

# A Review on Experimental Investigation on Partial Replacement of Cement by Oyster Shell Powder in Plain Concrete

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**Abstract**— Cement is the most abundantly used material in construction industry. Production of cement lays an impact on environment imparting pollution. As a Civil Engineer, we are trying to partially replace the cement with oyster shell powder which is rich in calcium carbonate to reduce environmental impacts of cement. We studied many papers and decided to replace cement by 5,10,15% with oyster shell powder. The main objective of paper is to check strength of concrete after successful replacement with oyster shell powder. By studying many review papers we have done chemical tests on oyster shell powder for knowing its chemical parameters. By doing this research we are trying to minimize use of cement and using ecofriendly ways for prevention and maintenance of environmental balance.

**Keywords:** ordinary Portland cement (53 Grade), oyster shell powder, chemical parameters

## I. INTRODUCTION

With the growth of construction industry the use of cement has been increased significantly. The enlarging construction industries led to increase in production of cement which puts severe impacts on environment and ecological system. So as an engineer we should try to replace the cement with other ecofriendly substitutes. We are trying to partially replace cement with oyster shell powder. Oyster is an invertebrate animal which lives in shell. Oyster shell is rich in calcium carbonate, and as calcium carbonate imparts strength to cement so oyster shell powder can be used as a substitute for replacing cement in the concrete. More ever we know that concrete is weak in tension and by studying various literature papers it has been concluded that use of oyster shell powder can increase tensile strength of cement also. An oyster is a soft-bodied invertebrate that is found in the shallow waters of the sea river. It has a rough irregularly shaped, double-hinged shell. Due to its certain structure it has been seen that the use of oyster shell powder can increase the tensile strength of concrete also.

So we are replacing cement by 5, 10, 15% by oyster shell powder. IS10262-2009 can be used for mix design grade of concrete. It has been stated that an oyster shell contains about 95% of calcium carbonate. According to literature papers, river shells contains more calcium carbonate as compared to sea shells. As in concern for environment we should try to replace cement with various substitutes.

### A. Objectives

- Experimenting the concrete mixes containing 5%, 10% and 15% 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.

- Performing the slump test and analyzing the difference of slump for different % of shell to obtain the workability of the concrete with partially replacements.
- Evaluating and studying the effect of varying percentages of shell and comparing the results with normal concrete without any replacements.

## II. LITERATURE REVIEW

A. “An Effect on Oyster Shell Powders Mechanical Properties in Self Compacting Concrete” S.Abinaya, S.Prasanna venkatesh.

From In this study, pozzolonic replaced with various percentages by oyster shell powder and the fresh and hardened properties of cement concrete were studied. In this study, it has been found that with the increase in various percentage of replacement river and oyster shell powder, hence if we increase the sea and river oyster shell powder replace of pozzolonic properties fly ash

.so optimum percentage increase the river and sea oyster shell powder we have a better workable concrete is 5%.The result of the mechanical properties (compressive, split and flexure strength) have shown significant performance difference and the higher compressive strength has been obtained for oyster shell powder replacement level could be of optimum consideration for flow ability, mechanical properties study.

B. “Mechanical properties of seashell concrete” Monita Oliviana and Annisa Arifandita Mifshellaa.(2015)

In this research, the ground cockle seashell was used as a partial cement replacement. The ground seashells were prepared by burning, crushing, grinding and filtering the cockle using no200 sieve. The mechanical properties studied were compressive strength, splitting tensile strength, flexural strength and modulus of elasticity of seashell concrete. These properties were compared with those of a control Ordinary Portland Cement (OPC) concrete. Based on the trial mixes using the ground seashell with proportion of 2, 4, 6 and 8% by weight of cement, the optimum compressive strength was achieved for the mix that replaced cement by 4%. The seashell concrete yielded less compressive strength and modulus elasticity compared to the OPC concrete. It is noted that the tensile strength and flexural strength were higher than those of the OPC concrete, which is advantageous to increase concrete tension properties. In this study, the effect of replacing cement by ground seashell on the mechanistic properties of concrete was examined.

- 1) Replacement of the cement with the ground seashell led to a decrease of compressive strength of seashell concrete compared with the control OPC concrete.
- 2) The tensile and flexural strength of the seashell concrete were higher than the control concrete. The Young’s

Modulus of Elasticity of seashell concrete increased with the age of concrete.

- 3) It can be concluded that the concrete containing ground seashell yielded relatively better tension properties, but lower compressive strength and modulus of elasticity than the control concrete.

*C. "Partial replacement of cement by groundnut shell ash and sea shell powder" V.Samidurai, G.Mahesh, M.Maruthupandi*

The construction industry relies heavily on cement for its operations in the development of shelter and other infrastructural facilities. Various research workers in the recent past had look into the utilization of agricultural wastes that are known to be puzollanas to partially substitute cement that is the major component of concrete. The use of Ordinary Portland Cement (OPC) and Rice Husk Ash (RHA) concrete in minimizing thermally induced expansion cracks has been identified. The utilization of Groundnut shell will promote waste management at little cost, reduce pollution by these waste and increase the economic base of the farmer when such waste are sold thereby encourages more production. Also, GSA production required less energy demand compared with cement production and save the needed foreign exchange spent on importation of cement or its constituents. The effective utilization of these oyster shell wastes which are available almost free of cost and in abundance will not only reduce their pollution tendency but will help in reducing the amount of cement used in concrete work. Investigations are made in order to perform the partial replacement for cement in concrete by Groundnut Shell Ash and Oyster shell powder.

