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EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CEMENT USING ASHES

SUGIRTHA M S [1], VIGNESH T [2], SANTHOSH KUMAR S[3], Mr.ARVINTH.R.A[4]

[1]UG Scholar, Department of Civil Engineering, Adithya Institute of Technology, Coimbatore, India

[2]UG Scholar, Department of Civil Engineering, Adithya Institute of Technology, Coimbatore, India

[3]UG Scholar, Department of Civil Engineering, Adithya Institute of Technology, Coimbatore, India

[4]Assistant professor, Department of Civil Engineering, Adithya Institute of Technology, Coimbatore, India

***Abstract*:-** Cement is widely noted to be most expensive constituents of concrete. The entire construction industry is in search of suitable and effective the waste product that would considerably minimize the use of cements and ultimately reduces the construction cost. Thus the need to find alternative binding materials that can be used solely or in partial replacement of cement. Agricultural waste material in this case as sugarcane bagasse, rice husk and coconut shells which is an environmental pollutant, are collected and burnt in open air which in turn used as a pozzolana in partial replacement of cement in concrete production. Concrete mortar specimens were produced with mix design of M25 using the 15% replacement of ashes with ordinary Portland cement. Fresh concrete tests were undertaken and hardened concrete tests at the age of 7, 14 and 28 days were noted. The result shows the variation in strength of concrete between the ashes.

I.INTRODUCTION

Ordinary Portland cement is recognized as a major construction material around the world. Researchers all over the world today are focusing on ways of utilizing either industrial or agro waste, as the supply source of raw materials for industry. This waste utilization would not only be economical but may also result in external exchange income and environmental pollution control. The waste such as sugarcane bagasse ash, rice husk ash and coconut shell ash are being used as supplementary cement replacement material. When these wastes are burned under controlled conditions, it gives ash with amorphous silica, which has pozzolanic properties. A few studies have been carried out on the ashes taken directly from the industries to study pozzolanic activity and their suitability as binders, partially replacing cement. So it is possible to use those ashes as cement replacement material to improve quality and reduce the cost of construction materials.

Sugarcane bagasse ash is the by-product of sugar factories found after burning sugarcane at controlled condition which itself is found after the extraction of all economical sugar from sugarcane.

Rice hull are hard protecting coverings of grains of rice. In addition protecting the rice during its growing season. Rice husk ash is prepared by burning the rice husk.

Agricultural waste material in this case which is an environmental pollutant are collected and burnt in the open air to produce coconut shell ash which in turn was used as partial replacement of cement in concrete production.

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II.METHODOLOGY

This project is to be carried out from following method. The properties of sieved ashes as cement are to be studied be carry out the compressive strength test and the tensile strength test. And the sieved ashes are added in the cubes, cylinder and prism at proportion of 15%. And the specimens are subjected to the loading until the failure occurs.

Fig.1. Sieved sugarcane bagasse ash, rice husk ash, coconut shell ash

TEST CONDUCTED TO BE ON CONCRETE

Table I Specimen Details for cubes

S.No	Specimen name	% of cement in concrete	
		Sieved ashes SA HA CA	Cement
1	C1,C2,C3	0	100
2	C4,C5,C6	15	85

