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# PERFORMANCE OF CONCRETE USING INDIAN ALMOND SHELL AS COARSE AGGREGATE

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***Abstract:*** A large amount of almond shell is disposed of every year. The anatomical and chemical characteristics of Indian almond shell are investigated in this paper in order to contribute to better utilization of these shells. The object of the study to introduce the type of concrete that is more costly effective when compared to other concretes. The test results of an ongoing study are an attempt to use the low-cost solid waste material almond shell as a coarse aggregate in the production of structural weight concrete. The BS8110 standards specified acceptable limits for the span reflection ratio of lightweight structural concrete and this study shows the AS concrete complies with this. The micromorphology, surface elements, thermal stability, crystallization, chemical composition and relative properties of almond shell are analyzed. The utilization organic waste materials in concrete beneficial factor for environment. Few studies have been conducted on the use of almond shells in concrete and have shown good potential. This study has investigated the properties and the mechanical behavior of almond shells partially replacing the conventional aggregates in concrete. The replacements were 25, 50, and 75%. The almond shells show a uniform grading in its natural state when obtained from local farmers. Since the organic material is highly porous, it tends to absorb much of the water content in the mix which reduces the slump. Furthermore, with a 5% almond shells replacement, the specimens have shown a compressive strength of 17.03 MPa with density of 1850 kg/m3 which is within the limits of the ACI and BS standards and identified as a structural lightweight concrete. Further recommendations for future studies have been identified based on the results of this study. It can be concluded that for lightweight concrete as a structural material, almond shell shows great as a coarse aggregate. This result especially has significance for low-cost applications such as in housing construction.

***Index Terms*** **– Almond shell, Fine aggregate, Coarse aggregate, Cement, Water**

## 1. INTRODUCTION

Environmental concerns are an important concern in the world. Sustainable development is still lacking today and is still a major issue. One of the main increasing demands is the production of industrial and residential buildings for human life as basic requirement to fulfill their needs Also, the human population is increased to 11 billion people by 2100 where it can be expected that the demands for common goods and services to also increases. Therefore, the demand of construction materials is growing. The global demand for aggregates from 2007 showed to be increased from 45 billion to 66 billion tons by 2025. Many agricultural wastes are disposed and therefore make serious damages to the environment. Agricultural waste materials could be a potential use to sustainably utilize in the production of concrete. Undesirable impacts could be decreased by replacing agricultural waste by conventional raw materials used in concrete. One such agricultural waste material is almond shell. Very few studies have been done on the utilization of

almond shell in concrete. Therefore, this study focuses on the use of almond shell as replacement for coarse aggregates in concrete. Stone fruit belongs to the same family of fruit as the peach, which is known as the Rosacea family. It is native to the Middle East, and it thrives only in a dry, hot environment. Almonds are the single seed from a type of stone fruit, and they are grown throughout California in the USA, in the entire Mediterranean Region, and also in Australia, Africa, India, Turkey and Iran. The Almond, as a stone fruit, is not easily grown in a wet environment, meaning these are prime locations for its cultivation. Currently, research efforts have been directed towards the potential for using Almond shell (AS) as a coarse aggregate in the production of structural lightweight concrete. In Iran, there is over 70 tones of Almond shell waste produced at each cropping, meaning it is a prime location for making use of this Waste material. Recycling AS leads to many benefits, such as maximization of the use of almond shell, preservation of natural resources and maintenance of ecological balance. In addition, the current economic and social climate means that in many countries across the world there is a higher recent deficit in low-cost, affordable housing, meaning that AS has potential as a cheaper alternative to the conventional aggregates in fulfilling this demand. This AS aggregate lightweight concrete has been very recently developed and employed as a structural material in the construction industry, meaning that its structural performance still requires investigation. This study attempts to determine some important characteristics of AS aggregate concrete, to result in wider acceptance of AS a lightweight aggregate material alternative in producing concrete that can be used as a structural, lightweight concrete for use in the construction industry, in particular for the application of low-cost residential dwellings. To achieve this, this investigation will attempt to determine the elastic modulus, compressive strength, and the bond strength between the concrete and aggregate. There is also a study into the flexural behavior of the AS concrete samples.

## 2. LITERATURE REVIEW

- **Imran Imran** et.al (2018) this study is based on Light weight concrete that has a lighter density than concrete in general. Nutmeg shell utilization as coarse aggregate is expected to be the added material in the lightweight concrete mixture. The purpose of this study is to determine characteristics of the concrete aggregate and the compressive strength of the concrete design based on the DOE (Department of Environment) method and the SNI Standard. In this research, this of nug met shell was varied as follows: 10%, 20%, 30%, 40% and 50% of the concrete weight. The research result shows that the amount of nug met shell used into the concrete mixture affects the compressive strength of the concrete characteristics (fck'). The compressive strength of the concrete characteristics increases with the increase in the amount of nutmeg shell used in the concrete mixture.