*D. "Waste Shell Cement Composites" Anibal Ramirez, Steve D. Barker, Timothy J. Love, Edward J. Milazzo, Lawrence P. McGillicuddy Seashells waste is a growing economic and environmental hazard.*

The purpose of this project was to use seashells in concrete and determine how the concrete would perform compared to a standard mix. The testing consisted of eight mix designs that contained either conch or oyster shells. The shells were used as a substitute for 10% or 25% sand, and 5% cement powder pending the mix design. Four of the mixes used shells that were vinegar treated to determine if that affected the strength of the concrete. These mixes were all compared to the control and each other through a series of tests. The tests conducted were the 3-point bend test, compressive test, split tensile test, and shrinkage test. The samples were also examined using electron microscopy and x-ray diffraction.

*E. "Composite cement mortars based on marine sediments and oyster shell powder" H. Ez-zakia, A. Diouria, S. Kamali-Bernardb,*

O. Sassic Additions of dredged marine sediments and oyster shell powder (OS) as cement substitute materials in mortars are examined by several techniques. The sediments have high water and chloride contents and calcite, quartz, illite and kaolinite as principal minerals. The OS powders are entirely composed of calcium car-bonate and traces of other impurities. Four mixtures of treated sediments and OS powders at 650 °C and 850 °C are added to Portland cement

at 8%, 16% and 33% by weight. The hydration of composite pastes is followed by calorimetric tests, the porosity accessible to water, the bulk density, the permeability to gas, the compressive strength and the accelerated carbonation resistance are measured. In general, the increase of addition amounts reduced the performance of mortars. However, a reduction of gas permeability was observed when the addition was up to 33%. Around 16% of addition, the compressive strength and carbonation resistance were improved.

*F. "A Review On Seashells Ash As Partial Cement Replacement" , Wan Ahmad Soffian Bin Wan Mohammad, Nor Hazurina Othman, Mohd Haziman Wan Ibrahim, Masazurah A Rahim, Shahiron Shahidanand Raha Abd Rahman.*

This review paper emphasis on various sea shells ash such as cockle, clam, oyster, mollusc, periwinkle, snail, and green mussel shell ash as partial cement replacement and its objective is to create sustainable environment and reduce problems of global warming. Cement production give huge impact to environment in every stage of its production. These include air pollution in form of dust and, gases, sound and vibration during quarry crushing and milling. One of the solutions to solve this problem is by using modified cement. The modified cement is a cementitious material that meets or exceeds the Portland cement performance by combining and optimizes the recycle and wasted materials. This will indirectly reduce the use of raw materials and then, become a sustain construction materials. Therefore, the replacement of cement in concrete by various sea shell ash may create tremendous saving of energy and also leads to important environmental benefits. This study includes previous investigation done on the properties of chemical and mechanical such as specific gravity, chemical composition, compressive strength, tensile strength and flexural strength of concrete produced using partial replacement of cement by seashells ash. Results show that the optimum percentage of seashells as cement replacement is between 4 – 5%.

*G. "The Acoustical Performances of Oyster Shell Waste Based Green Concrete Materials"*

Erni Setyowati and Gagoek Hardiman Research on green materials are continuously carried out by researchers, starting with research on middle-low income housing near the airport suffered by airport noise [1]. The orientation of housing facing the runway will have the biggest sound levels [2,3]. Efforts to control noise at middle-low housing annoyed by the noise will be more effective if housing uses a material that can absorb the sound. Therefore, this research is a part of a whole mapping research on housings noise control solution as a material which needs to be layered by another absorber material. Oyster shells in this research have function as cement substitution and provide aesthetic value on concrete materials. Types of shells observed in this research are: green mussels (*Perna viridis* Linn), blood clams (*Anadara granosa* Linn) and scallops (*Placuna placenta* Linn). All three shells were selected as samples in this study because it has a beautiful shell colors as well as having an acoustic performances.

#### H. "Tile Powder As Partial Replacement Of Cement In Concrete",

Ponnapati. Manogna, M. Sri Lakshmi Tile powder is one of the most active research areas that encompass a number of disciplines including civil engineering and construction materials. The tile industry inevitably produces wastes, irrespective of the improvements introduced in manufacturing processes. In the tile industry, about 15%-30% production goes as waste. These wastes creates a problem in present-day society, requiring a suitable form of management in order to achieve sustainable development. In this thesis it illustrates about the behavior of concrete with partial replacement of tile powder in cement accordingly in the range of 0%, 10%, 20%, 30%, 40%, and 50% by weight for M30 grade of concrete. For this purpose the tile concrete samples are tested and compared with the conventional concrete. The following tests are carried out, i.e., compressive strength, tensile strength and flexural strength for 7, 28 and 56 days.

### III. RESEARCH METHODOLOGY

The proposed work is planned to be carried out in the following manner.

- Collection of materials.
- Testing of materials.
- Mix design.
- Batching of material.
- Mixing.
- Casting of concrete.
- Testing.
- Compilation of results.
- Conclusion.

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