EXPERIMENTAL INVESTIGATION ON THE PROPERTIES OF CONCRETE BYPARTIAL REPLACEMENT OF CEMENT BY USING SUGARCANE BAGASSE ASH

[1]G.RAHUL, [2]P.SELVAPRABHU, [3]R.SELVAPRAKSH, [4]V.SOUNDHAR, [5]Mrs.B.KARTHIGA,M.E

[1,2,3,4]Students, [5]Assistant Professor
DEPARTMENT OF CIVIL ENGINEERING
PAAVAI ENGINEERING COLLEGE
NAMAKKAL, TAMILNADU

Abstract: This research addresses the suitability sugarcane bagasse ash (SCBA) in concrete used as partial cement replacement. The grades of concrete M25 was used for the experimental analysis The cement was partially replaced by SCBA at 0%, 10%, 20% and 25%, by weight in normal strength concrete (NSC), The innovative part of this study is to consider grades of concrete mixes to evaluate the performance of concrete while cement is replaced by sugarcane bagasse ash. The cubicle specimens having size 150 mm x 150 mm were used and tested after curing period of 7, 14 and 28 days. It was observed through the experimental work that the compressive strength increases with incorporating SCBA in concrete. Results Indicated that the use of SCBA In Concrete (M25) at 10% increased the average amount of compressive strength by 10% as compared so the normal strength concrete. The outcome of this work indicates that maximum strength of concrete could be attained at 10% replacement of cement with SCBA. Furthermore, the SCBA also gives compatible slump values which increase the workability of concrete.

Keywords: **Sugarcane baggase ash, partial replacement of cement.**

INTRODUCTION:

Sugarcane is main food crop in tropical and subtropical countries. It is the major resource for the sugar production. Sugarcane bagasse (SCB) is the waste created after juice extraction from sugarcane. The Sugarcane bagasse ash (SCBA) is acquired through the control burning of sugarcane bagasse. The SCB creates the environmental nuisance due to direct disposal on the open lands and forms garbage heaps in that area , According to Barroso that one ton sugarcane generates 280 kg of bagasse Waste. The sugar industry plays an essential part in the countrywide economy of Pakistan, According to the report of Pakistan sugar mills association, Pakistan produced 65.45 million tons of sugarcane in the year 2015-16 and year 2016-17 is forecasted at 71,371 million tons .Cement is die most widely consumable material infrastructure development works. It is considered as a durable material of construction However, the environmental issue of cement has become a rising concern, as cement industries are accountable around 2.5% of total worldwide waste emissions from industrial sources. It is need of time to rise the use of cement materials in the concrete which can reduce the significant amount of cement consumption, because the production of cement required huge energy and conferring to Assam it is also accountable for 5% of global anthropogenic CO2, release (every ton of cement produces around 01 ton of CO2), and their usage can also improve the properties of concrete. Therefore, realizing the significance of the issue, this research work is carried out to find out the optimum percentage cement replacement of SCBA in M25 grades of concrete, because grades M25 are widely used for reinforced concrete works. Grades M40 used for very heavy reinforced concrete/pre-cast/pre-stressed and M30 used for heavy reinforced concrete/pre-cast .Hence, the object of this research is lo evaluate the performance of concrete while incorporating sugarcane bagasse ash as cement replacement in different mixes proportions.

LITRATURE:

R Srinivasan and K. Sathiya had concluded that blended SCBA in concrete had higher compressive strength, tensile strength and flexural strength compared to that of SCBA. an extent of 10% .They even concluded that with the addition of more SCBA the density of the concrete and the lower weight of the concrete will be produced

