Experimental Study of Plain Concrete M25 Grade with Partial Replacement of Cement with Sugarcane Bagasse Ash and Fine Aggregate by Stone Dust under Compression

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Abstract- *The use of Industrial and agricultural waste product produced by industrial process has been centre point of waste reduction research for following 3 reasons :-*
(a)Economical (b)Environmental (c)Technical

The byproduct obtained after extracting juice from sugarcane is called Sugarcane bagasse. It is fibrous waste product of sugar refining industry, along with ethanol vapor. This waste product is already causing a threat to environmental pollution which calls for ways for urgent disposal of waste. There are 2 main component of Bagasse ash:(a) Aluminum Ion (b) Silica

Keywords- Concrete, Sugarcane bagasse ash (SCBA), Stone Dust

I. INTRODUCTION

Ordinary portland cement is widely used construction material for binding throughout the world. Now a days many researcher from nooks and corner of the world are focusing on ways of using either industrial an agricultural waste, as a source of raw material for industry. Use of this waste (S.C.B.A.) would not only be economical but may also beneficial in earning of foreign exchange and checking the environmental pollution. There are several industrial waste being used as supplementary cement replacement material such as blast fumace slag, fly ash, and silica fume. Currently these has been an attempt to utilize the large amount of bagasse ash, the residue obtained from in time sugar industry and the bagasse biomass fuel in generation of electricity for industrial use. When this waste is burned under controlled condition it turned into ash containing amorphous silica. The properties of this silica is pozzolanic. A few studies have been carried out on the ashes obtained directly from the industry to study pozzolanic activity and their suitability as binders, partially replacing cement. These for it is possible to replace cement by sugarcane bagasse ash (S.C.B.A.) to enhance the quality and to make construction material more economical. This material can be use as mortar, soil cement interlocking blocks, concrete roof tiles, concrete pavers.

In this study the another partial replacement of fine aggregate by stone dust is done. The sanitary and stone cutting querry inevitably produce large amount of waste. It is found in previous researches that 40% replacement of natural sand with stone dust alongwith stone aggregate with ceramic waste the compressive strength is maximum. So in this study we kept the percentage of stone dust constant at 40% and along with we use the variable quantity of S.C.B.A. to 30%.

Sugarcane production in India is over 301 million tons / year leaving about 12 million tons of waste material which remain unutilized. The main ingredients of Conc. consists of ordinary Portland cement Sugarcane bagasse ash, stone dust, natural sand, coarse aggregate and water. After mixing concrete specimens were casted and subsequently all test specimen's were cured in water at 7 and 28 days.

II. MATERIAL USED

Cement:-

Most common cement is used is ordinary Portland cement. Ordinary Portland cement accounts for about 80-90% in out of total concrete production. A lot of test were conducted to find out the properties of cement such as consistency test, setting time test, soundness test etc.

Fine Aggregate:-

Natural sand which is locally available free of foreign material alongwith stone dust obtained from query is used as fine aggregate. The present study the sand conforms to Zone-II as per Indian standards. The specific gravity of sand 2.64. Those fraction which passed from 4.75 mm to 150 micron are termed as fine aggregate. The Bulk density of sand 1395.18 kg/m³ in loose state and 1604.93 kg/m³ in rodded state.

Stone dust used in laboratory investigation was procured from a local crushing query. The specific gravity of stone dust was 2.57 and fineness modulus was 2.63.

Coarse Aggregate:-

The crushed aggregate used were 10 and 20 mm nominal size and are tested as per IS code 383-1970 and results are willing the permissible limit. The specific gravity coarse aggregate is 3.0, the bulk density of coarse aggregate in loose state is 1694.39 kg/m³ and in rodded state is 1939.71 kg/m³.

Water:-

Water available in Integral University Campus which is under ground water conforming to the requirements of water for concrete and coming as per IS-456-2000 is used.

