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RESEARCH ARTICLE OPEN ACCESS

PARTIAL REPLACEMENT OF CEMENT WITH BAGASSE ASH & COCOUNT COIR FIBRE

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BAGASSE:

There has been an attempt to utilize the large amount of bagasse ash, the residue from an in-line sugar industry and the bagasse-biomass fuel in electric generation industry. When this waste is burned under controlled conditions, it also gives ash having amorphous silica, which has pozzolanic properties. A few studies have been carried out on the ashes obtained directly from the industries to study pozzolanic activity and their suitability as binders, partially replacing cement.

Therefore it is possible to use bagasse ash (SCBA) as cement replacement material to improve quality and reduce the cost of construction materials. Pozzolanic Portland cement is recognized as a major construction material throughout the world. Portland cement is the conventional building material that actually is responsible for about 5% - 8% of global CO2 emissions.

This environmental problem will most likely be increased due to exponential demand of Portland cement. Researchers all over the world today are focusing on ways of utilizing either industrial or agricultural waste, as a source of raw materials for industry.

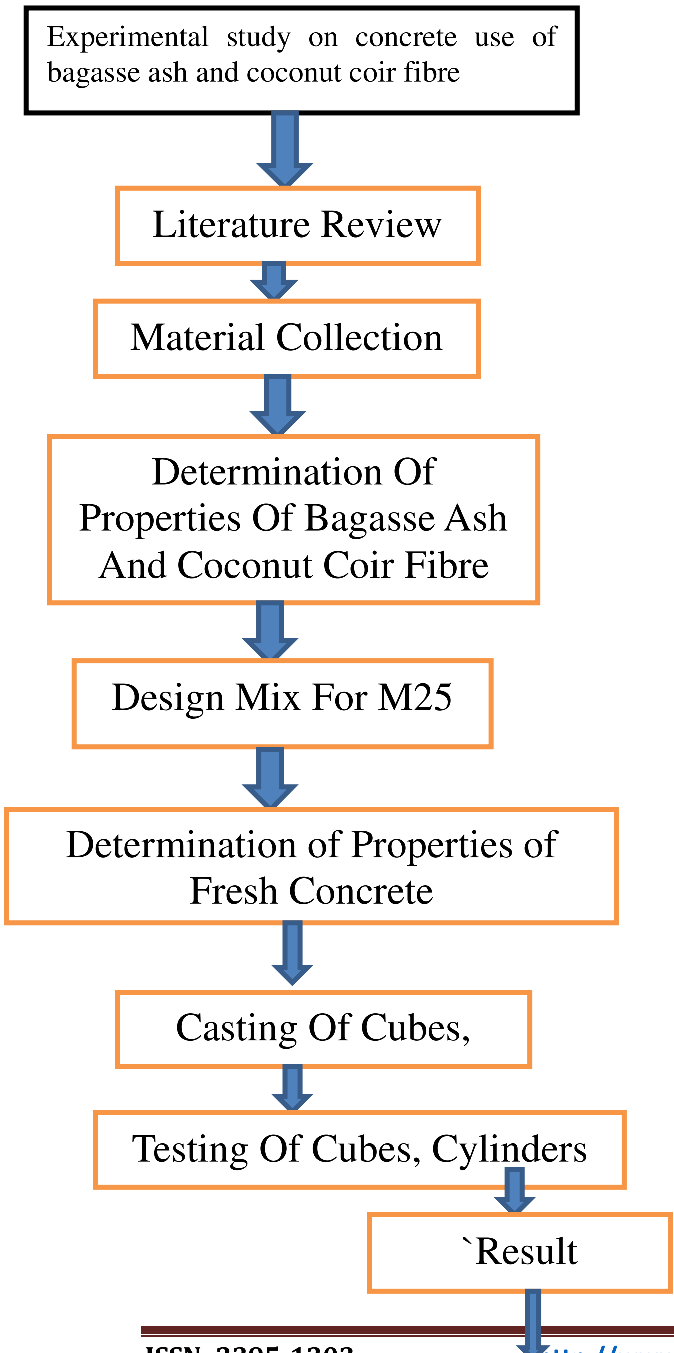
COCONUT COIR FIBER

A. International Status According to the research conducted by Majid Ali, et. al, from New Zealand, the mechanical and dynamic properties of coconut fibre reinforced concrete (CFRC) members were well examined. A comparison between the static and dynamic moduli was conducted. The influence of 1%, 2%, 3% and 5% fibre contents by mass of cement and fibre lengths of 2.5, 5 and 7.5 cm is investigated. Noor Md. Sadiqul Hasan, et. al from Malaysia, have investigated the physical and mechanical characteristics of concrete after adding coconut fiber on a volume basis.

They conducted a micro structural analysis test using a scanning electron microscope for understanding the bonding behaviour of the coconut fibers. Mahyuddin Ramli, et. al, from Malaysia studied the strength and durability of coconut fiber reinforced concrete in aggressive environments. Their aim was to mitigate the development of cracks in marine structures by introducing coconut fibers which would provide a localized reinforcing effect. Yalley, et.al, from United Kingdom performed various tests to study the enhancement of concrete properties after addition of coconut fiber. Their study focused on the coconut fiber obtained from Ghana Africa.