Table II Specimen Details for cylinders

		% of Cement in Concrete

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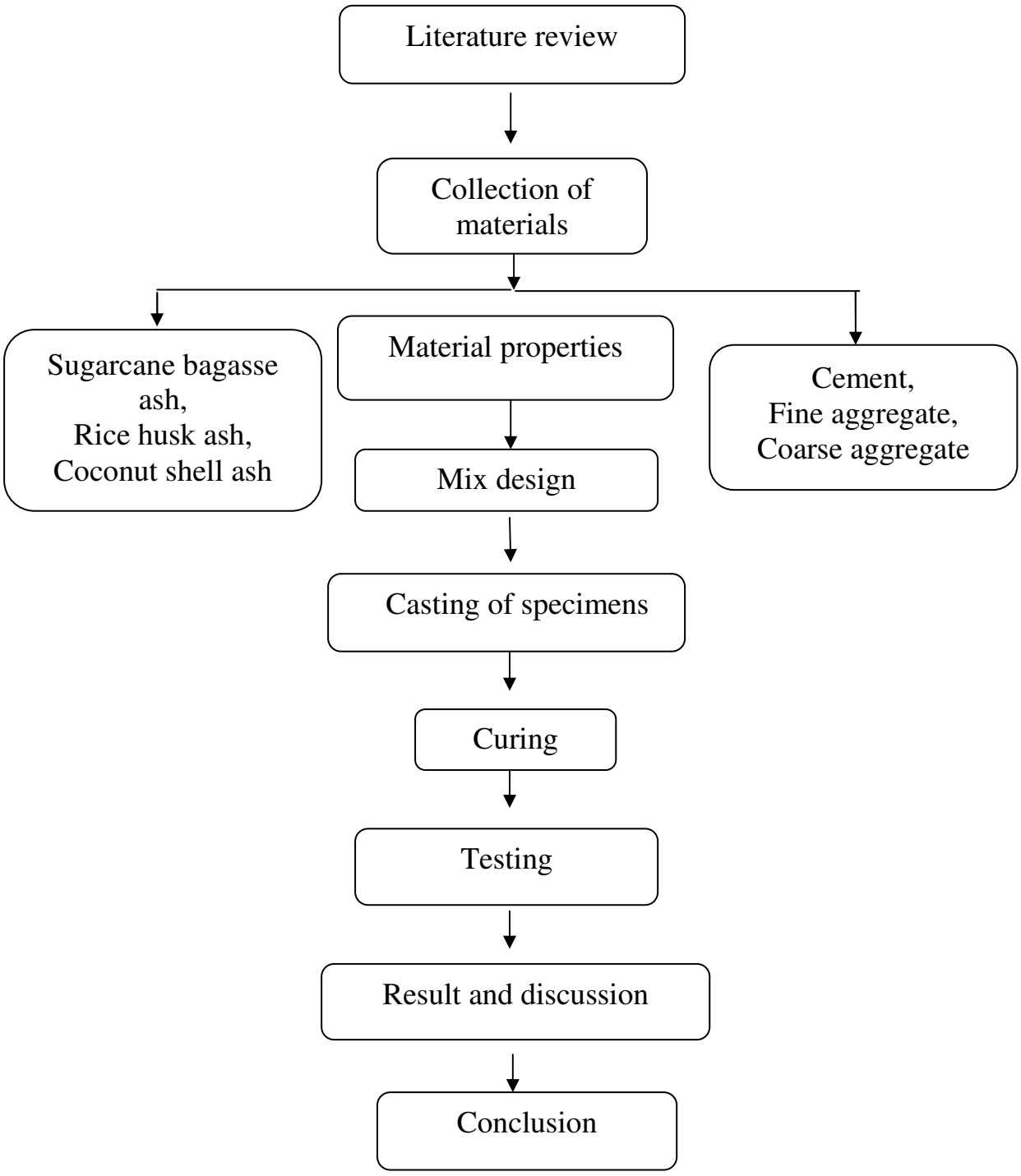
S.No	Specimen name	Sieved ashes SA HA CA	Cement
1	Cy1,Cy2,Cy3	0	100
2	Cy4	15	85

III.FLOW CHART - METHODOLOGY OF THE PROJECT



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IV.RESULTS AND DISCUSSIONS

FRESH CONCRETE TEST PROPERTIES

SLUMP TEST

Table III Degree of workability Vs slump

Degree of workability	Slump in mm
Very low	0 - 25
Low	25 - 50
Medium	50 - 75
High	75 - 100

