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USE OF COCONUT SHELLS AS A PARTIAL REPLACEMENT OF COARSE AGGREGATES

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Abstract: Concrete is the man made composite, the major constituent being natural aggregate such as gravel or crushed rock, sand and fine particles of cement powder all mixed with water. Concrete as we know is the premier ingredient in building construction, but the rising cost of conventional building materials and threats to the environment are the major factors which call for the research for alternative materials of construction. The prices of building materials are rising day by day and the rising cost of construction building materials plays a vital role in construction industry. The coarse aggregates are one of the main ingredients of concrete.As a whole, the study main concern is the environment and the construction and building technology to enhance natural world as well as building materials. In view to provide new knowledge to the contractors and developers on how to improve the construction industry methods and services by using coconut shells and to sustain good product performance and meet recycling goals, there is need to design a technical specification of concrete using coconut shell as aggregates that will meet the Indian standard requirements in order to help contribute to the industry in saving the environment, to encourage the government to find solutions regarding the disposal to landfills of site materials and save the environment.Use of natural aggregate in such a rate leads to a question about the preservation of natural aggregates sources. In addition, operations associated with aggregate extraction and processing are the principal causes of environmental concerns. In light of this, in the contemporary civil engineering construction, using alternative materials in place of natural aggregate in concrete production makes concrete as sustainable and environmentally friendly construction material. Different alternative site materials and industrial by products such as fly ash, bottom ash, recycled aggregates, foundry sand, china clay sand, crumb rubber, glass will be replaced with natural aggregate and investigated properties of the concretes The use of coconut by products has been a long time source of income for some people. Recycling of the disposed material is one method of treating the agricultural site. The used of coconut shell could be a valuable substitute in the formation of composite material that can be used as a housing construction, such as concrete.The present investigation is carried out on implementation of coconut shell in concrete successfully. Hence, in general bulk uses of coconut shell as lightweight aggregate are found in many construction applications such as buildings, saving in energy, reduction in land fill cost, and protecting environment from pollution effect for the sustainable development of construction industry.

Key Words: Concrete, Coconut Shell, and Coarse Aggregate

I. INTRODUCTION

Infrastructure development across the world created demand for construction materials. Concrete is the premier civil engineering construction material. Concrete manufacturing involve consumption of ingredients, aggregates, water and admixture(s). Among all the ingredients, aggregates form the major part. Different alternative site materials and industrial by-products such as fly ash, bottom ash, recycled aggregates, foundry sand, china clay sand, crumb rubber, glass will be replaced with natural aggregate and investigated properties of the concretes. Apart from above mentioned site materials and industrial by-products, few studies identified that coconut shells, the agricultural by product can also be used as aggregate in concrete. Now-a-days many engineers and scientists are in process to find various natural as well as modernized ways for the production of construction materials especially concrete. They are also keen in maintaining its quality and strength and therefore various other materials are used as a replacement of a particular material in the making of concrete. One such material is coconut shell which can be used in concrete making by partially replacing coarse aggregate which is a very important component in concrete. Coconuts being naturally available in nature and since its shells are non-biodegradable in; they can be used readily in concrete which fulfill almost all the qualities of the original form of concrete. Natural sources are depleting by rapid rate; there should be some way to stop it somewhere. One way to overcome this problem is to replace the coarse aggregates used in the production of concrete by coconut shell which are readily available in nature. Use of this non-biodegradable material in concrete would not only make the construction cost less since coconut shells would require less costing as compared to the coarse aggregates but also re-use the waste material and help in environmental aspect.

production of concrete compared to conventional aggregate concrete.There is presence of sugar in the Coconut shell as long as it is not in a free form; it will not affect the setting and strength of concrete. It is found that wood based materials, being hard and of organic origin, will not pollute or leak to produce toxic substances once they are bound in concrete matrix.

