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EXPERIMENTAL INVESTIGATION ON LIGHT WEIGHT CONCRETE USING COCONUT SHELL AS CORSE AGGREGATE AND VERMICULITE MINERAL AS PARTIAL REPLACEMENT OF RIVER SAND

[1] Deepak B , [2] A.Alton,
[1] Student, [2] Assistant Professor
[1,2] Department of civil engineering,
[1,2] Vel Tech High Tech Dr.Rangarajan Dr.Sakunthala Engineering College, Avadi.
[1] deepakbalraj27@gmail.com.

ABSTRACT

Generally, concrete with low density material will have its dead weight reduced which in turn takes up reduced earthquake load. This lightweight concrete can be obtained by replacement of aggregate by materials like Scoria, Ciders, Pumice, Polystyrene beads, Perlite, Vermiculite, coconut shell, etc., In this experimental study fine aggregate and coarse aggregate is partially replacement of vermiculite and Coconut shell. Use of vermiculite in concrete, it will enhance the shrinkage and crack resistance, fire resistance and reduces environmental impact and also reduce the cost.

In this study an attempt has been made to find the suitability of the Coconut shell as a possible substitute for conventional crushed stone Coarse aggregate. In this present study, an attempt has been made to study the mechanical properties of M30 grade concrete with 20%, 25% and 30% of partial replacement of vermiculite by the total fine aggregate and along with 5% , 10% and 15% of coconut shell is partially replaced as a Corse aggregate.

The concrete cubes is casted and tested for compressive strength after curing period of 7 days, 14 days , &28 days. Hence, lightweight concrete can be obtained by using the above combination of vermiculite and coconut shell without any considerable loss in compressive strength and main aim to make economical and eco-friendly.

keywords : Coconut shell, Coconut shell, strength.

1. INTRODUCTION

The river sand has become expensive due to scarcity from natural sources and sand mining from river has become objectionably

excessive. As environmental constraints make the availability and use of river sand less attractive, a suitable replacement product for concrete industry need to be found. The seismic effect that influence any civil engineering structure depends on the mass of that structure and so reducing the mass of the structure can make the structure less vulnerable to seismic damage

This lightweight concrete can be obtained by replacement of aggregate by materials like Scoria, Ciders, Pumice, Polystyrene beads, Perlite, Vermiculite, etc.,. In this study, exfoliated vermiculite is used as partial replacement for fine aggregate and coconut shell is used as a partial replacement for Corse aggregate. Use of exfoliated vermiculite in concrete reduces the structural load, making the structure lightweight and thereby reducing the seismic effect to the structure

1.1. AIM OF THE STUDY

The aim of this research is to find the variation in compressive and flexural strength development of concrete by using vermiculite and coconut shell , and to meet the scarcity of natural aggregates in future. And to make economical and eco-friendly concrete.

1.2.OBJECTIVES OF THE STUDY

1.
- To study the properties of the vermiculite concrete with conventional concrete.
- To determine the behaviour of concrete using vermiculite as fine aggregate and coconut shell as Corse aggregate.
- To reduce the cost of construction work and also maintain the same quality as like fine aggregate in cement concrete.
- To meet the scarcity of natural fine aggregate in future, the vermiculite can be alternatively used to determine the optimum level natural fine aggregate by vermiculite in concrete.

1.3. SIGNIFICANCE OF THE STUDY

- Lightweight aggregate concrete can be used for casting structural steel to protect it against fire and corrosion.
- Light weight concrete will lead to new development in future to save the materials and to form a better means of structures.
- It is a time saving method to finish the work on or before the given time
- It can also help in covering architectural purposes.

2. REVIEW PAPERS

In previous investigations, researchers evaluate the effect of using Vermiculite and coconut shell as the partial replacement of

aggregates in concrete composites and also give an idea using these materials within specific range. From this they found the exact percentage of increase in Compressive and Flexural strength of the Concrete and moreover, Durability results. Due to this vermiculite and coconut shell can be considered as a very high efficient replacement material.

Dinesh.A et al (2016) It was designed with the used of expanded perlite aggregate, expanded vermiculite aggregate that will provide an advantage of reducing dead weight of structure and to obtain a more economical structural low density of the concrete by the using of these materials as a replacement of the coarse aggregate.

Divya .M.R (2016) The study on M30 grade concrete using vermiculite as partial replacement with 40%,50% and 60% to the total weight of fine aggregate**.** The aim of their project is to study the strength parameters such as compressive strength, split tensile & flexural strength of concrete. They study result shows the optimum strength in compare the strengths for different vermiculite percentage was observed to be 50%**.**

Gunasekaran.M et al (2016) Study on Vermiculite replacing natural sand is investigated. Design mix having the mix proportion 1:3 with the water cement ratio 0.5.

3. METHODOLOGY AND MIX DESIGN

Data was collected from the study area, review of literature and secondary source of information. The main aim is to identify materials and check the parameter of materials using study. Material parameters are mainly used for design the mix as per code practices. Mix design can be calculated from the procedure for prepare the specimen. Fresh concrete will be casted and cured. Finally specimen will be tested to get results.

