

Partial Replacement of Oyster Shells as Coarse Aggregate in Concrete

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Abstract:- Oyster shell is a hard, protective layer, a calcareous exoskeleton which encloses, supports and protects the soft parts of an animal (mollusc). The hard shells are regarded as waste which are accumulated in many parts of the country. In our project, those shells are used as partial coarse aggregate replacement in concrete which is an effort towards protecting natural coarse aggregate for future generation. Coarse aggregate is partially replaced with 0%, 5%, 10% & 15% by oyster shells. Grade of concrete adopted is M30. Workability, compressive, split tensile & flexural strength tests will be conducted in accordance to IS codes.

1. INTRODUCTION

GENERAL

The demand of construction industry is considered, at the same time the need for concrete material production, such as fine aggregate and coarse aggregate increased. The environmental problems occur when the extraction of sand, gravel and other materials exceeds the rate. To overcome these issues, waste materials has been analyzed and investigated their capability and potential to be used as partial coarse & fine aggregate replacement material in concrete production. By integrating the oyster shell (dead remain of the living beings in sea) as partial coarse aggregate replacement could reduce consumption of natural coarse aggregate use and also contribute towards cleaner environment since enormous amount of oyster shell wastes have been illegally disposed of at oyster farm sites. In addition, concrete is present in most buildings and accounts for 7-10% of global CO₂ emission, which is a vast amount. Thus, oyster shell being an eco-friendly material, help prevent environmental pollution too.

II. LITERATURE REVIEW

B.Ramakrishna and A.Sateesh (2016), on the topic of 'Exploratory study on the use of cockle shell as partial coarse and fine aggregate replacement in concrete' have written a journal by integrating the cockle shells as partial coarse and fine aggregate replacement which could reduce consumption of natural fine aggregate use. Following were 4 types of mix used in this study.

- Plain concrete with 100% of natural coarse and fine aggregate.
- Mix containing cockle shells as partial coarse aggregate replacement.
- Mix containing crushed cockle shells as partial fine aggregate replacement.

Mix containing crushed cockle shells as partial fine aggregate replacement and uncrushed cockle shells as partial coarse aggregate replacement.

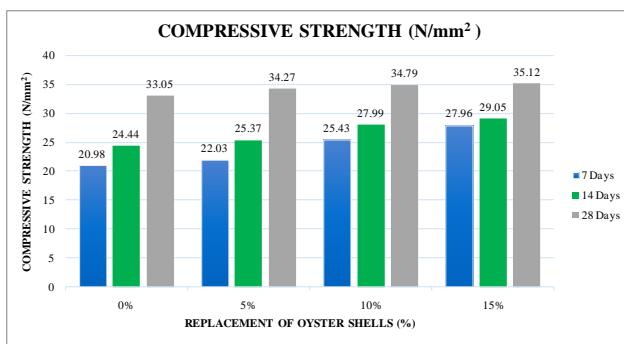
For this research, 7 different percentages that is 0%, 5%, 10%, 15%, 20%, 25% and 30% of shells have been used which produce several types of concrete mix. Workability, compressive and tensile strength test were conducted in accordance to IS 456. The study found that the replacement of natural coarse aggregate by cockle shell at a level of 25% and fine aggregate by crushed cockle shell at a level of 10% resulted in increase of compressive strength but this replacement reduced the concrete workability.

K.Muthusamy and N.R.Sabri (2012), carried out a project on the topic 'Cockle shell: A potential partial coarse aggregate replacement in concrete'. This paper presents the result on the workability and compressive strength on concrete containing various percentage of cockle shell content as partial coarse aggregate replacement. Concrete mixes containing 0%, 5%, 10%, 15%, 20%, 25% and 30% cockle shell replacement level were cast before subjected to water curing for 28 days. Results show that replacement of appropriate cockle shell content was able to produce workable concrete with satisfactory strength. Integration of 20% cockle shells enhanced the strength of concrete making it to be the highest as compared to any other replacement level. Nevertheless, integration of too much of cockle shell produced harsher mix which disrupts the strength performance.

A journal on the topic of 'Developing Concrete using sea shell as a fine aggregate' investigates the results on partial replacement of river sand by sea shell. The sea shell was used after grinding it to the maximum size of 4.75 mm. IS:10262-2009 was followed for the mix design of M20 grade concrete. Sea shell used in concrete confirms to zone II as per IS:383-1970. Then cubes were casted for 5 parts of partial replacement as 20%, 40%, 60%, 80% and 100%. All the specimens were tested on 7 and 28 days for compressive, flexural and split tensile strength. The gradual increase in strength was observed in all the 20%, 40%, 60% and 80% after that there was fall in strength in the 100% replacement. The maximum percentage of successful replacement was found in 80% which mark the maximum strength value in all the three tests. The increase in strength clearly shows that the sea shell starts to react with the other ingredients of concrete which there by increase in the heat of hydration concrete.

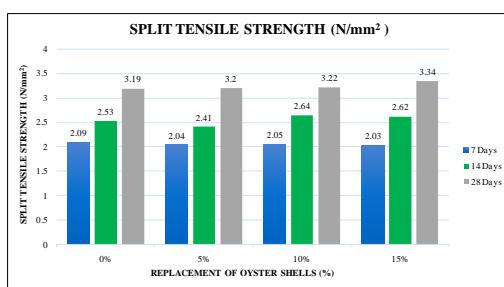
III. RESULTS AND DISCUSSIONS

- It is found that at the age of 28 days increase in compressive strength is 3.69%, 5.26% and 6.26% for mixes replaced with 5%, 10% and 15% oyster shells respectively than the control mix.
- From chart, it is observed that maximum compressive strength obtained at 15% oyster shell replacement (35.12 MPa).
- The increase in strength is due to their unique texture and another is due to the presence of large amount of CaCO_3 in oyster shells.



Split Tensile Strength for Oyster Shell Replacement in Concrete It is found that at the age of 28 days increase in split tensile strength is 0.3%, 0.94% and 4.7% for mixes replaced with 5%, 10% and 15% oyster shells respectively than the control mix.

- From chart, it is observed that maximum split tensile strength obtained at 15% oyster shell replacement (3.34 MPa).
- There is not much percentage increase in split tensile strength of oyster replaced concrete. The values are more or less equal to conventional concrete.
- This is because of the fact that the oyster shells are brittle material and not tensile in nature.

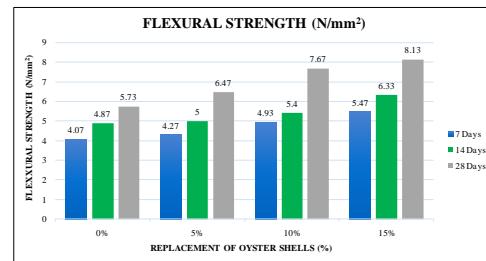


Flexural Strength for Oyster Shell Replacement in Concrete It is found that at the age of 28 days increase in flexural strength is

12.9%, 33.86% and 41.88% for mixes replaced with 5%, 10% and 15% oyster shells respectively than the control mix.

- From chart, it is observed that maximum flexural strength obtained at 15% oyster shell replacement (8.13 MPa).

The increase in strength is due to their unique texture and another is due to the presence of large amount of CaCO_3 in oyster shells.



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