Sugarcane Bagasse Ash:-

The sugarcane bagasse ash consists of 50% cellulose , 25% hemi cellulose and 25% lignin. The production percentage of Sugarcane bagasse ash is 26% in each tone of sugarcane with moisture of 50% and 0.62% of residual ash. After ignition residue obtained contain silicon dioxide (SiO2). The ash is used in sugarcane harvesting as a fertilizer. In spite of a material of have degradation and that present few nutrients. In this study the S.C.B.A. used is obtained from Sugar factor. Biswan, Sitapur. The chemical composition of bagasse ash by mass is as follows:-

SiO2	-	78.35%
Al2	-	8.54%
Fe2O	-	3.60%
CaO	-	2.16%
Na2O	-	0.11%
K2O	-	3.47%
MnO	-	0.14%
TiO2	-	0.51%
BaO	-	< 0.16%
P2O5	-	1.069%
Loss of ignition	-	0.419

III. EXPERIMENTAL WORK

In this experimental study 36 nos. of concrete specimen (Cubes) were casted. The size of cube was 150 mm x 150 mm x 150 mm. The mix design of Conc. was done according to IS Code 10262-1981 for M25 grade for stone aggregate and W/C ratio 0.5 Mix. use was 1:2.456:1.828.

Based upon the quantities of ingredient of mixes the quantities of S.C.B.A. for 0, 5, 10, 15, 20, 25 replacement by weight estimated and the quantity stone dust 40% constantly replacement by weight estimated.

The ingredients of concrete were. Thoroughly mixed in tilted type concrete mixer machine till uniform consistency was achieved. Machine oil was some used on the interior surface of the cast iron mould before casting. Concrete was then placed into the mould and completed. The top surface was leveled with a trowel. The specimen were removed after 24 hours and placed under water for 7 days and 28 days. The specimen were taken out from curing tank just before to the test. The test for compressive strength was conducted using a 2000 KN compression testing machine. This test was conducted as per IS Code 516-1959.

Property	Specific gravity	Initial setting time	Final Setting time	Compression strength
Value	3.15	33 minute	611 minute	44.59 Mpa

Sl.No.	Sieve Designation	Percentage passing		
		Fine Aggregate		Coarse aggregate
		Natural Sand	Stone Dust	
1	12.5 mm	--	-	100
2	10 mm	100	100	98.23
3	4.75	100	100	9.9
4	2.36 mm	99.35	81.1	0.09
5	1.18	96.50	39.80	0
6	600 µ	56.39	9.58	-
7	300 µ	21.88	4.22	-
8	150 µ	5.32	1.08	-

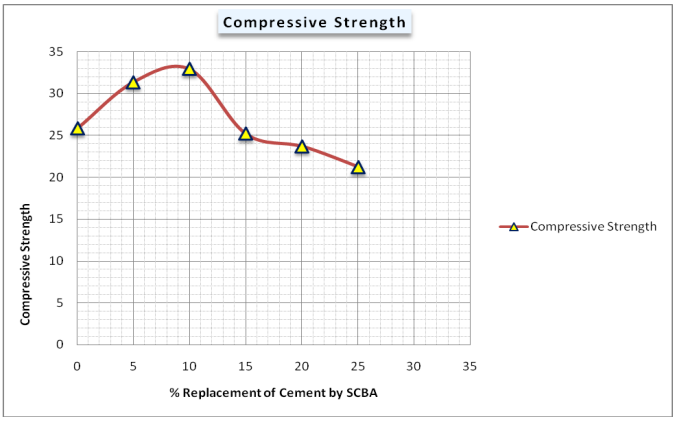
The details of Mix designation and specimen used in study:-

Specimen Designate	Binder		Fine aggregate		Coarse aggregate	No. of sample
	Cement	S.C.B.A.	Stone dust	Coarse sand		
Mx	100 %	0%	0	100 %	100%	6
Mxo	95%	5%	40%	60%	100%	6
Mx1	90%	10%	40%	60%	100%	6
Mx2	85%	15%	40%	60%	100%	6
Mx3	80%	20%	40%	60%	100%	6
Mx4	75%	25%	40%	60%	100%	6

Details of Specimen

IV. RESULT AND DISCUSSION

After curing for 28 days 36 specimen cube of 150mm x 150mm x 150mm after 28 days. It can be observed from Table that strength of Conc. is increased at some point due to replacement of cement with S.C.B.A. and fine sand with stone dust. But after increasing the percentage of S.C.B.A. the strength decrease. Hence in concrete cement can be save up to 10% and sand up to 40% by using S.C.B.A. up to 10% and stone dust 40%.



Variation of compressive strength with percentage replacement of S.C.B.A. alongwith 40% stone dust as fine aggregate.

V. CONCLUSION

The result show that the S.C.B.A. in blended Conc. had significantly higher compressive strength compare to that of concrete could be replaced with S.C.B.A. upto max. limit of 10%.

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