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Analyzing the Strength of Concrete Blocks Reinforced by Half Portion of Coconut Shell

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Abstract: ***Concrete is the premier construction material around the world and is most widely used in all types of construction works, including infrastructure, low and high-rise buildings, and domestic developments. It is a man-made product, essentially consisting of a mixture of cement, aggregates, water and admixture(s). Inert granular materials such as sand, crushed stone or gravel form the major part of the aggregates. Traditionally aggregates have been readily available at economic prices and of qualities to suit all purposes. But the continued extensive extraction use of aggregates from natural resources has been questioned because of the depletion of quality primary aggregates and greater awareness of environmental protection.***
In light of this, the non-availability of natural resources to future generations has also been realized. Different alternative waste materials and industrial by products such as fly ash, bottom ash, recycled aggregates, foundry sand, China clay sand, crumb rubber, glass were replaced with natural aggregate and investigated properties of the concretes. Apart from above mentioned waste materials and industrial by products, few studies identified that coconut shells, the agricultural by product can also be used as aggregate in concrete. According to a report, coconut is grown in more than 86 countries worldwide, with a total production of 54 billion nuts per annum. India occupies the premier position in the world with an annual production of 13 billion nuts, followed by Indonesia and the Philippines.
Keywords: Coconut shell, Coarse Aggregate, Natural resources, Environmental protection

I. INTRODUCTION

A. Concrete Blocks

A brick is building material used to make walls, pavements and other elements in masonry construction. They are the most used material and yet most often ignored. People give little attention to what type of brick could be used in building a house. Due to growing demand and changing trends, the walls have been changing from bricks to concrete bricks/ blocks. Concrete block masonry which is also known as concrete masonry unit (CMU) have advantages over brick and stone masonry. Concrete blocks are manufactured in required shape and sizes and these may be solid or hollow blocks. The common size of concrete blocks is 39cm x 19cm x (30cm or 20 cm or 10cm) or 2-inch, 4-inch, 6-inch, 8-inch, 10-inch and 12-inch unit configurations. Cement, aggregate, water is used to prepare concrete blocks. The cement- aggregate ratio in concrete blocks is 1:6. Aggregate used is of 60% fine aggregate and 40% coarse aggregate. Their minimum strength is about 3 N/mm^2.

B. Solid Concrete Blocks

Depending upon the structure, shape, size and manufacturing processes concrete blocks are mainly classified into 2 types and they are Solid concrete blocks and Hollow concrete Blocks. Solid concrete blocks are commonly used, which are heavy in weight and manufactured from dense aggregate. They are very strong and provides good stability to the structures. So for large work of masonry like for load bearing walls these solid blocks are preferable. They are available in large sizes compared to bricks. So, it takes less time to construct concrete masonry than brick masonry. The concrete commonly used to make concrete blocks is a mixture of powdered Portland cement, water, sand, and gravel. This produces a light grey block with a fine surface texture and a high compressive strength. A typical concrete block weighs 38-43 lb (17.2-19.5 kg). In general, the concrete mixture used for blocks has a higher percentage of sand and a lower percentage of gravel and water than the concrete mixtures used for general construction purposes. This produces a very dry, stiff mixture that holds its shape when it is removed from the block mould.

C. Coconut Shells

Coconut shell is one of the solid disposals waste from agricultural activities. The use of coconut shells as one of the composite materials in the production of concrete was driven by the problem caused by the disposal of solid waste. Coconut shells represent more than 60% of domestic waste volume. Coconut shells present serious disposal problems for local environments. However, these wastes can be used as potential material or replacement material in the construction industry.

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In addition, the use of coconut shells in concrete production will give more benefits compared to conventional materials. If coconut shells are used for structural applications, it would not only be advantageous towards the environment, but also towards low-income families, especially in the surrounding areas of coconut plantation.

II. EXPERIMENTAL METHODOLOGY

A. In this method we will form concrete blocks having 30 cm length, 20 cm breadth and 20 cmheight with water-cement ratio of 0.5.

B. We will place stacks of half portion of coconut shells at the bottom with convex surfaceupwards with the hypothesis, it would increase its strength.

C. The diameter of coconut shell we will use for the experiment is 8 cm and the Cement usedin this study is 53 grade ordinary Portland cement

D. We will then place coconut shells in two stacks of varying layers from 1 to 6 shells each asshown in the Fig. 1.

E. Fresh concrete will then be poured on top of the coconut shells in the mould in three layersso that holes are formed under the coconut shells.

F. Each layer will be tamped 25 times using tamping rod without affecting the position ofcoconut shells.

G. We will remove the mould after 24 hours. Cure the blocks by immersing in water for 28Days and will find the compressive strength.