Mrs.U.R.Kawade et al observed that cement can be replaced with SCBA up to an extent of 15% .The SCLA increases the partial replacement by increasing the workability of the concrete to which the super plasticizer is not required. Remained part (bagasse) is further used as fuel to heat the boilers. The incineration of bagasse produces the ash. Bagasse has a various use in market as such in production of woods, animal foods and thermal expansion etc. then also a lot of bagasse remains unused and they get dumped as landfill. The government is more concerned in utilizing the flash. The ministry of Environment directs the industries to extract the fly ash and reuse it in production of cement, tiles and bricks etc. Since our nation is a developing, so requirement of infrastructure cement requirement is also very high. The production of cement produces harmful gases like CO2 which degrades the environment causing health issues to the residents. With the advancement in the technology new methods have been adopted to reduce the consumption of cement. One such method is addition of bagasse ash to concrete. Sugarcane ash is an industrial waste product which contains aluminium ion and silica, which is pozzolanic in nature. For natural pozzolans the minimum silica, aluminium and iron oxide content is 70 % and SIO3 should be less than 4 9%. The researchers have found that bagasse fulfil these requirement. Thus ash behaves as a pozzolanic material. In Bagasse there is 50% cellulose, 25%of hemicellulose and 25% of lignin. It has been observed that approximately 26% of bagasse and 0.62% of residual ash are produced from 1 ton of sugarcane. Use of ash in concrete reduces the cement requirement and also reduces the cost of construction. Researchers also suggest that the bagasse fly

ash can be successfully used in producing bricks, tiles, stabilizing the soil etc.

S Aishwarya, et al found that when concrete was mixed with partial 10% of SCBA then the compressive strength increased 1.21 times and tensile strength increased 1.04 times. With addition of SCBA to concrete, members shows a better durability as they are less permeable to chloride ions

Lathamaheswari, et al observed in their research that the workability of concrete has not been very much affected by increment in replacement of cement with SCBA and cement would be replaced with SCBA up to a maximum limit of 10 % When cement was partially replaced by SCBA in concrete , it had also shown a good modulus of elasticity .

CONSTITUENT MATERIALS

CEMENT:

The most commonly used cement in concrete is Ordinary Portland Cement of 53 Grade conforming IS 12600-1989 (2009). The physical properties of the cement obtained on conducting appropriate tests as per IS :226-4831.

FINE AGGREGATE:

Locally available free of debris and nearly riverbed sand is used as fine aggregate. The sand particles should also pack to give minimum void ratio, higher voids content leads to requirement of more mixing water. In the present study the sand confirms to zone I as per Indian standards. (IS: 10262, IS: 383). The specific gravity of sand is 2.62. The bulk density of fine aggregate is 1715 kg/m3

COURSE AGGREGATE:

The crushed aggregates used were 20mm and 10mm nominal maximum size and are tested as per Indian standards and results are within the permissible limit. (IS: 10262, IS: 383). The specific gravity and bulk density of 10mm and 20 mm aggregate are 2.74 and 2.79 and 1472 kg/ m3 and 1438 kg/ m3 respectively.

WATER:

Water available in the college campus conforming to the requirements of water for concreting and curing as per IS: 456-2009.

SUGARCANE BAGASSE ASH:

Sugarcane bagasse brought from sugar mills and was burnt in a closed drum (uncontrolled burning), SCBA was obtained after passing through 300µm standard sieve used for experimental study. Figure 1 and 2 shows the sugarcane bagasse ash after passing from sieved size 300µm and sugarcane bagasse ash retained materials on sieved 300um respectively after the process of sieving

CHEMICAL COMPOUNDS OF SUGARCANE BAGASSE ASH:

CHEMICAL COMPOUND	ABBREVIATION	PERCENTAGE (%)
Silica	SiO2	68.42
Aluminium Oxide	Al2O3	5.812
Ferric Oxide	Fe2O3	0.218
Calcium Oxide	CaO	2.56
Phosphorous Oxide	P2O5	1.28
Magnesium Oxide	MgO	0.572
Sulphide Oxide	SO3	4.33
Loss on Ignition	LOI	15.90

CHEMICAL COMPOUND	ABBREVIATION	Mg/kg
Sodium Oxide	Na2O	1621
Potassium Oxide	K2O	940
Manganese Oxide	MnO	244
Titanium Oxide	TiO2	240
Barium Oxide	BaO	23.73

