An experimental Investigation on Strength Properties of Concrete by the Partial replacement of Cement with Sugar Cane Bagasse Ash and Fine Aggregate by Granite Powder and Glass Powder

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Abstract: In this experimental work, a research has been carried out to study the effects of sugarcane bagasse ash by partial replacement of cement. Granite powder and glass powder both are partially replaced with fine aggregate in concrete. Sugarcane bagasse is the agro waste produced after the juice extraction from sugarcane and granite powder is by-product produced in granite industries while cutting granite rocks to the desired shapes and sizes, glass powder is a industrial waste. Disposing these three wastes to vacant areas has been a great threat to environment. The alternative way to reduce the use of cement and fine aggregate is, by its replacement with sugarcane bagasse ash and both granite powder, glass powder which will not be harmful to the environment. The main objectives of this experimental work is to search an alternative material for making eco-friendly concrete using by-product from granite factories like granite fines and sugar mill like sugarcane bagasse ash and preventing waste disposal to the environment also preserving natural resources

The percentage replacement of both the (granite powder + glass powder) with fine aggregate are 10%+ 10%,15% +15%, 20%+20%,25%+25% and 25%+25% partially replaced respectively with the Sugarcane bagasse ash which is partially replaced with cement for constant 10% replacement by weight of cement which is carried out for M_{20} mix concrete . From the results it can be concluded. When all the materials are used simultaneously, the optimum strength is observed at 10% for sugarcane bagasse ash and 15% for granite powder 15% for glass powder in concrete resulted in an increase in compressive strength, split tensile strength and flexural strength. So sugarcane bagasse ash and granite powder and glass powder can be successfully used in concrete.

Index Terms - Sugarcane bagasse ash, granite powder, glass powder, compressive strength, split tensile strength and flexural strength.

I .Introduction

As cement industry is creating environmental problem by emission of CO_2 some of raw material having similar composition can be replaced by cement in concrete then cost could be reduced without affecting its quality. For this reason sugarcane bagasse ash (SCBA) is one of the major raw materials used for sugar production can be used as mineral admixture due to its high silica content. Sugarcane bagasse (SCBA) is the waste produced after juice extraction from sugarcane. The Sugarcane bagasse ash (SCBA) is obtained as by product of control burning of sugarcane bagasse. SCBA. SCBA constitutes an environmental trouble as they custom refuse loads in areas they are disposed so the utilization of sugarcane bagasse ash in concrete solves the problem of its disposal thus keeping the environment free from pollution.

The global consumption of natural river sand is very high due to the extensive use of concrete. Some developing countries are facing a shortage in the supply of natural sand. Granite powder, one of the by-products in granite stone crushing process, is a fine material which will be easily carried away by the air and will cause nuisance causing health problems and environmental pollution. Glass powder is the industrial waste .The major effect of air pollution is lung diseases, inhaling problems, the people who are living in and around the dumping areas are suffering from these problems. So to replace river sand, granite powder and glass powder is used which is an industrial by product. So utilization of granite powder will avoid the disposal problems and related environmental issues. Utilization of granite powder will reduce cost and the usage of river sand and conserve natural resources.

II. MATERIALS AND MATERIAL PROPERTIES

CEMENT: Cement is a binder, a substance used in construction that sets, hardens and adheres to other materials binding them together. Ordinary Portland Cement 43 grade confirming to IS: 8112-1989 was used. The test conducted on cement is Specific gravity by Le-Chatelier Flask. This paper presents the progress of research by using ordinary Portland cement (OPC) of 43 grade of specific gravity 3.10 is used. [1]-[6].

FINE AGGREGATE:-Natural sand confirming to Zone-II having specific gravity 2.7 issued. The testing of sand was done as per IS383-1970.Percentage of water absorption=2.149%

COURSE AGGREGATE:-Coarse aggregate 20 mm and 12.5 mm nominal size having specific gravity 2.76 and 2.80 respectively was used and was tested as per IS: 383-1970. The tests conducted on coarse aggregates are specific gravity test for 20mm is 2.76 and 12.5 mm is for 2.80 and water absorption test for 20 mm is 1.15% and 12.5 is 1.3%.

