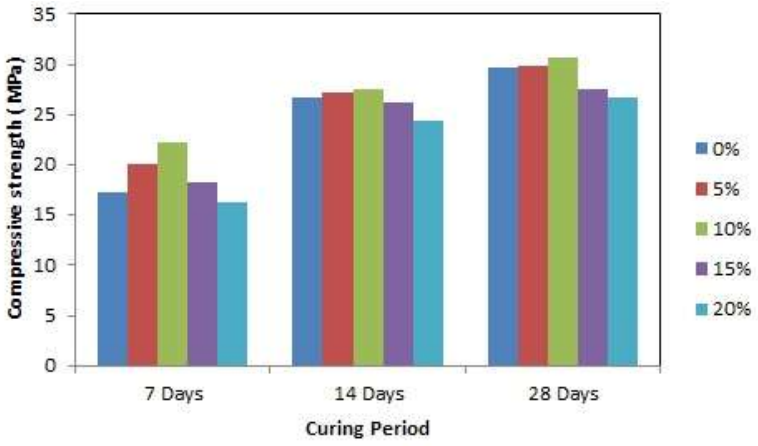

Fig. 3 Effect of curing period on compressive strength.

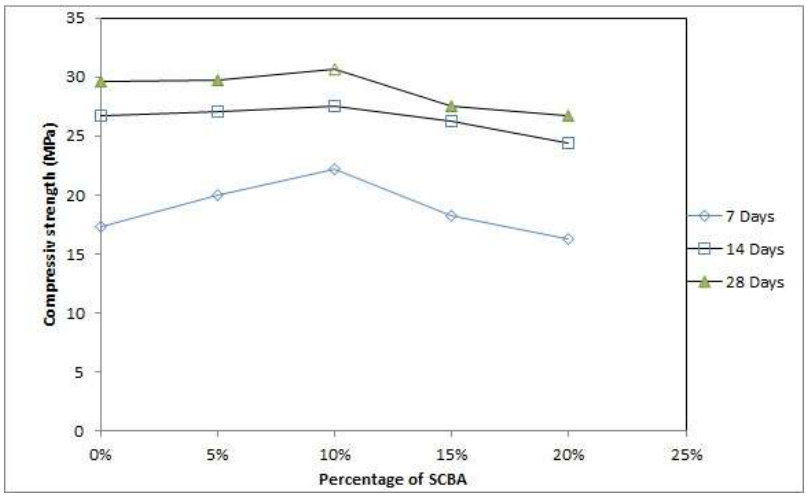

Fig. 4 Effect of SCBA on compressive strength for 7 days, 14 days, 28 days curing period

Table no. 6 Characteristic strength of concrete at w/c 0.50 after 7, 14 and 28 Days.

Sr. No	%SCBA	Compressive Strength (MPa)		
		7 Days	14 Days	28 Days
1.	0	17.33	26.67	29.60
2.	5	20	27.11	29.77
3.	10	22.22	27.56	30.66
4.	15	18.22	26.22	27.56
5.	20	16.22	24.44	26.67

IV. CONCLUSION

1. From the study conducted, it is concluded that workability of concrete increases by increasing the percentage of replacement of SCBA in concrete.
2. The finely grounded SCBA can be successfully replaced by cement and is responsible for higher compressive strengths than normal concrete (keeping quantity of cement constant).
3. The cement could be advantageously replaced with SCBA up to a maximum limit of 10% for M20 concrete .The study reveals that the compressive strength increased up to 10% replacement whereas beyond 15% replacement the strength was found to be decreasing. Therefore it is possible to use bagasse (SCBA) as cement replacement material to improve quality control and reduction of cost.
4. The minimum and maximum compressive strength of concrete mixed with SCBA is 20 MPa and 30.66 MPa.
5. The slump achieved at the rate of 65mm to 85mm for the different mix of SCBA .

A conclusion section must be included and should indicate clearly the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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