Use of coconut shell aggregate in concrete as structural

lightweight concrete is recommended. Coconut shell aggregate is a possible construction material and Use of this non-biodegradable material in concrete would not only make the construction cost less since coconut shells would require less costing as compared to the coarse aggregates but also re-use the site material and help in environmental aspect. A potential exists for the use of coconut shells as replacement ofconventional aggregate in both conventional reinforced concrete and plaincement concrete construction. The use of coconut shells as partial replacement for conventional aggregates should be encouraged as an environmental protection and construction cost reduction measure. The increase in population also increases the industrial by-products, domestic sites etc. It has been noticed in India that coconut shell (CS) as an agricultural site, requires high dumping yards as well as an environmental polluting agent. A large amount of agricultural site which is disposed in most of tropical countries if not be disposed properly it would lead to social and environmental problem. Utilized these disposed material is one method of treating the agricultural site from site to wealth. On currently reduces the environmental problem of solid site.

Various researchers and have investigated the use of coconut shells and their derivatives in civil engineering construction Cost reduction of 48% can be achieved if coconut shells are used to replace gravel in concrete.

II. USE OF COCONUT SHELLS

A potential exists for the use of coconut shells as replacement of conventional aggregate in both conventional reinforced concrete and plain cement concrete construction. The use of coconut shells as partial replacement for conventional aggregates should be encouraged as an environmental protection and construction cost reduction measure comes content here.

III. RESEARCH OBJECTIVES

- To test the feasibility of utilizing coconut shell as a replacement for coarseaggregate in the construction of concrete.
- To prove that aggregate replaced concretes which are lightweight can be
- Used for structural applications with equivalent strengths to normal weight Concrete.
- To make sustainable concrete with more economical for constructions.

The purpose of the present investigation is to study the performance of CS concretes in terms of strength and transport properties with normal water curing and with no chemical admixtures in the mixes.

IV. METHODOLOGY

The present study requires preliminary investigations in a systematic manner:

- Selection of type of grade of mix, mix design by an appropriate method, trial mixes, final mix proportions.
- Estimating quantity of cement, fine aggregate, coarse aggregate, coconut shells required for the project work.
- Testing of properties of cement, fine aggregate, coarse aggregate
- Preparing the concrete cubes with coconut shells and gravel.
- Testing those cubes in compression testing machine.

V. TEST DATA FOR MATERIALS

1. Cement used = Ordinary Portland
2. Specific gravity of cement = 3.15
3. Specific gravity of coarse aggregate = 2.60
4. Specific gravity of Fine aggregate = 2.59
5. Sieve analysis for coarse aggregate **(**Conforming to grading of IS: 383-1970)

Sieve analysis for fine aggregate **(**Conforming to grading zone II)

6. QUANTITIES REQUIRED FOR THE MIX PER BAG CEMENT:

The mix is 1:1:27:2.71:0:44 *(by* mass). For 50 kg of cement, the quantity of materials is worked out as below:

a) Cement = 50 kg
b) Sand = 63.5kg
c) Coarse aggregate = 135.5 kg

7. COMPACTION FACTOR:

Figure: 1: Compaction Factor

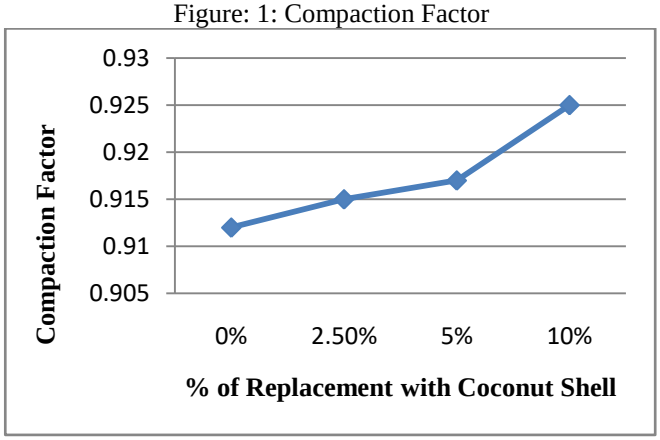


Table: 1: Compaction Factor

Percentage of CS added	Compaction factor
0%	0.90
2.5%	0.912
5%	0.917
10%	0.925

VI. RESULTS AND DISCUSSION:

COMPRESSIVE STRENGTH TEST RESULTS:

Table: 2: 14 Day Test Results

PERCENTAGE OF CS USED IN M-25	**COMPRESSIVE STRENGTH N/mm^2**		**AVERAGE COMPRESSIVE STRENGTH N/mm^2**
	CUBE 1	CUBE2	
0%	24.7	23.6	24.15
2.5%	24.2	23.4	23.8
5%	23.5	22.1	22.8
10%	21.5	20.2	20.85

Figure: 2: 14 Day Test Results

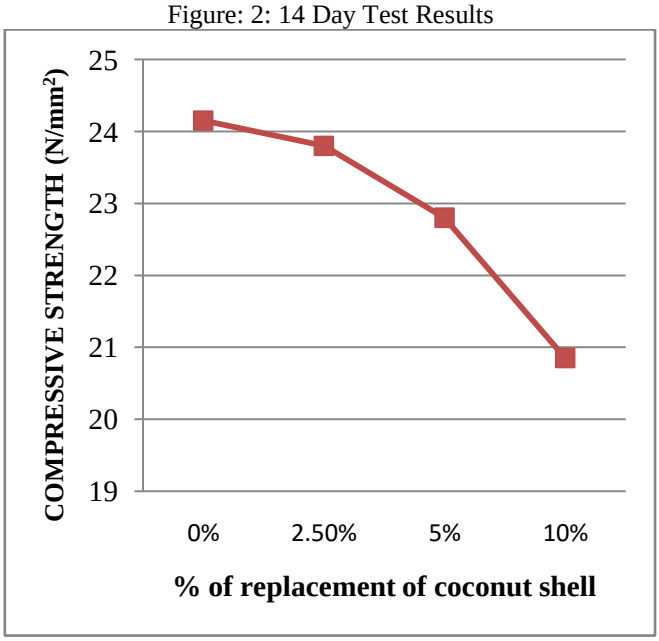
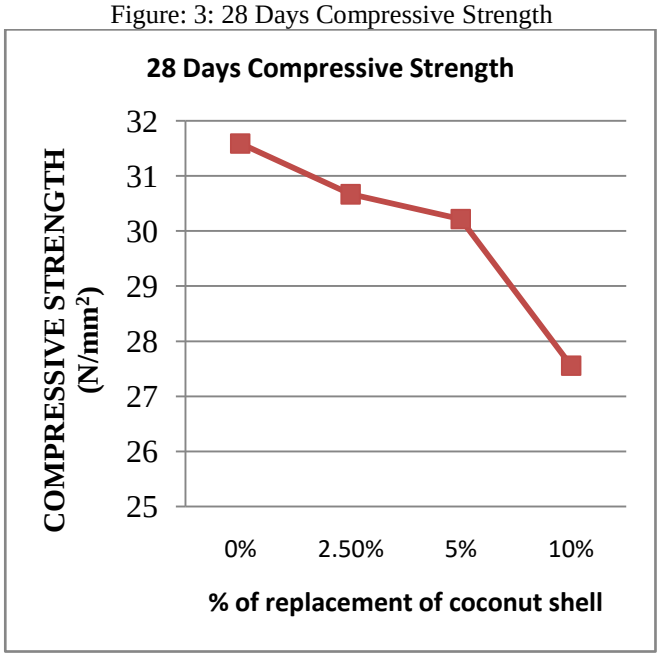


Table: 3: 28 Day Test Results

PERCENTAGE OF CS USED IN M-25	COMPRESSIVE STRENGTH N/mm^2		AVERAGE COMPRESSIVE STRENGTH N/mm^2
	CUBE 1	CUBE2	
0%	31.7	31.48	31.59
2.5%	31.5	30.5	31.00
5%	30.00	30.22	30.11
10%	29.55	28.89	29.22

The maximum compressive strength of 31.59 N/mm^2 was attained at 0% replacement, while the minimum strength of 29 .22 N/mm^2 was attained at 10% replacement. At 10% replacement, concrete attained 29.22 N/mm^2 marginally less than 31.59 N/mm^2, The strength reduced as the percentage of replacement increased.