Slump observation

W/C ratio = 0.45

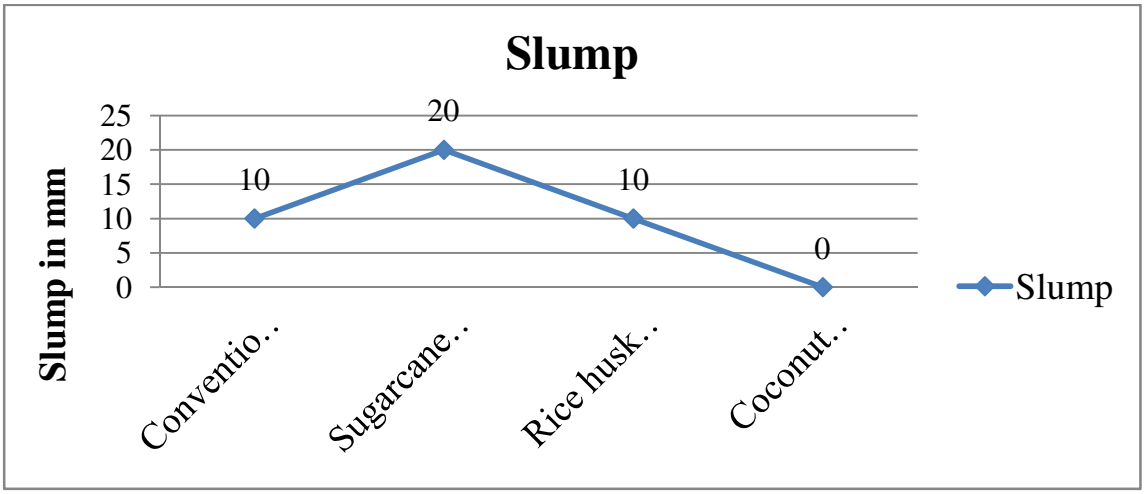

Fig 2 Slump test

- Slump value of conventional concrete is 10 mm and for sugarcane bagasse ash, rice husk ash and coconut shell ash for the replacement level of 15% the slump values are 20 mm, 10mm and 0mm respectively.

FLOW PERCENT CALCULATION

$$\text{FLOW PERCENT} = \frac{\text{spread dia in cm} - 25 \times 100}{25}$$

Dimension of the mould

Top diameter = 17 cm; Bottom diameter = 25 cm

Height = 12 cm

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Example

Flow percent = $\frac{34 - 25 \text{ X } 100}{25}$ = 36

Table IV Flow table

Test	Conventional concrete	15% of Sugarcane ash	15% of Rice husk ash	15% of Coconut shell ash
Flowtable test(%)	67.3	76	71.11	73.07

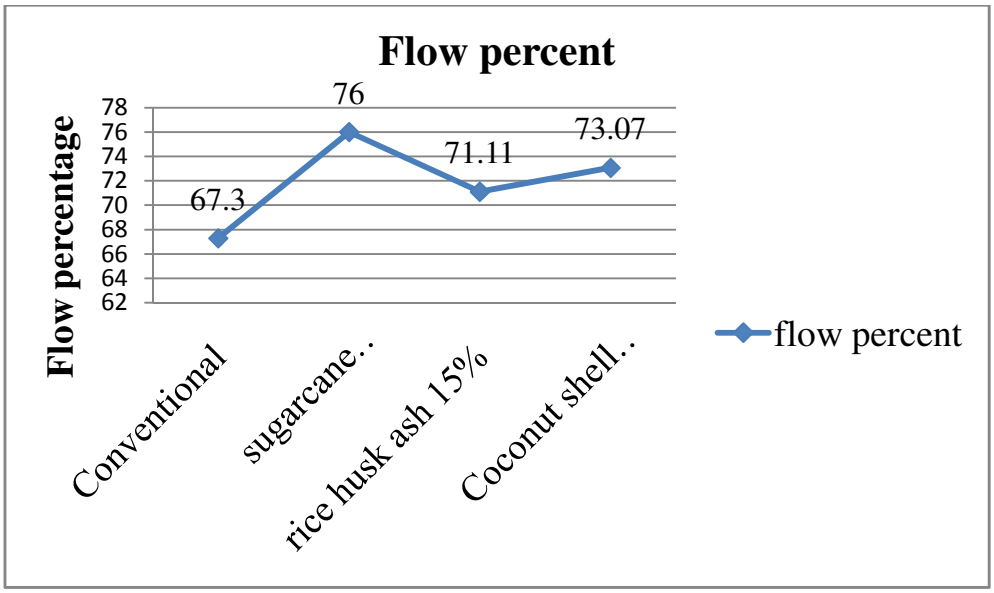

Fig 3 Flow percent

Flow percentage of the conventional concrete is 67.3% and for sugarcane bagasse ash, rice husk ash and coconut shell ash for the replacement level of 15% the flow percentage are 76%, 71.1% and 73.07 respectively.