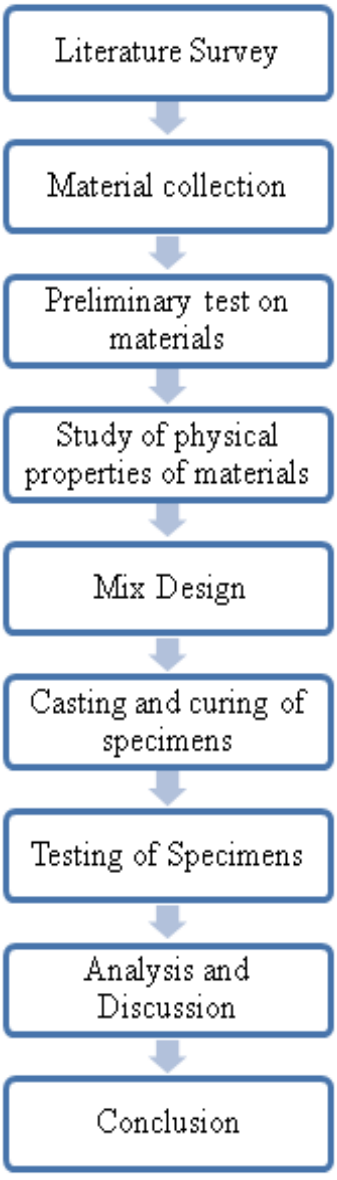

Fig 1: Methodology

4. EXPERIMENTAL INVESTIGATION

4.1.1 COMPRESSIVE STRENGTH TEST

The compressive strength of the concrete was determined using a compression testing machine**.** Compressive strength is the ability of material or structure to carry the load on its surface without any crack or deflection. The cubes of size 150mm×150mm×150mm of M30 grade concrete were casted for various percentages of vermiculite(20%, 25% and 30%) and coconut shell by 5% 10%, 15%. The cubes are cured and tested for 7 days , 14 days and 28 days . Testing was made with loading rate of 140kg/cm² per minute.

Compressive strength = load / area (N/mm2)

Fig. 2: Compression testing machine

4.1.2 SPLIT TENSILE STRENGTH TEST

A method of determining the tensile strength of concrete using a cylinder which splits across the vertical diameter. The tensile strength of concrete is one of the basic and important properties. Splitting tensile strength test on concrete cylinder is a method to determine the tensile strength of concrete. The following procedure is adopted to conduct the tensile strength test.

Fig 3: Split tensile test

4.1.3 FLEXURAL STRENGTH TEST

Flexural test evaluates the tensile strength of concrete indirectly. The flexural strength test was carried out of beam at the age of 28 days of curing, using 40 tons capacity universal testing machine.

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Fig 5: Flexural strength test

5 HARDENED CONCRETE

5.1.1 COMPRESSIVE STRENGTH TEST RESULT

Table 1: compressive strength test result

S.No	Mix	Mix ratio		Average compressive strength at 7 days (N/mm)	Average compressive strength at 14days (N/mm)	Average compressive strength at 28days (N/mm)
		% of vermiculite	% of coconut shell			
1.	M1	0	0	17.89	27.81	35.11
2.	M2	20	5	16.74	26.70	34.92
3.	M3	20	10	16.70	26.75	34.73
4.	M4	20	15	16.68	26.67	34.60
5.	M5	25	5	16.60	26.53	34.55
6.	M6	25	10	16.56	26.48	34.48
7.	M7	25	15	16.33	26.36	33.89
8.	M8	30	5	16.21	25.09	33.76
9.	M9	30	10	15.01	24.86	32.54
10.	M10	30	15	14.89	24.72	32.14

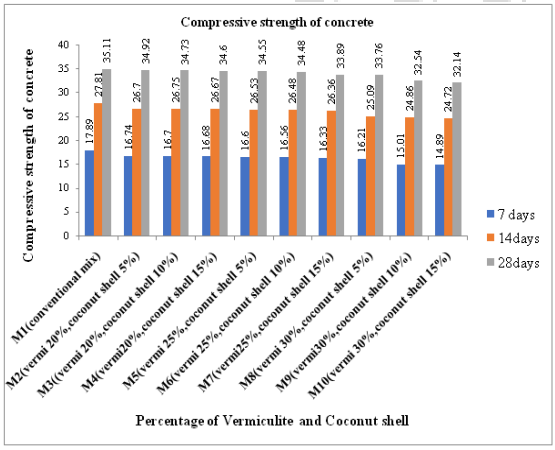

Fig 6: Compressive strength of concrete

5.1.2 SPLIT TENSILE STRENGTH TEST RESULT

Table 2 : Split tensile strength test result

S.No	Mix	Mix ratio		Average split tensile strength at 7 days (N/mm)	Average split tensile strength at 14days (N/mm)	Average split tensile strength at 28days (N/mm)
		% of vermiculite	% of coconut shell			
1.	M1	0	0	3.05	3.98	4.98
2.	M2	20	5	3.3	4.55	5.73
3.	M3	20	10	3.33	4.54	5.68
4.	M4	20	15	3.34	4.57	5.61
5.	M5	25	5	3.32	4.6	5.56
6.	M6	25	10	3.35	4.3	5.31
7.	M7	25	15	3.4	4.33	5.3
8.	M8	30	5	3.18	4.24	5.00
9.	M9	30	10	3.21	4.18	4.82
10.	M10	30	15	3.25	4.56	4.76