SUGARCANE BAGGAGE

SUGARCANE BAGGAGE ASH

MATERIAL TESTING:

COMPRESSIVE STRENGTH TEST:

For checking the compressive strength of cement prepare a mortar of cement and sand in proportion 1:3 with water cement ratio 0.4. Prepare cubes of side 76 mm. Alter placing mortar in mould compact it with vibrator 1o1-minutes. After 24 hours remove the specimen from moulds and they are submerged in clean water for curing. The cubes are then tested in compression testing machine at the end of

3rd,7th,14th and 28th day. During the test the load is to be applied uniformly at the rate of 35N/mm^2.

FINENESS TEST:

This test is used for checking the proper grading of cement. For testing fineness of cement. For testing fineness of cement take 100gm of cement and this continuously passed through standard sieve No. 9 for 15 minutes. According to 1S: 269-1976 this weight should not be more than 10% of its original weight.

Sl.No	Weight of cement (g)	Weight retained on sieve (g)	% weight of residue (w2/w1)×100
1	100	5.1	5.1
2	100	4.8	4.8

SPECIFIC GRAVITY:

Dried the Le - Chatlier flask and filled kerosene oil with a point between the stem to zero and 1ml. Initial reading of the flask in the kerosene oil of the recorded level. About 64gms of cement was placed into the flask so that the bulb portion above the level of kerosene rose. Cement should not be allowed to adhere to the flask above the flask. Insert the stopper into the flask and roll it gently into an inclined position. The surface of the liquid is raised to no further air bubbles until the air is expelled. The flask in the kerosene of the level was noted.

Weight of cement = 64g
Initial reading = 0.6ml
Final reading = 21.2ml
Volume of cement = final reading - initial reading
=21.2-0.6
=20.6ml
Specific gravity = weight of cement / volume of cement
=64/20.6
=3.1

PROPERTIES OF CEMENT:

Grade	OPC 53
Specific Gravity	3.1
Initial Setting Time	120 min
Final Setting Time	400 min
Standard Consistency	33 %
Fineness	4.95

SIEVE ANALYSIS:

1 kg of fine aggregate was taken . The sieves were arranged the order of 4.75mm , 2.36mm , 1.18mm , 600u , 3004 , and 150u with 4.75mm sieve on the top . Sieving was carried out for at least 15 minutes and the weight of aggregate retained on each sieves were obtained . The value obtained was compared with grading , limit chart of fine aggregate given below and the actual zone , and the actual zone , and to which particular sand comes under was determined .

SIEVE ANALYSIS FINE AGGREGATE:

Sieve size(mm)	Weight retained on each sieve	% Weight retained	
4.75	0	0	0
2.36	16	1.6	1.6
1.18	155	15.5	17.1
0.6	294	29.4	46.5
0.3	302	30.2	76.7
0.15	187	18.7	95.4
Pan	46	4.6	100

TESTS ON CONCRETE:

WORKABILITY:

Fresh concrete or plastic concrete is freshly mixed material, which can be moulded into any shape. The relative quantities of cement, coarse aggregate, fine aggregate and water mixed together, control the concrete properties in the fresh state. Workability is defined as the ease with which concrete can be compacted. It is the property of concrete which determines the amount of useful internal work necessary to produce full compaction. The workability of various mixes was assessed by determining the slump value and compacting factor according to IS 1199: 1959

SLUMP TEST:

It is one of the most commonly used method of measuring consistency of concrete . The mould is placed on a smooth , horizontal , rigid and non - absorbent surface . The mould is then filled in four layers . Each layer is tamped 25 times using tamping rod . The concrete at the top of the mould is levelled using a trowel . The mould is removed from the concrete immediately by raising it in the vertical direction . This allows the concrete to subside . This subsidence is referred as the SLUMP of concrete . The difference in level between the height of the mould and that of the highest point of the subsided concrete is measured . This difference in height in mm is taken as Slump of Concrete

COMPACTION FACTOR TEST:

It is more precise and sensitive than the slump test and is particularly useful for concrete mixes of very low workability, The tests works on the principle of determining the degree of compaction achieved by a standard amount of work done by allowing the concrete to fall through a standard height. The degree of compaction, called the Compaction Factor is measured by the ratio of the density actually achieved in the test to density of same concrete fully compacted.