COMPACTION FACTOR TEST

Upper hopper and bottom hopper

Top internal diameter = 254 mm

Bottom internal diameter = 127 mm

Internal height = 279 mm

Cylinder

Internal diameter = 229 mm

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Internal height = 305 mm

Distance between bottom of upper hopper and top of bottom hopper = 203 mm

Distance between bottom of lower hopper and top of cylinder = 203 mm

Compaction factor = weight of partially compacted concrete

Weight of fully compacted concrete

Table V Compaction factor

Test	Conventional concrete	15% of Sugarcane ash	15% of Rice husk ash	15% of Coconut shell ash
Compaction factor test	0.87	0.88	0.86	0.90

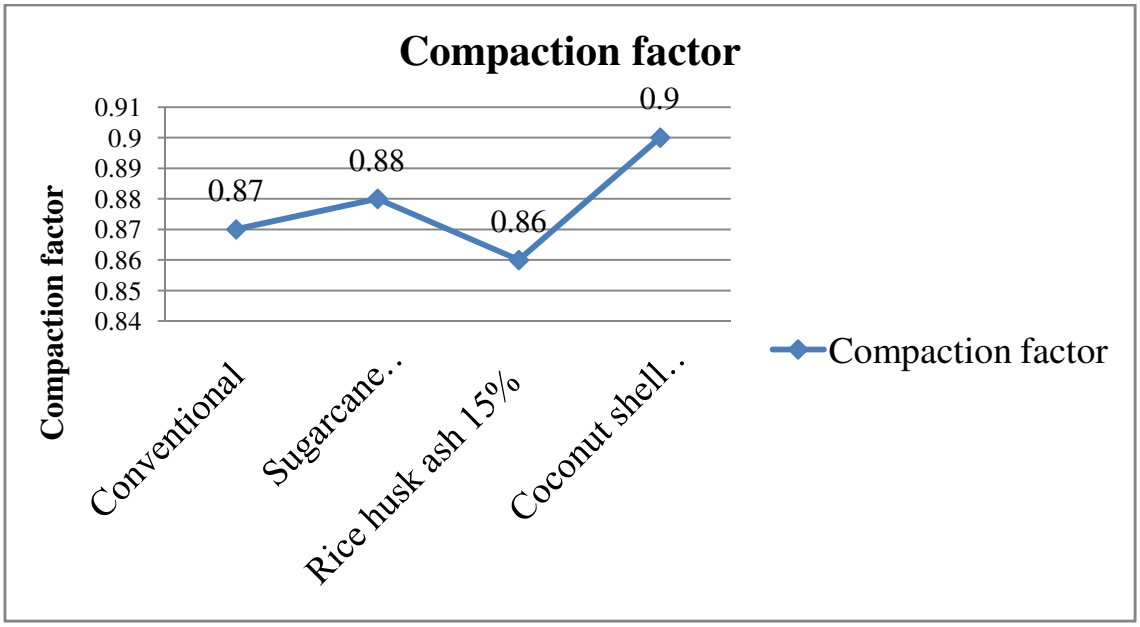

Fig 4 Compaction factor

Compaction factor of the conventional concrete is 0.87 and for sugarcane bagasse ash, rice husk ash and coconut shell ash for the replacement level of 15% the compaction factor are 0.88, 0.86 and 0.9 respectively.

HARDENED CONCRETE TEST PROPERTIES

COMPRESSIVE STRENGTH OF CONCRETE

Size of mould = 150 x 150 x 150 mm

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Compressive stress = p/A

Where,

p = Nominal load

A = Area of cross section

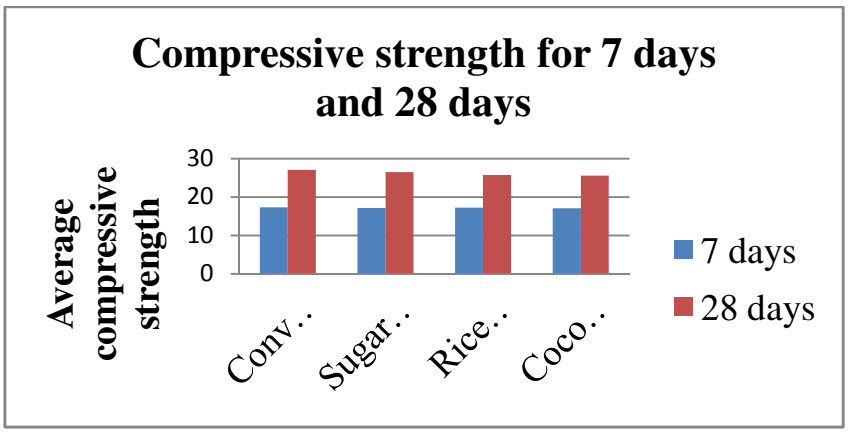

Fig.5. Compressive strength for 7 days and 28 days

- From the results, the compressive strength of concrete at 7 days value is nearly to the control specimen value when the cement is replaced by sugarcane bagasse ash at 15%.
- Compressive strength of concrete at 28 days value is increased to control specimen value when the cement is replaced by 15% of rice husk ash.