H. 20 blocks to be casted to determine the compressive strength.

I. Test to be perform on concrete block is compressive strength test.

Fig.1 : Solid Concrete Block casted with Coconut Shell

III. RESULT & DISCUSSION

A. Compression Test On Concrete

Solid Concrete Blocks (300*200*200 mm) were casted for compressive strength. Compaction of the concrete blocks was done using machine. The specimens were demoulded after 24 hours and subsequently immersed in water. Each specimen was tested for the determination of average compressive strength. The test was performed on Compressive Testing Machine (CTM).

Fig 2. Testing of Solid Concrete Block

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Sr.no	Type of Block Casted	Compressive Strength after 28 days inN/mm^2
1	Conventional Block	8.14
2	1 layer of Coconut Shell	8.81
3	2 layers of Coconut Shell	9.32
4	3 layers of Coconut Shell	9.96
5	4 layers of Coconut Shell	10.28
6	5 layers of Coconut Shell	10.04
7	6 layers of Coconut Shell	9.83
8	Only Arch Action	7.42

At 28 days, the compressive strength was 8.14, 8.81, 9.32, 9.96, 10.28, 10.04, 9.83, 7.42 N/mm^2 for each type of block casted respectively. The 28-day strength of block with 4 layers of coconut shell showed greater compressive strength than that of Conventional concrete block available in market. So as one casted with only arch action showed lesser compressive strength.

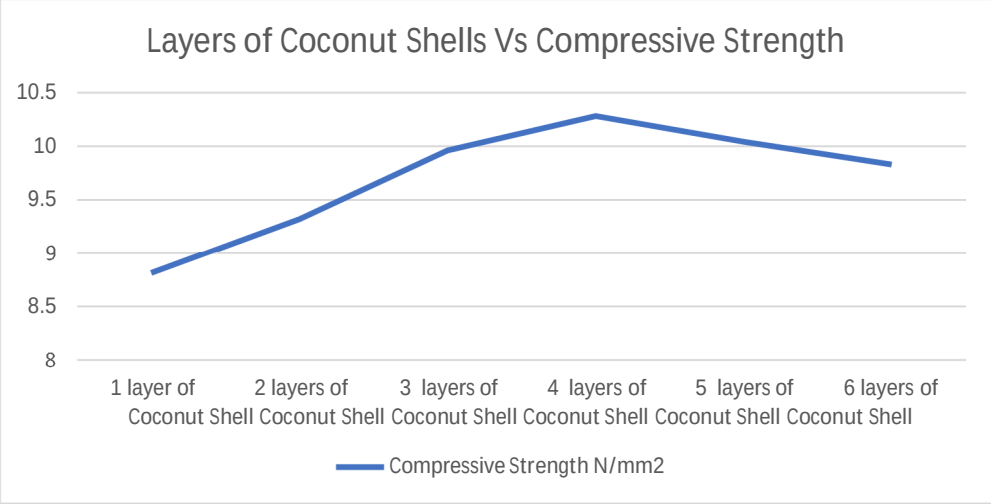

Fig. 3 Comparison of compressive strength depending on number of shells

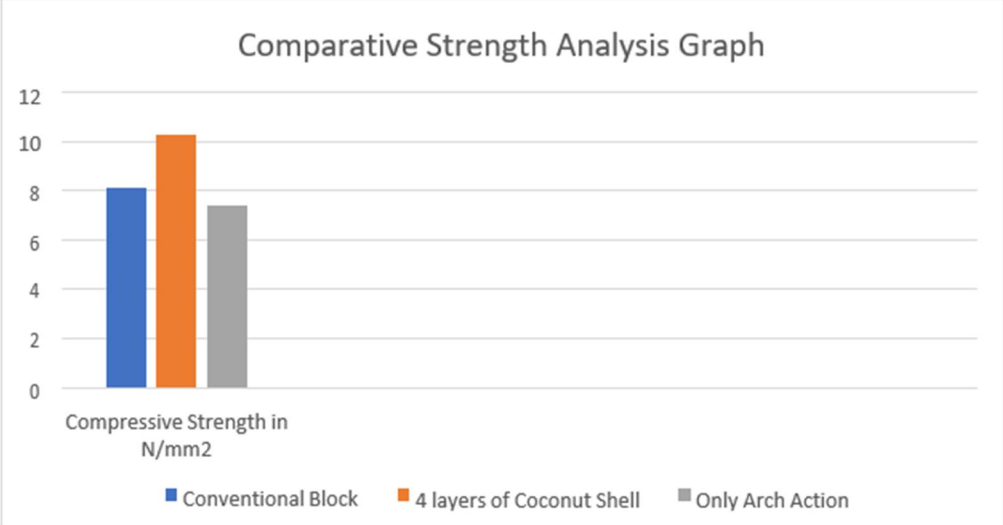

Fig. 4 Comparison of conventional block with blocks having coconut shell

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IV. CONCLUSION

Based on experimental investigations concerning the compressive of concrete, the following conclusions are drawn:

A. In all the previous studies, the coconut shells were broken into small pieces and usedas aggregates. In this study, we have developed a new method of forming the holes of solid concrete blocks by placing varying layers of half portion of coconut shells. The compressive strength of this designed solid concrete blocks was found to be 26.28% higher than solid concrete block available in the market.