They investigated the compressive strength, tensile strength, torsional strength, toughness and its ability to resist cracking and spalling.

METHODOLOGY



ANALYSIS AND REPORT PREPARATION

Chemical Analysis Of Bagasse Ash
bagasse ash are collected for experimental work tested for the chemical compound at pollucon laboratories PVT LTD, Surat. chemical compound result of bagasse as is follow:

CHEMICAL COMPOUND	ABBREVATION	SBA	PPC
silica	Sio2	67.81%	20.98%
Aluminium oxide	Al2o3	19.41%	5.42%
Ferric oxide	Fe2o3	3.85%	3.92%
Calcium oxide	cao	4.03%	62.85%
Sodium Sulfite	Na2	0.35%	0.28%
Magnesium oxide	MgO	1.11%	1.76%
Sulphide oxide	SO3	0.66%	2.36%
Alkalies	K20	1.69%	0.53%
Loss on ignition	LOI	1.09%	1.9%

TYPICAL PROPERTIES OF COIR FIBRE:

Colour	Brown
Fibre length, mm	10-200
Fibre diameter, mm	0.2-0.35
Bulk density, kg/m3	140-150
Ultimate tensile strength, N/mm2	80-120
Modulus of elasticity, N/mm2	18-25
Water absorption, %	30-40

Target Strength for MIX Proportioning

F'ck = fck + 1.65s

F'ck = Target Average Compressive Strength @ 28days

fck = Characteristic Compressive Strength @ 28days

S = Standard Deviation

From Table 1 S = 4 N/mm2

Target Strength = 25 + 1.65 x 4

= 31.6 N/mm2

Selection of Water Cement ratio

From Table 5 of IS 456 Max w/c

Ratio = 0.45

Adopt w/c Ratio = 0.40
0.40 < 0.45 , Hence

Mix Design for Concrete M25

Grade Designation : M25

Grade of Cement : PPC 53 grade

Conforming to IS 8112

Minimum Cement Content : 320 kg/m3

Maximum Cement Content : 450kg/m3

Maximum Nominal Size of

Aggregate : 20mm

Maximum Water-Cement Ratio: 0.45

Workability : 100mm (Slump)

Type of Aggregate : Crushed Agg

Test Data for Materials

- Cement Used
- PPC 53 Grade

Conforming to IS 8112

- Specific Gravity

i) Cement : 3.15

ii) Coarse aggregate : 2.71

iii) Fine Aggregate : 2.41

- Water Absorption

i) Coarse Aggregate : 0.5%

ii) Fine Aggregate : 1.0%

Sieve Analysis

- Coarse Aggregate 20mm Grading Zone II is 0.62 From

Table 2 of IS 383

- Fine Aggregate is Grading Zone I of Table 4 of IS 383

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0.40 < 0.45 , Hence OK

Selection of Water Content

From Table 2 Max w/c = 186 Litres (for 25 to 50mm slump)