- **K. Gunasekaran** et.al (2017) they concluded that aggregates provide volume at low cost, comprising 66 percent to 78 percent of the concrete. With increasing concern over the excessive exploitation of natural and quality aggregates, the aggregate produced from industrial wastes and agriculture wastes being viable new source for building material. This study was carried out to determine the possibilities of using coconut shell as aggregate in concrete. Utilizing coconut shell as aggregate in concrete production not only solves the problem of disposing this solid waste but also helps conserve natural resources. In this paper, the physical properties of crushed coconut shell aggregate were presented. The fresh concrete properties such as density and slump and 28-day compressive strength of a lightweight concrete made with coconut shell as coarse aggregate also presented. The findings indicated that water absorption of the coconut shell aggregate was high about 24 % but the crushing value and impact Value was comparable to that of other lightweight aggregates. The average fresh 6 concrete density and 28-day cube compressive strength of the concrete using coconut shell aggregate were 1975 kg/m3 and 19.1 N/mm2 respectively. It is concluded that crushed coconut shells are suitable when it is used as substitute for conventional aggregates in lightweight concrete production.

- **Verma, Sanjay Kumar** et.al (2017) Concrete is a premier construction material consisting of natural aggregate. Due to rapid industrialization and constructions in developing country like India, natural resources are depleting constantly. Search of alternative material for making concrete is a prime need in present scenario. Environmental issues; restrictions on local & natural access or sources and dispose of waste material are gaining great importance. Coarse aggregate is a major ingredient for making concrete for various types of construction works, including infrastructure development, low and high- rise buildings and domestic developments. It occupies about 65-80% part of concrete. Coconut Shell is a waste, generated by industrial and agricultural processes, and has created

disposal and management problems that pose serious issues of environmental pollution. The waste coconut shell may be utilized to replace natural coarse aggregate. In present study, compressive strength of concrete of M20 grades has studied by replacing natural coarse aggregates at 0%, 5%, 10%, 20% and 30%, by weight with coconut shell. Compressive strength of coconut shell concrete has been evaluated on 7, 14, 21 and 28 days. The compressive strength of coconut shell concrete was reduced as percentage replacement increased. Concrete mixtures were tested and compared in terms of compressive strength of the conventional concrete. The study result shows that Coconut Shell Concrete (CSC) can be used as light weight concrete. Use of Coconut Shell as a substitute of aggregate will not only is cost effective and eco-friendly, but also help to resolve the problem of shortage of conventional material such as coarse aggregate. Use of such materials also reduces the problem of disposal of waste material..

## 3. RESEARCH METHODOLOGY

- STUDY OF MATERIALS
- TESTING OF MATERIALS
- MIX DESIGN
- SPECIMEN PREPARATION
- CURING 7-28 DAYS
- RESULT ANALYSIS

## 4. NEED OF THE STUDY

Environmental issues in the world are an important factor for the human existence on earth. Almond shells are an agricultural waste which is poorly recycled. The utilization of almond shells as a partial replacement of concrete has been investigated in this study. A large amount of almond shell is disposed of every year. The anatomicaland chemical characteristics of Indian almond shell are investigated in this paper in order to contribute to better utilization of these shells. The object of the study to introduce the type of concrete that is more costly effective when compared to other concretes

## 5.RESULT AND ANALYSIS

### COMPRESSION TEST AFTER 28 DAYS CURING

| SL NO. | ADDITION OF ALMONDSHELL | SAMPLE1 | SAMPLE2 | SAMPLE3 | AVERAGE |
|---|---|---|---|---|---|
| 1 | 0% | 231 | 256 | 267 | 251.3 |
| 2 | 25% | 230 | 268 | 270 | 256 |
| 3 | 50% | 170 | 139 | 145 | 151.3 |
| 4 | 75% | 62 | 74 | 92 | 76 |

**COMPRESSION TEST AFTER 7 DAYS CURING**

| SL NO. | ADDITION OF ALMONDSHELL | SAMPLE1 | SAMPLE2 | SAMPLE3 | AVERAGE |
|---|---|---|---|---|---|
| 1 | 0% | 225 | 250 | 258 | 244.3 |
| 2 | 25% | 250 | 220 | 235 | 235 |
| 3 | 50% | 120 | 130 | 157 | 135.6 |
| 4 | 75% | 37 | 57 | 76 | 56.6 |

## 1. CONCLUSION

Environmental issues in the world are an important factor for the human existence on earth. Almond shells are an agricultural waste which is poorly recycled. The utilization of almond shells as a partial replacementof concrete has been investigated in this study. The results of this study have indicated a partial replacement of almond shells in concrete of up to 25% shows good results in the mechanical aspect of concrete. The almond shells have a good grading in the sieve analysis results in its natural state when received from local farmers. Since the almond shells is a very porous material, it tends to absorb much of the water from the mix, thus reducing the slump. The 25% replacement of almond shells hasshown a compressive strength of 17.03 MPa with a density of 1850 kg/m3. At higher contents of almond shells of50 and 75% the strength of both compressive and was significantly reduced compared to the normal concrete with 0% almond shell content. However, these low strength almond shell concretes may still be applicable in the use of non-structural or low bearing elements such as pedestrian pavements, undergroundwells, non-load bearing walls etc.

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