B. Moreover, by rate analysis we have found out that the cost of our solid concrete blocks was found to be lesser by 1 Rs (i.e., 34 Rs) than conventional concrete block available in the market

C. It is observed that the compressive strength increased up to a certain limit of 4 layersof coconut shell after that, a slight decrease in compressive strength can be seen.

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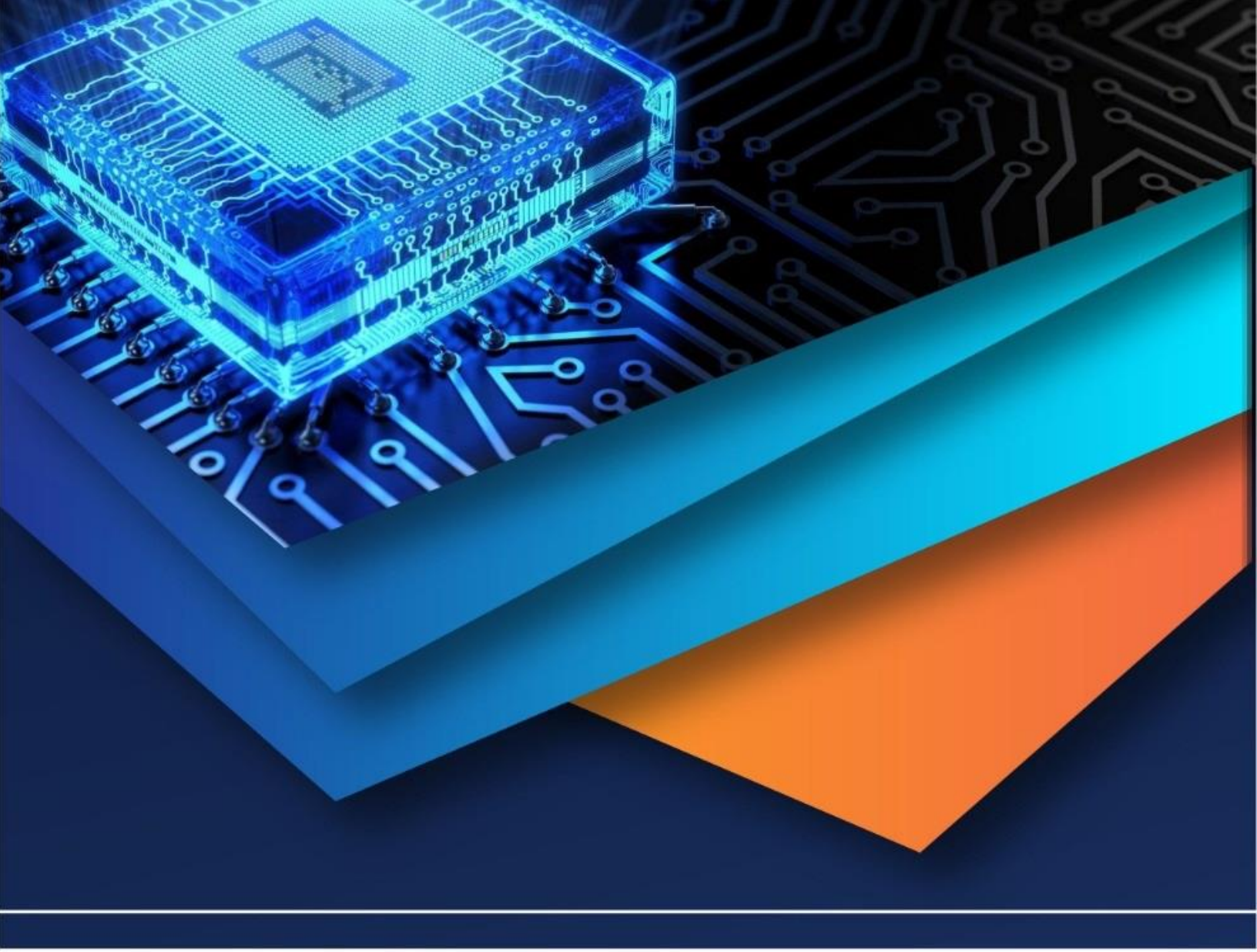

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