Estimated w.c for 100 (Slump) = 186 + (6/100)x186

= 197 Litres

Calculation of Cement Content

Water Cement Ratio = 0.40

Cement Content = 197/0.40 = 492.5 kg/m3

From Table 5 of IS 456 Minimum Cement Content

Extreme Exposure Condition = 360 kg/m3

MIX PROPORTIONS

Mix	Bagasse Ash	Coconut Coir	Cement	Bagasse Ash	Coconut Coir Fibre	Fine Aggregate	Coarse Aggregate	Water
CC	0%	0%	450kg/m3	-	-	574kg/m3	1146kg/m3	197 Litres
M1	3%		436.5kg/m3	13.5kg/m3	22.5kg/m3	574kg/m3	1146kg/m3	197 Litres
M2	6%	5%	423kg/m3	27kg/m3	22.5kg/m3	574kg/m3	1146kg/m3	197 Litres
M3	9%		409.5kg/m3	40.5kg/m3	22.5kg/m3	574kg/m3	1146kg/m3	197 Litres

CASTING & CURING

CUBE MOULD:

The mould used was of size 150mmx150mmx150mm. Each mould was provided with a metal base plate having a plane surface. The base plate support the mould during the filling without leakage and it was attached to the mould by screws and coating of mould oil was applied between the interior surfaces of mould and the base plate.

CUBE CASTING:

The concrete was filled into the mould in layer and each layer was compacted by using manual hand dumping after the top layer was smoothly finished by using trowel.

CYLINDER MOULD:

The mould used was of size 150 mm diameter and 300mm depth. Each mould was provided with a metal base plate having a plane surface. The base plate support the mould during the filling without leakage and it was attached to the mould by screws and coating of mould oil was applied between the interior surfaces of mould and the base plate.

CASTING CYLINDER:

The concrete was filled into the mould in layer and each layer was compacted by using manual hand dumping after the top layer was smoothly finished by using trowel.

CURING:

The specimen were remoulded after 24 hours and cured for 28 days in curing tank. After curing period, the specimens were kept for drying and then tested using CTM 4000KN capacity.

RESULTS & DISCUSSION

The results of the various tests carried out to determine the strength and behaviour of bagasse ash and Coir Fibre are presented here

COMPRESSIVE STRENGTH TEST

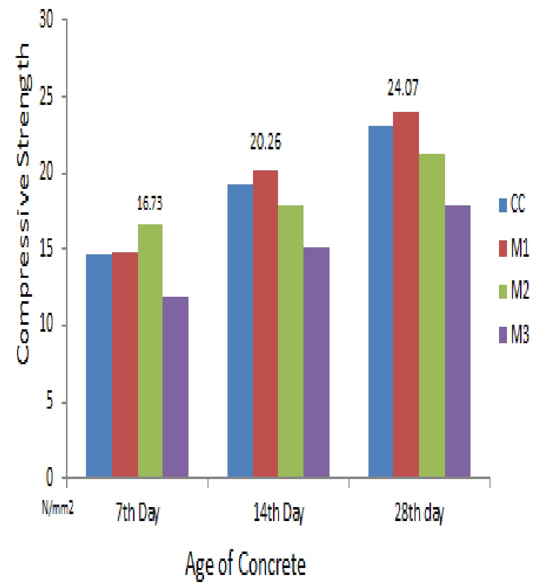
GENERAL

Compressive strength of concrete using bagasse ash replacement and coir fibre were added results were compered for split tensile test with ordinary mix.

