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Study on Sugarcane bagasse ash concrete.

Rohini H. Munde[1], Dr. S.S. Jamkar[2], Dr. S.N. Deshmukh[3]

[1]PG Student, Department, of Applied Mechanics Govt. college of Engineering Aurangabad, Maharashtra, India.
[2]Professor, Department, of Applied Mechanics Govt. college of Engineering Aurangabad, Maharashtra, India.
[3]AssociateProfessor, Department, of Applied Mechanics Govt. college of Engineering Aurangabad, Maharashtra, India.

Abstract – *Sugarcane bagasse ash (SCBA) is industrial waste product which causes environmental problems. Sugarcane bagasse ash mainly contains silica and alumina. The paper presents experimental study on workability and compressive strength of concrete. In this work concrete mix was prepared with 0.5 w/c ratio at 0%, 10%, 20%, and 30% replacement of cement by Sugarcane bagasse ash. The results are compared with concrete with (10%, 20%, and 30%) or without (0%) Sugarcane bagasse ash. Results indicated that cement is replaced by Sugarcane bagasse ash up to 20% in concrete.*

Key Words: Sugarcane bagasse ash, Concrete, Workability, compressive strength.

1. INTRODUCTION

Concrete is the world's most important, most commonly and most consumed construction material in modern society with the development in urbanization and industrialization. Concrete has excellent mechanical and durability properties. Cement is main ingredient of concrete. Ordinary Portland cement is most commonly used material throughout the world. The cement industry produced about 5% of global emission of CO_2 (1) and on Another serious problem in developing countries like India is disposal of solid waste, generated from agricultural and other industrial production. Sugarcane Bagasse ash is the industrial waste. Sugarcane is one of the major crops grown in over 110 countries and the total production is more than 1500 million tons (3). India is the second largest producers of Sugarcane which produced over 300 million tons per year (2). Sugarcane bagasse ash mainly contains silica and alumina. This Sugarcane bagasse ash generates various problem associated with environment. Because the disposal of SCBA is on open land and having landfill problem due to this open land filling problems like water pollution, soil pollution, air pollution is done. All this pollution causes global warming and green house effect and which is dangerous for environment and human life. To reduce these environmental problems it is necessary to utilized this as cement replacement material in concrete. In this paper cement were replaced by 0%, 10%, 20%, and 30% by Sugarcane bagasse ash in concrete.

2. MATERIAL USED

2.1 Cement

OPC 53 grade cement is used. Specific gravity of cement is 3.15. The physical properties of cement tested as per IS: 12269:1987(4).fineness of cement obtained was 3.74% (residue on 90 micron sieve).

2.2 Sugarcane bagasse ash

Sugarcane bagasse consists of approximately 50% of cellulose, 25% of hemicelluloses and 25% lignin. Each ton of sugarcane generates near about 26 % of bagasse and 0.62% Sugarcane bagasse ash (3). In the present work Sugarcane bagasse ash was collected directly from cleaning operation of boiler in sugar industry. Sugarecane bagasse ash passing through 90 micron was used. Chemical properties of Sugarcane bagasse ash are given in Table-1. Sugarcane bagasse ash mainly contain high amount of silica and alumina.

Table -1: Chemical compassion of Sugarcane bagasse ash

Chemical composition	(% by mass)
Silicon dioxide (SiO_2)	95.56
Aluminium oxide (Al_2O_3)	5.43
Ferric Oxide (Fe_2O_3)	0.53
Magnesium Oxide (MgO)	2.14
Calcium Oxide (CaO)	0.29
Sodium Oxide (Na_2O)	0.002
Potassium oxide (K_2O)	0.010
Briume oxide (BaO)	BDL

2.3 Fine and Coarse aggregates

Locally available river sand and crushed angular basalt was used as fine aggregate (FA) and Coarse aggregate (CA) with maximum size of 4.75mm and 20mm respectively in this experimental work. Coarse aggregates are 20mm and 10mm used in 60-40 % ratio. Specific gravity of fine and coarse aggregate was 2.56 and 2.79 respectively. Water absorption of fine and coarse aggregate obtained 1.12% and 0.55%respectively. Specific gravity and Water absorption

properties of fine and coarse aggregate resolute as per IS: 2386:1963 (5).

2.4 Superplasticizer and water

Superplasticizer (SP) named Conplast SP 430 and portable water was used in this experimental work.

3. EXPERIMENTAL PROGRAM

In this experimental work, concrete mix design was prepared according to the IS: 10262:2009 (6). Water cement ratio was 0.5 kept constant for all 4 mix designs. The mix proportions for 0.5 water cement ratio with 0%, 10%, 20% and 30% replacement of cement by Sugarcane bagasse ash are shown in Table-2.