Figure: 3: 28 Days Compressive Strength



FLEXURAL STRENGTH TEST RESULTS:

Table: 4: Flexural Strength Test Results

% age	14-DAY	28-DAY
0%	4.15	4.44
2.5%	3.85	4.15
5%	3.63	3.85
7.5%	3.56	3.70
10%	3.26	3.63

The maximum flexural strength of 4.44 N/mm^2 was attained at 0% replacement, while the minimum strength of 3.63 N/mm^2 was attained at 10% replacement. At 10% replacement, concrete attained 3.63 N/mm^2 marginally less than 4.44 N/mm^2.

Figure: 4: Flexural Strength At 14Days

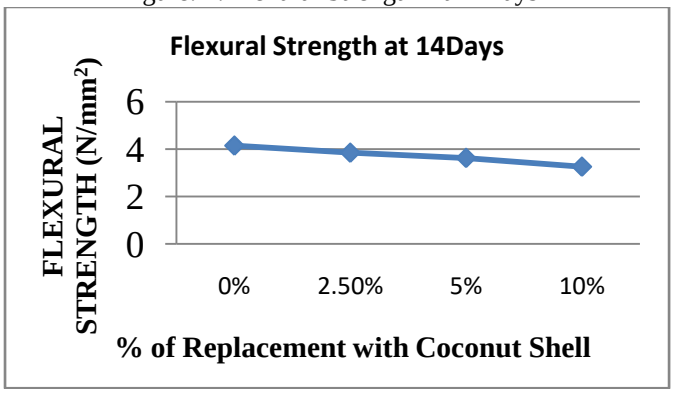
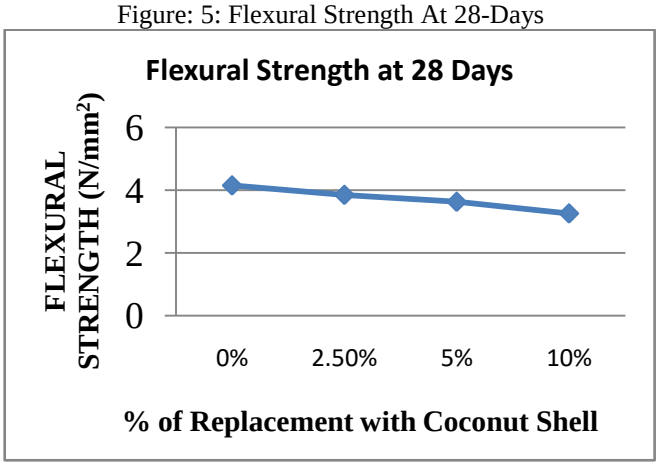


Figure: 5: Flexural Strength At 28-Days



VII. CONCLUSIONS

Based on the limited number of experimental investigation carried out to determine the mechanical properties of concrete namely, compressive strength and flexural strength of concrete, an optimum replacement of coarse aggregate with coconut shell
aggregate, corresponding to the mix ratio 1: 1:27,2:71, The observed value of 28 day
compressive strength and flexural strength were 31.00N/mm and 4.15N/mm This indicates that concrete made with coconut shell aggregate has strength comparable with that of conventional concrete.
The possibility of recycling and reuse of coconut shells which are discarded as waste led to the present study on its possible use as coarse aggregate in the development of lightweight concrete. The study established that coconut shell aggregate can replace conventional coarse aggregate in the production of lightweight concrete structures effectively
without compromising on strength aspects
It is concluded that:

1. Production of Sustainable Light-weight concrete is attained.
2. Overall cost reduction of the construction is observed.
3. It is analyzed that in the replacement of coarse aggregate with coconut shell if increase in the percent of replacement it reduced the compressive strength of the concrete.
4. It is observed in this study that flexural strength of concrete reduces as the percent of replacement is increases.
5. Density reduced at the increment of percent replacement
6. Workability increases as the percent of replacement increases.

So coconut shell can be used as partial replacement of coarse aggregate as there is marginal difference in strength between coconut shell and convention aggregate. Because of it is a waste material and abundantly available in the area of its production and near the industry used coconut, one can reduce the effective cost of the concrete and it is also helpful for the environmental point of view

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