An Experimental Study on Partial Replacement of Cement Using Oyster Shell Powder in Concrete

Tamilselvan S[1], Dr. P. Senthamilselvi[2]
[1]*PG Scholar, Department of Structural Engineering, Government College of Engineering, Salem, Tamilnadu, India*
[2] *Associate Professor, Department of Civil Engineering, Government College of Engineering, Salem, Tamilnadu, India*

Abstract: **In this day and age we are in front of most complex safety problems connected to environment. Many things which are made-up for our comfortable life are accountable for polluting environment due to offensive waste management technique. The present exploration assesses the merging of oyster shell in concrete. The consequence of oyster shell as fractional replacement of cement on the compressive strength (primary) of concrete has been investigated. Globally, over 150 countries produce cement and/or clinker, the primary input to cement. In 2001, the United States was the world's third largest producer of cement (90 million metric tons (MMT)), behind China (661 MMT) and India (100 MMT). This work reports an experimental procedure to investigate the effect of using oyster shell powder as partial replacement of cement. Tabby is a type of concrete made by burning oyster shells to create lime, then mixing it with water, sand, ash and broken oyster shells. Tabby was used by early Spanish settlers in present-day North Carolina and Florida, then by English colonists primarily in coastal South Carolina and Georgia. Oyster shell as a alternate for straight cement with partial replacement using M25 grade concrete The main objective is to support the use of these outwardly waste products as a construction material.**

Keywords: Compressive strength, **Oyster shell,** ***split tensile strength.***

1. INTRODUCTION

1.1 GENERAL

Concrete is one of the two most used structure materials in construction. In order to reduce reliance of raw material in concrete producing, the green concrete had been promoted. Green concrete is the concrete that had been produced using recycle or wasted natural materials. One of the ways to produce green concrete is by using modified cement. Cement is the second largest volume materials used by human being after water. Cement plays the role of a binder, a substance that sets and hardens and might bind alternative materials along. During production of cement and hydration process of cement, the amount of CO2 emitted by the industry is nearly 900 kg of CO2 for every 1000 kg of cement produced. This CO2 production causes serious environmental damages. The sea shells are high potential materials to become partial cement replacement and filler in concrete. The calcium carbonate (CaCO3) in the sea shells is more than 90% and is similar to contain of calcium carbonate in the limestone dust that been used in the Portland cement production. Impressively, the crystal structures of seashells are largely composed of calcite and aragonite, which have higher strengths and density than limestone powder. Also, the particle sizes of seashells are between 36μm to 75μm and are similar to the particle size of Portland cement. Due to the physical and chemical properties of conch and oyster shells, they may be a suitable substitute for cement and aggregates.

1.1 OBJECTIVES OF STUDY

Investigation on the concrete mixes containing 2%, 4% and 6% of shell as partial replacement of cement to evaluate the mechanical properties of concrete such as compressive strength, tensile splitting strength, and flexural strength characteristics.

I am testing the strength of concrete by using oyster shell powder as a substitute for cement.

2. REVIEW OF LITERATURE

2.1 LITERATURE BASED ON OYSTER SHELL POWDER CONCRETE

1.Experimental study on partial replacement of cement by oyster shell powder Yamuna Bharathi in (2016)

This research helps to access the behavior of concrete mixed with osp and determination of optimum percentage of combined mixture which can be recommended as suitable alternative construction material in low cost housing delivery especially in coastal areas and near fresh water where they are found as waste. Seashell osp is mainly composed of calcium and the rough texture makes it suitable to be used as partial cement replacement which provides an economic alternative to the conventional materials such as gravel. Experimental studies were performed on conventional concrete and mixtures of seashell with concrete. The percentage of seashell is varied from 2%, 4%, and 6%.

3. MATERIAL INVESTIGATION

3.1. DISCUSSION THE PROPERTIES OF MATERIALS USED

3.2 MATERIALS USED

- Cement (OPC 53)
- Fine Aggregate
- Coarse Aggregate
- Water
- Oyster Shell Powder

3.3 TEST ON CEMENT

- Specific gravity
- Fineness
- Consistency

4. MIX DESIGN

Grade	Cement Kg/m³	Fine aggregate Kg/m³	Coarse aggregate Kg/m³	Water Content Lit/m³
M25	426.66	654.89	1161.73	191.5

- Mix Ratio
- 1: 1.5: 2.7
- w/c = 0.45

5. CASTING OF CONCRETE

Fig 5.1 Mixing of Conventional Concrete

Fig 5.2 Compressive Strength Test for Conventional Concrete

Fig 5.3 Mould preparation for cube specimen

The typical concrete mix is made up of roughly 8% cement, oyster shell powder 2%, 20% air and water, 30% sand, and 40% gravel. This is called the 10-20-30-40 Rule–though proportions may vary depending on the type of cement and other factors.

Fig 5.4 Oyster shell powder mixing of concrete

Mixing concrete is simply defined as the "complete blending of the materials which are

required for the production of a homogeneous concrete". This can vary from hand to machine mixing, with machine mixing being the most common.

Fig 5.5 Mixing of concrete

A concrete mould employs resilient side shuttering, made of rubber for example, which is prevented from deflecting, when concrete is poured, by tensioning wires extending along the length of the shuttering.