Table -2: Concrete mix proportion

w/c ratio	SCBA in %.	Quantity of material in kg/m3				
		SCBA	Cement	FA	CA	SP
0.5	0	0	300	769	1257	5.4
0.5	10	30	270	769	1257	5.4
0.5	20	60	240	769	1257	5.4
0.5	30	90	210	769	1257	5.4

4. TEST CONDUCTED ON CONCRETE

In this experimental work test are conducted on concrete to determine workability and compressive strength of concrete with and without Sugarcane bagasse ash. Workability of concrete was determined by slump cone test on fresh concrete and compressive strength of concrete was calculated by compression strength test on harden concrete.

Compression strength was done on compression testing machine. For compression strength test cube specimens of size 150×150×150 mm was used. Test was performed on concrete cubes after 7 and 28 water curing. Compression strength test of concrete was done as per IS: 516:1959 (7).

5. RESULT AND DISCUSSION

5.1 Workability test results

Workability test results are shown in Table-3. Workability of concrete was measured by slump value. As presented in Fig-1.It was observed that workability of concrete decreases with increasing % replacement of Sugarcane bagassse ash in concrete.

Table -3: Workability test results

% Replacement of cement by SCBA.	Workability (Slump value in mm)
0 %	48
10%	43
20%	39
30%	37

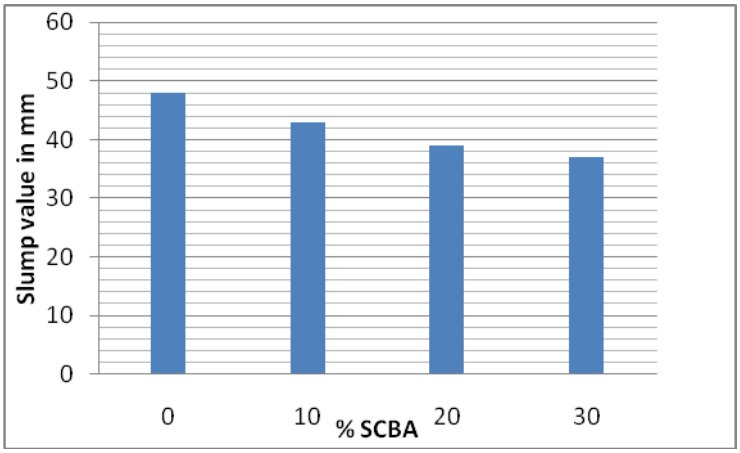

Fig-1: Slump value verses various % replacement of SCBA in concrete.

5.2 Compression strength test result

The results of compressive strength of concrete at 7 and 28 days with (10%, 20%, and 30%) and without (0%) Sugarcane bagasse ash are given in Table-4. Compressive strength verses % replacements of cement by Sugarcane bagasse ash in concrete at both the edges of curing were presented in Fig-2. Compressive strength of concrete increased up to 20% replacement of cement by sugarcane bagasse ash in concrete compare to concrete without Sugarcane bagasse ash at 7 and 28 days.

Table -4: Compressive strength test result

% Replacement of cement by SCBA.	Compressive strength in N/mm^2	
	7 days	28 days
0 %	20.14	27.70
10%	22.22	28.14
20%	23.70	29.03
30%	18.51	26.51

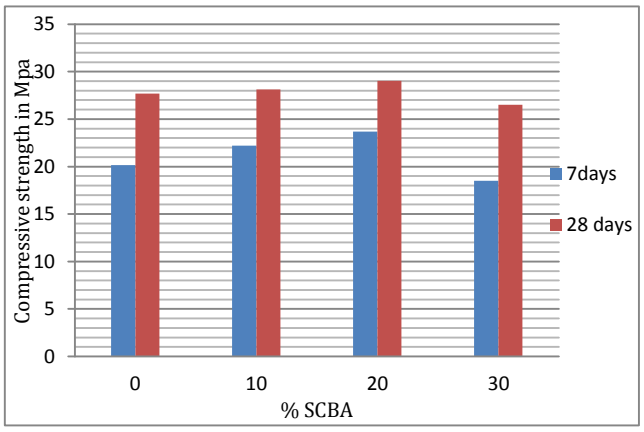

Fig -2: Compressive strength verses various % replacements of cement by SCBA in concrete

6. CONCLUSIONS

1) Workability of concrete decreased with increasing % replacement of Sugarcane hagasse ash in concrete.

2) Compressive strength of concrete increased up to 20% replacement of cement by Sugarcane bagasse ash in concrete compared to concrete without Sugarcane bagasse ash at 7 and 28 days

3) OPC cement is replaced by Sugarcane bagasse ash up to 20% in concrete reduced environmental problems and cost of construction also.

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