Compressive Strength Test on Concrete

Mix	Specimen	7th Day Test in N/mm2	Average Compressive Strength in N/mm2	14thDay Test in N/mm2	Average Strength In N/mm2	28th Day Test in N/mm2	Average Strength In N/mm2
CC	Sample 1	14.84	14.68	19.5	19.26	23.80	23.07
	Sample 2	14.89		18.6		24.09	
	Sample 3	14.31		19.7		21.33	
M1	Sample 1	15.27	14.75	20.6	20.26	24.62	24.03
	Sample 2	14.20		19.9		23.69	
	Sample 3	14.80		20.3		23.78	
M2	Sample 1	17.73	16.73	18.06	17.96	20.22	21.19
	Sample 2	15.11		17.8		23.73	
	Sample 3	17.33		18.03		19.63	
M3	Sample 1	12.84	11.91	15.6	15.15	15.77	17.89
	Sample 2	10.09		14.8		19.28	
	Sample 3	12.80		15.06		18.62	

Compressive Strength of Concrete



7^{th}, 14^{th} &28^{th} day Split Tensile Strength

SPLIT TENSILE STRENGTH TEST:

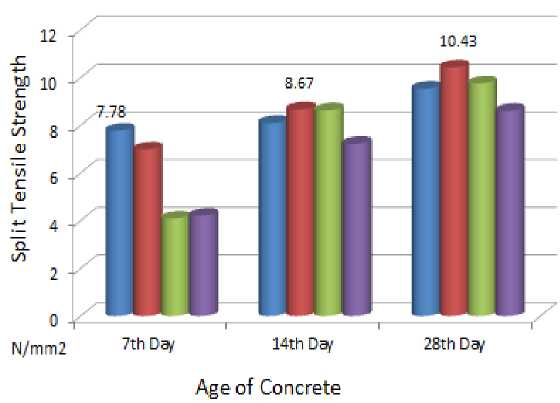
GENERAL

Split tensile Strength of concrete using Bagasse ash as Partial Replacement in Cement and coir fibre were added with concrete and compared with Ordinary mix.

Split Tensile Strength on Concrete

Mix	Specimen	7th Day Strength (N/mm2)	Average Split Tensile Strength in N/mm2	14thDay Strength (N/mm2)	Average Split Tensile Strength in N/mm2	28th Day Strength (N/mm2)	Average Split Tensile Strength in N/mm2
CC	Sample 1	7.69	7.78	7.92	8.10	9.33	9.54
	Sample 2	7.75		8.14		9.62	
	Sample 3	7.92		8.26		9.67	
M1	Sample 1	7.07	6.99	8.43	8.67	10.35	10.43
	Sample 2	7.13		8.65		10.46	
	Sample 3	6.79		8.94		10.63	
M2	Sample 1	3.96	4.09	8.48	8.63	10.07	9.76
	Sample 2	4.13		8.88		10.18	
	Sample 3	4.18		8.55		9.05	
M3	Sample 1	4.18	4.21	7.07	7.23	8.77	8.61
	Sample 2	4.24		7.35		8.60	
	Sample 3	4.21		7.29		8.48	

Split Tensile Strength on Concrete



The split tensile strength values using bagasse ash and coir fibre as a average value at the age of 7th day 7.78,6.99,4.09,4.21 at 14th day 8.16,8.67,8.63,7.23 and 28th day 9.54,10.43,9.76,8.61N/mm2 respectively. It can be seen from the results that there is a good amount of enhancement in the tensile strength of bagasse ash specimen upon the addition of coir fibres. The results indicate that the 3% is the optimum percentage of volume of fibres.

CONCLUSIONS

From the experimental study it can be said that the replacement of **BAGASSE ASH** as 3% and additional of **COCONUT COIR FIBRE** in the concrete as significantly increased. The compressive tensile strength of partially replaced concrete were performed better in all strength test. Comparing with the strength of conventional concrete. The partially replaced concrete performed in all test.

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