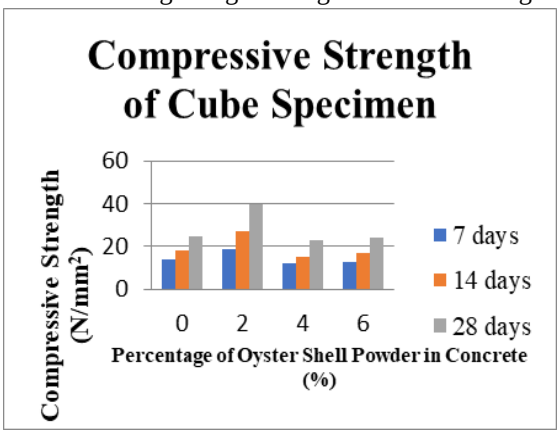

Fig 5.6 Casting of Oyster shell powder concrete

Concrete objects are poured in a mould that has to be removed when the concrete has hardened. During the hardening time embeds are placed into the concrete. The required hardening time before demoulding by the aid of embeds is approximately 24 hourds, depending on the circumstances.

6. SPLIT TENSILE STRENGTH TEST

The split tensile test is an indirect way of evaluating the tensile test of concrete. In this test, a standard cylindrical specimen is laid horizontally, and the force is applied on the cylinder radially on the surface which causes the formation of a vertical crack in the specimen along its diameter.

Fig 6.1 Preparation of Cylinder mould

Fig 6.2 Preparation of Cylinder concrete

Fig 6.3 Split tensile strength test of Oyster shell powder concrete

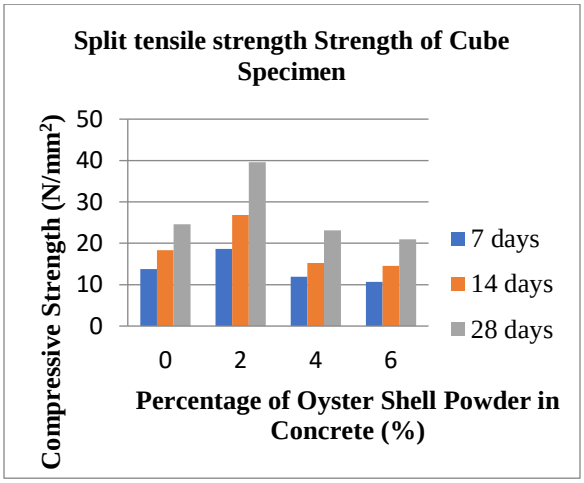

Fig 6.4 Spilt Tensile Strength chart for conventional Vs Oyster shell powder concrete 2%, 4% And 6%

7. CONCLUSION

The mix design was prepared for the My grade of concrete and the concrete were casted and tested with partial replacement of cement by oyster shell powder with various percentages of 0, 2%, 4% and 6%. The maximum Compressive strength for partial replacement of cement with oyster shell powder be achieved by 2% is found to be greater than the conventional concrete It achieved maximum compressive strength when there is partial replacement of cement with oyster shell powder (2) So the optimum percentage of replacement of oyster shell powder is 2%. The replacement of oyster shell powder with cement found to be increase in strength with 2% and 6% replacement than conventional concrete. The 4% replacement of oyster shell powder with cement not increase the strength much more It is observed that the strength of concrete with 2% replacement is starting to reduce after 28 days. As per above result it is clear that the material which is replaced by cement has less component of silica and high of lime due to which the material on getting hydrated provide less variation in increase of strength. The strength of concretes blended with the grounded oyster shell as a partial replacement of cement has been examined in this study.

REFERENCE

1. Concrete Technology. Theory and Practice M.S.Shetty B. Vijaya Rangan, DjwantoroHardjito, Steenie E. Wallah, and Dody M.J. Sumajouw Faculty of Engineering and Computing, Curtin University of Technology, Australia.
2. P. Nath, P. K. Sarker. Department of Civil Engineering, Curtin University, Kent Street, Bentley, Australia.
3. Geopolymer concrete: a concrete of Next decade Raijiwala D.B. Patil H.S.
4. V. Fly Ash-Based Geopolymer Mortar Incorporating Bottom AshDjwantoroHARDJITO. Dept. of Civil Engineering. Petra Christian University
5. Hardjito D. (2005). Studies of fly ash-based geopolymer concrete. PhD Thesis, Curtin university of Technology, Perth, Australia.
6. Vijai K., Kumutha R. and Vishnuram B. G. (2010). Effect of types of curing on strength of geopolymer concrete. International Journal of the Physical Sciences, 5(9), 1419-1423.
7. Davidovits J. (2008). Geopolymer Chemistry and Application. 2nd edn, InstitutGéopolymère, Saint-Quentin, France.

8. Wallah S. E. and Rangan B. V. (2006). Low-calcium fly ash-based geopolymer concrete: long-term properties. Research Report GC 2. Faculty of Engineering, Curtin University of Technology, Perth, Australia.
9. Wu H. C. and Sun P. (2010). Effect of mixture compositions on workability and strength of fly ash-based inorganic polymer mortar, ACI Materials Journal, 107(6)
10. Drying Shrinkage of Heat-Cured Fly Ash-Based Geopolymer Concrete Steenie Edward Wallah Department of Civil Engineering. Faculty of Engineering Sam Ratulangi University, Indonesia
11. Low calcium fly ash geopolymer concrete A promising sustainable alternative for rigid Concrete road furniture D S Cheema, Main Roads, Western Australia
12. Utilisation of fly ash in a geopolymeric material JC. Swanepoel, CA Strydom Department of Chemistry, University of Pretoria, South Africa
13. Recent research geopolymer concrete Nguyen van chanh- Assoc. Professor. Phd, bui dang trung, danh van tuan. University of technology, Vietnam
14. IS: 456-2000, Code of practice for plain and Reinforced Concrete.