Sugarcane bagasse ash: The SCBA is obtained from the locally available sugar mill which is one of the agricultural by product used to replace the cement in various percentages. The SCBA is sieved through 75 microns sieve to remove the larger particles with specific gravity 2.05 and fineness 1.5% (passing through 90micron sieve) as per IS:3812 part I-2003.[1]

Granite powder and Glass powder: These are the byproduct of granite and glass industries,. Specific Gravity of waste granite powder and glass powder is 2.54 and 2.47 respectively. Confirming to Zone IV. [6] -[11]

III. METHODOLOGY

Mixing of Concrete.

Weigh all the raw materials as per mix design M20 and pour them on the tray. Make a dry mix of the materials then add the water and mix it properly to have a good consistency.

CASTING AND CURING

The specimens of standard cubes (150mm x 150mm x 150mm), and standard cylinders (100mm diameter x200mm height) and prism of 100 x 100 x 500 mm were casted and cured for a period of 7days & 28days. After mixing, the Mixture is placed in these specimens of standard dimensions.

The test specimen cubes, cylinders and prism specimens are placed in curing tank for curing.

IV. MIX PROPORTIONS:

The following table shows the concrete mix proportions. With constant water ratio concrete design mix of grade M20 was prepared and design mix was studied for compressive strength.

Concrete design mix proportions

CEMENT	FINE AGGREGATE	COARSE AGGREGATE	W/C RATIO
1	1.42	2.49	0.44

V. RESULTS AND DISCUSSION

The research work is to analyses the strength properties of SCBA which is partially replaced by the OPC and river sand is replaced with the granite powder and glass powder. The tests on concrete are carried out according to IS 10262-2000. The tests are carried out on conventional concrete as well as modified concrete are comparatively studied.

Compression Test

Sl. No.	%SCBA+ GP+GP	7 days Avg. Compressive Strength (N/mm2)	28 days Avg. Compressive Strength (N/mm2)
1	0%	21.14	30.13
2	10%+10%+10%	22.82	33.19
3	10%+15%+15%	23.61	34.55
4	10%+20%+20%	16.89	25.63
5	10%+25%+25%	15.57	24.44

Sl. No.	%SCBAA+ GP+GP	7 days Avg. Compressive Strength (MPa)	28 days Avg. Compressive Strength (MPa)
1	0%	1.42	2.43
2	10%+10%+10%	1.53	2.87
3	10%+15%+15%	1.74	3.34
4	10%+20%+20%	1.38	2.57

5	10%+25%+25%	1.21	2.16

Split Tensile Test

Sl. No.	%SCBAA+ GP+GP	7 days Avg. Compressive Strength (MPa)	28 days Avg. Compressive Strength (MPa)
1	0%	1.42	2.43
2	10%+10%+10%	1.53	2.87
3	10%+15%+15%	1.74	3.34
4	10%+20%+20%	1.38	2.57
5	10%+25%+25%	1.21	2.16

Flexural Test

Sl. No.	%SCBA+ GP+GP	7 days Avg. Compressive Strength (Mpa)	28 days Avg. Compressive Strength (Mpa)
1	0%	3.48	4.61
2	10%+10%+10%	3.55	4.89
3	10%+15%+15%	3.62	4.96
4	10%+20%+20%	3.20	4.22
5	10%+25%+25%	2.83	3.89

VI. CONCLUSION

From the experimental results, it can be concluded as follows:

- From the results it can be concluded that optimum amount of sugarcane bagasse ash that can be replaced with cement by weight is up to 10% and granite powder and glass powder that can be replaced by fine aggregate by weight is up to 30% i.e (15%+15%) respectively in concrete resulted in an increase in compressive strength, split tensile strength and flexural strength.
- The utilization of sugarcane bagasse ash in concrete solves the problem of its disposal thus keeping the environment free from pollution.
- Utilization of granite and glass powders will avoid the disposal problems and related environmental issues. Utilization of these will reduce the usage of river sand and conserve natural resources. The Replacement of these fines in concrete gives more Economical and provides better performance.
- Hence we can partially replace cement with sugarcane bagasse ash and fine aggregate by granite powder and glass powder in concrete successfully.

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