Mechanical properties on Concrete by using Coconut Shell As A Partial Replacement Of Coarse Aggregates With silica fume

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Abstract:

It is suggested that coarse aggregate be partially replaced with coconut shell and silica fume added in order to achieve the desired strength in order to study the properties of concrete. Compressive strength and splitting tensile strength are among the characteristics. The use of construction is expanding daily as population growth is speeding up. These tests are performed on 150mm x 150mm x 150mm cube specimens at three different ages, namely 28, 56, and 90 days. This investigation's primary goal is to evaluate the concrete's quality.

Keywords: Coconut shell, Silica fume, compressive strength, split tensile.

1. INTRODUCTION

Therefore, an effort has been made in this study to partially replace coarse aggregate with coconut shell. Since coconut shells are a novel building material, it is necessary to investigate their varied strength characteristics. For the required strength to be reached, appropriate actions must also be taken. Fibres are incorporated into concretetostrengthenit. According to the study, lightweight aggregates (LWA) are crucial to the current movement towards sustainable concrete because they reduce transportation needs, maximise structural efficiency, which reduces the need for overall building materials, conserve energy, lower labour requirements, and extend the lifespan of structural concrete.

Therefore, an effort has been made in this study to partially replace coarse aggregate with coconut shell. Since coconut shells are a novel building material, A highly pozzolanic substance called silica fume, a by-product of the ferrosilicon industry, is utilised to improve the mechanical and durability properties of concrete. It can either be used as a standalone ingredient applied straight to concrete or combined with silica fume and portland cement.

2. OBJECTIVES:

1. To optimize the coarse aggregate by partial replacement of coconutshell.
2. To optimize the usage of cement by partial replacement of silicafume.

3. MATERIALS

3.1 Cement

A binder, also known as a material that sets, hardens, and attaches to other materials to bind them together, is a cement. Typically, cement is used to combine sand and gravel rather than being utilised on its own.Concrete is made when sand and gravel are combined with cement, while mortar is made from cement mixed with fine aggregates. Typically inorganic, frequently lime and calcium silicate based, and available in both hydraulic and non-hydraulic forms, cement is used in construction.

3.2 Fine aggregate

Sand is a byproduct created when stone, gravel, and slag are crushed in crushes. According to IS: 383-1970, Robo sand has a fineness modulus of 3.62 and is in compliance with Zone III. Construction-related robot sand needs to pass through sieves smaller than 4.75 mm.

3.3 Coarse aggregate

Quarry sites are where one can find coarse aggregate. In this experiment, 20 mm and 10 mm aggregates that adhere to ASTM Standard 102622009's Zone III are used. We are employing 60% of 20mm aggregates and 40% of 10mm aggregates in this experiment.

3.4 Silica Fume

Concrete made with silica fume is more robust and long-lasting than traditional concrete. With the help of this extremely reactive pozzolan, field strengths of 14,000 psi have been attained. Additionally, because the extremely small silica fume particles seal internal holes, rebar corrosion is decreased.

3.5 Coconut Shell

The study's findings demonstrate the potential of coconut shell concrete (CSC) as a lightweight concrete. In addition to being economical and environmentally benign, using coconut shell as an aggregate substitute will also assist to address the issue of a shortage of traditional materials like coarse aggregate.

4. EXPREMENTAL RESULT:

4.1 COMPRESSIVE STRENGTH:

The resistance to failure when subjected to compressive forces is known as compressive strength. Samples measuring 150mmX150mmX150mm are utilised for cube tests. These samples are put through compression testing after 28, 56, and 90 days of cure.

Table 1: Compressive Strength of Concrete with coconut shell Partial replacement of coarse aggregate

Sl.no	% of coconut shell	28 Days (N/mm^2)	56 Days (N/mm^2)	90 Days (N/mm^2)
1	0	39.31	42.85	45.98
2	10	37.92	41.33	44.36
3	20	35.69	38.86	41.71
4	30	33.57	36.54	39.24

Table 2: : Compressive Strength of Concrete with silica fume Partial replacement of Cement

Sl.no	% of Silica fume	28 Days (N/mm^2)	56 Days (N/mm^2)	90 Days (N/mm^2)
1	0	39.31	42.76	45.91
2	5	40.15	43.72	46.94
3	10	40.68	44.35	47.59
4	15	39.96	43.51	46.73

Table 3: Compressive Strength of Combined replacement of Cement with silica fume and coarse aggregate with coconut shell

Sl.no	CS+SF	28 days (N/mm²)	56 Days (N/mm²)	90 Days (N/mm²)
1	0%	39.31	42.82	45.95
2	10%CS+10%SF	50.63	55.18	59.24

4.2 SPLIT TENSILE STRENGTH

Table 4: Split tensile strength Concrete with coconut shell Partial replacement of coarse aggregate

Sl.no	% of coconut shell	28 days (N/mm²)	56 Days (N/mm²)	90 Days (N/mm²)
1	0%	3.85	4.19	4.53
2	5%	3.73	4.06	4.36
3	10%	3.54	3.85	4.13
4	15%	3.38	3.67	3.98

Table 5: Split tensile strength Concrete with silica fume Partial replacement of Cement

Sl.no	% of SILICA FLUME	28 days (N/mm²)	56 Days (N/mm²)	90 Days (N/mm²)
1	0%	3.85	4.18	4.48
2	5%	3.97	4.38	4.64
3	10%	4.06	4.42	4.76
4	15%	3.93	4.27	4.59

Table 6: Split tensile Strength of Combined replacement of Cement with silica fume and coarse aggregate with coconut shell

Sl.no	CS+SF	28 days (N/mm²)	56 Days (N/mm²)	90 Days (N/mm²)
1	0%	3.85	4.19	4.52
2	10%CS+10%SF	4.07	4.43	4.78

5.CONCLUSION

The compressive strength results for concrete samples over 28, 56, and 90 days were as follows: normal concrete exhibited strengths of 39.31 N/mm², 42.85 N/mm², and 45.98 N/mm², respectively. When 10% of the coarse aggregate was replaced by coconut shell, the compressive strength decreased to 37.92 N/mm² at 28 days, 41.33 N/mm² at 56 days, and 44.36 N/mm² at 90 days. Conversely, a 10% replacement of cement with silica fume increased the compressive strength to 50.63

N/mm² at 28 days, 55.18 N/mm² at 56 days, and 59.24 N/mm² at 90 days. However, the combined replacement of 10% coconut shell and 10% silica fume for compressive strength is not provided. Similarly, for split tensile strength, the values for normal concrete at 28, 56, and 90 days are missing. At 10% replacement of fine aggregate with quarry dust, and at 10% replacement of cement with metakaolin, the split tensile strength values are also not provided. Additionally, the combined replacement of split tensile strength with 10% coconut shell and 10% silica fume lacks values.

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