CONCLUSION

This research was successfully carried out, to the establishment of SCBA as an alternative cement replacement material in concrete. After the detailed investigation the following conclusions have been drawn:

- SCBA in concrete gives the higher compressive strength as compared to the normal strength concrete, hence optimal results were found at the 10% replacement of cement with SCBA.
- The usage of SCBA in concrete is not only a waste-minimizing technique, also it saves the amount of cement.
- Also it is best use of sugar cane bagasse ash instead of land filling and make environment clean.

REFERENCES:

[1] Ganesan, K., Rajagopal, K., &Thangavel K., 2007. "Evaluation of Bagasse Ash as Supplementary Cementitious Material", Journal of Cement and Concrete Composites

[2] R. Srinivasan, K Sathiya, 2010. "Experimental study on bagasse ash in concrete", International Journal of Service Learning in Engineering 5(2), p. 60.

[3] Payá,J.,et. al., 2002. Sugarcane bagasse ash (SCBA): "Studies on its properties for reusing in concrete production", Journal of Chemical technology and Biotechnology 77, p. 321.

[4] N. B. Singh, V. D. Singh and SaritaRai, 2000. Hydration of Bagasse Ash-Blended Portland cement, Journal of Cement and Concrete Research 30, p. 1485.

[5] SumrerngRukzon, PrinyaChindaprasirt, 2012. Utilization of Bagasse Ash in High Strength Concrete, Journal of Materials and Design 34, p. 45.

[6] V. S. Aigbodion, S. B. Hassan, T. Ause and G.B. Nyior, 2010. Potential Utilization of Solid Waste (Bagasse Ash), Journal of Minerals & Materials Characterization & Engineering 9, p.67-77.

[7] Ganesan, K., Rajagopal, K., &Thangavel, K. 2007. "Evaluation of bagasse ash as supplementary Cementitious material". Cement and Concrete Composites, 29, 515-524.

[8] Committee Board of sugar cane and sugar (2004). Summary of sugar cane and sugar industry in Thailand in 2003/2004, Division of sugar cane and sugar industry Policy, Ministry of Industry, Vol.2 Bangkok Thailand (in Thai).

[9] Baguant,K., Properties of concrete with bagasse ash as fine aggregate, In Proc 5th CANMET/ACI Intl. conf. on fly ash, silica fume, slag and natural pozzolans in concrete, Ed by Malhotra VM, USA, ACI SP, (1995)153(18), 315-337.

[10] Payá,J.,et. al.,Sugarcane bagasse ash (SCBA): studies on its properties for reusing in concrete production, Journal of Chemical technology and Biotechnology, (2002)77, 321-325. 6. IS 383 -1970 "Specifications for Coarse and Fine Aggregates from Malyadri et al., International Journal of Computer Engineering In Research Trends Volume 2, Issue 12, December-2015, pp. 995-1001 Natural Sources for Concrete", Bureau of Indian Standards, New Delhi.

[11] IS 10262 -1981 "IS Method of Mix Design", Bureau of Indian Standards, New Delhi

[12] IS 516 -1959 "Methods of Tests for strength of concrete", Bureau of Indian Standards, New Delhi

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

[14] Ali I (2004) Biomass: An ideal fuel for sugar mills for steam/power generation. Fuel Research Centre, PCSIR, Karachi, XVII(197), Dec DERT

[15] Wang R, Trettin V, Rudert R (2003) Umlauf recrystallization of granulated blast furnace slag and the significance for the hydraulic Reactivity.