TENSILE STRENGTH OF CONCRETE

Diameter of cylinder = 150 mm

Length of cylinder = 300 mm

Tensile strength of cylinder = 2p/ JIDl

Where, P = Failure load

D = Diameter of cylinder

L = Length of cylinder

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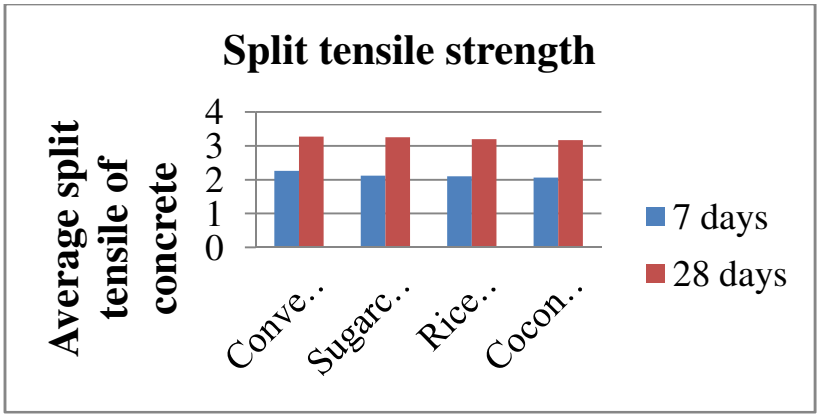

Fig.6. Split tensile strength for 7 days and 28 days

- Tensile strength of concrete at 7 days and 28 days value is increased to control specimen value when the cement is replaced by 15% of sugarcane bagasse ash and rice husk ash.

Flexural strength of concrete

Size of mould = 500mm x 100mm x 100mm

Breadth of the specimen = 100mm

Depth of the specimen = 100mm

Distance between the lines of fracture and the nearer support (a) =

Length of the span (l) =

If a > 20cm then modulus of rupture $fb = \frac{p \times l}{b \times d^2}$

If a < 20cm then modulus of rupture $fb = \frac{3p \times a}{b \times d^2}$

If a < 17cm then discard the specimen

Flexural strength

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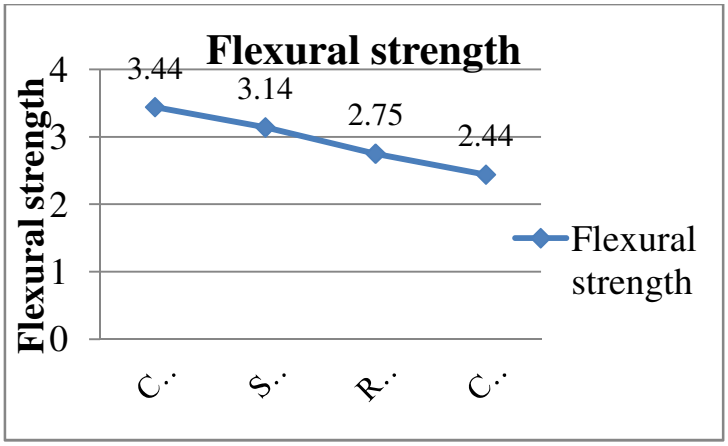

Fig.7. Flexural strength for 28 days

- Flexural strength of concrete at 28 days value for conventional is greater than the values replaced at 15%.
- The value goes on decrease for the ashes replaced by 15% on concrete.

V.CONCLUSION

Based on the result and discussion mentioned above, the following conclusion is obtained.

- The compressive strength result represents that, the strength of mixes with 15% of bagasse increases at later days (28 days) as compared to 7 days that may be due to pozzolanic properties of bagasse ash.
- It is found that the concrete at the replacement of 15% on rice husk ash gives the better strength at early days than the sugarcane bagasse ash and coconut shell ash.
- The tensile strength of concrete at 7 days and 28 days value is increased to control specimen value when the cement is replaced by 15% of sugarcane bagasse ash and rice husk ash.
- It results that 15% partial replacement of ordinary Portland cement with coconut shell ash using W/C ratio of 0.5 are only suitable for production of both heavy weight and light weight concrete than the W/C ratio of 0.45.
- To conclude that both sugarcane bagasse ash and rice husk ash are to be used as partial replacement pozzolanic material which reduce the cost of construction.

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