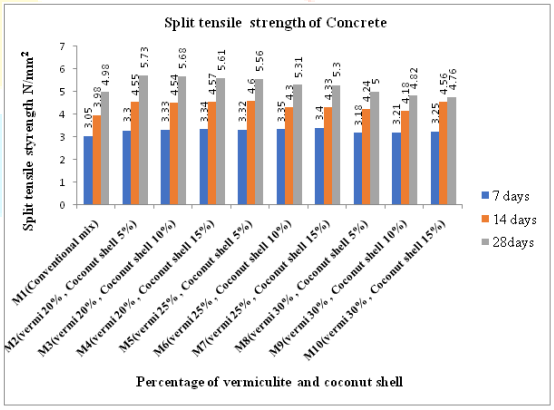

Fig 7 : split tensile strength

5.1.3 FLEXURAL STRENGTH TEST RESULT

Table 8: Flexural strength test result

S.No	Mix	Proportion	Flexural strength
1.	M1	0 % Vermiculite + 0% coconut shell	5.97
2.	M2	20 % Vermiculite + 5% coconut shell	6.11
3.	M3	20 % Vermiculite + 10% coconut shell	6.18
4.	M4	20 % Vermiculite + 15% coconut shell	6.89
5.	M5	25 % Vermiculite + 5% coconut shell	7.02
6.	M6	25 % Vermiculite + 10% coconut shell	6.97
7.	M7	25 % Vermiculite + 15% coconut shell	6.99
8.	M8	30% Vermiculite + 5% coconut shell	6.56
9.	M9	30 % Vermiculite + 10% coconut shell	6.14
10.	M10	30 % Vermiculite + 15% coconut shell	6.05

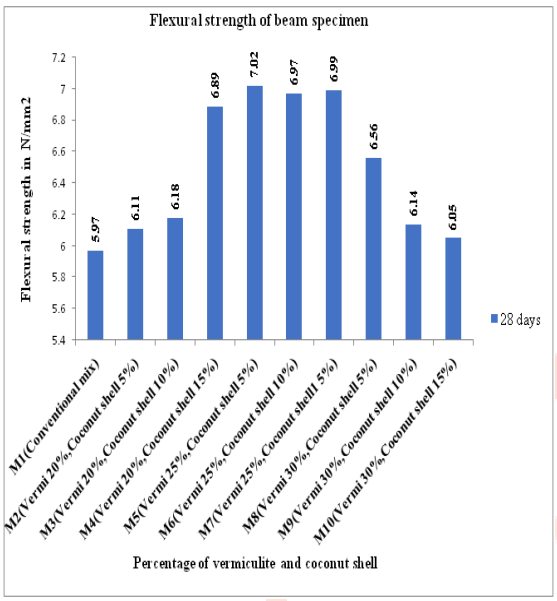

Fig 9: Flexural strength of beam

6. CONCLUSION

The strength parameters such as compressive strength, split tensile strength and Flexural strength of vermiculite and coconut shell concretes of various percentages are found.The optimum strength in comparing the strengths for different vermiculite was observed to be 25% Addition of vermiculites as fine aggregate and 5% of coconut shell concrete makes it heat resisting & resists shrinkage and cracks in concrete. Because of inert chemical nature of vermiculite when it is used in concrete it will not undergo any chemical reaction and also it is an eco friendly material.

Though the compressive strength of concrete decreases with increase of percentage of vermiculite, but with the replacement of 25%of vermiculite as fine aggregate and addition of 15% of coconut shell as coarse aggregate may be accepted as it is giving required target mean strength. Though the Split Tensile strength of concrete decreases with increase of percentage of vermiculite and coconut shell, but with the replacement of vermiculite at 25% for fine aggregate and addition of 5% coconut shell as coarse aggregate may be accepted as it is giving required target mean strength.

Vermiculite and coconut shell is a filler material used in the construction industry mainly for its low bulk density and inertness. Vermiculite is used for insulation property. We conclude here by comparing the various compression test of the sample (10% replacement of vermiculite to the total weight of sand) gives better results. Hence finally, it is economical and giving good compressive strength.

The following conclusions can be drawn from the above investigation. There was a notable change in difference in room temperature and environmental temperature. Replacement of fine aggregate with vermiculite and coarse aggregate with coconut shell results in light weight concrete.

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