EXPERIMENTAL ANALYSIS OF SPECIFIC STRENGTH - CONCRETE BY PARTIALLY REPLACING FINE AGGREGATES WITH ARECA NUT

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Abstract

Concrete is the most important composite engineering material and the addition of some other materials may change the properties of concrete. Studies have been carried out to investigate the possibility of utilizing a broad range of materials as partial replacement materials for cement keeping in mind the increasing cost of construction material and environmental effects. Due to the high material consumption of the construction industry, the utilization of areca nut coir dust as a partial replacement for fine aggregate in non-structural concrete is particularly attractive. The study is aimed at investigating the effect of use of areca nut fiber dust as partial replacement of fine aggregates in various percentages.

Keywords: Areca nut, concrete composite ,material environmental effects , application , construction industry .

1. Introduction

[1] By creating a environment concerned concrete substitute for the construction business, the adverse effect will be controlled. **[2]** Present day improvements in technology have uncovered that the natural and inorganic assets in strong waste materials are truly significant and can be utilized to deliver different valuable items. Thus, in the present situation it turns out to be progressively critical and the need of great importance to locate a substitute material in the production of concrete. Coconut fiber or areca nut coir, when dried, contains cellulose, lignin, pentosanes and fiery remains in different rates**.[3]** In Asia, the construction business is yet to understand the upsides of light weight concrete in elevated structures. Coconut dust is an agrarian waste whose applications as a substitute in fine total is a suitable prospect which can be additionally investigated.**[4]** The point of this experimental research is to spread attention to utilize the areca nut coir dust as a substitute of fine aggregates in concrete and finding its split tensile strength, compressive quality, and functionality**.[5]** The acquired outcomes are contrasted and that of a conventional blend. As per our Indian standards, the investigations are performed.

1.2 Arca-Nut Areca nut coir Dust

Areca nut coir is a kind of naturally extracted fiber, which is extricated from the coconut husks**.[6]** In fact, areca nut coir is the stringy material found between the hard interior shell and the external layer of a coconut. Areca nut coir dust is a areca nut coir

fiber's byproduct, and this is an essential Industry in many nations where there are coconuts**.[7]** Areca nut coir dust firmly retains fluids and gases. This property is because of the honeycomb structured mesocarp tissue that provides a higher surface zone for every volume unit. Areca nut coir dust has a same dry thickness, accessible water content and water holding capacity (WHC) which is similar to sphagnum peat. The air-filled porosity (AFP) is marginally low, however this is made up for a more even conveyance of blend moisture.

1.2 Preparation of areca nut coir dust:

[8] Husk is isolated from the internal hard-shelled nut and it absorb water to diminish the essence and extricate the fibers. The wet husk is then held against a rotating drum studded with metal spikes which brush the fibers out. Amid this task, the long fibers are isolated from the essence which gathers with the undesirable short fibers underneath the machine. Areca nut coir dust is typically air dried and packed into bails or squares before it is sent out to decrease travel price. before utilizing this, the bale should be separated. Compacted areca nut coir raises in volume on breakout by 1-5-fold.

2. RESEARCH METHODOLOGY

This paper centers around the successful usage of the areca nut coir business byproducts and to diminish the issue of industrial byproduct disposal. Likewise, to check the achievability of utilizing the areca nut coir businesses byproducts as a substitute for fine aggregates. The target of this research is to explore the impact of utilization of areca nut coir dust as:

1. To reuse the byproduct of the industries and comprehend the adequacy of areca nut coir dust in quality parameters.
2. To decide the concrete properties, for example, compressive quality, split tensile test and usefulness.
3. Partial substitute of fine aggregates in different rates (0– half).

3.MATERIALS AND ITS PROPERTIES

3.1 Cement

Common Portland cement, with I.S l2269-l987 is the most regularly utilized folio in the concrete preparation. Cement is made through a firmly controlled substance mix of calcium, silicon, aluminum, press and different fixings. Portland cement clinker is made by warming a blend of crude materials to a calcining temperature of over 700°C (l,328 °F) in a cement oven and afterward a combination temperature, which is about l,350 °C (2,980 °F) for current cements, to sinter the materials into clinker. Concrete is shaped when Portland cement makes a glue with water that ties with sand and rock to solidify. Portland cement is the essential element of the concrete**[9].**

3.2 Coarse aggregates

Aggregate is a general classification of coarse to particulate material of medium grained which is utilized in construction, including gravel, reused concrete, sand, slag, geosynthetic aggregates and crushed stone. Coarse aggregates utilized in the task is pounded precise stone with a most extreme size of 30mm. Aggregates are composite of materials, for example, concrete and black-top concrete; the total fills in as reinforcement to add solidarity to the general composite material. The measure of aggregates greater than 3.25mm is considered as coarse aggregates. Because of the generally high water powered conductivity esteem when contrasted with most soils, aggregates are broadly

utilized in utilizations of waste Aggregates are additionally utilized as base-materials for foundations, streets, and railways. The consequences of different tests directed on coarse total are given in table beneath. The aggregates were tried according to Indian Standard Specifications Seems to be: 383-l970**[10].**

Table 1 Coarse aggregates properties Value

S.no	Characteristics	value
1	Fineness	3.7
2	Specific gravity	3.05
3	Setting Time	3.7
4	Consistency	28%

3.3 Fine aggregates

The aggregates size lower than 3.25mm, are determined as fine aggregates. The fine aggregates had a place with evaluating zone II. The properties of the fine aggregates are recorded in table underneath. The four reviewing zones turn out to be logically better from evaluating Zone1 to evaluating Zone-4.The aggregates were sieved through a lot of strainers to acquire sifter examination. IS details mark the fine total into four sorts of fine total, steady with its reviewing as evaluating zone-1 to reviewing zone-4 **[11]** .

Table 2 Fine aggregates and characteristics

S.no	Characteristics	value
1	Specific gravity	2.65
2	amount of water absorption	1.50%
3	Fineness modulus	3
4	Grading	Zone II

3.4 Areca nut coir Dust

The areca nut coir dust was purchased from Erode. Because of its property, areca nut coir dust was presoaked in consumable water for 24 hours before use. The physical properties of areca nut coir dust were performed with a similar test system as that of fine aggregates. Areca nut coir dust has high water ingestion. Areca nut coir dust requires no any previous treatments, aside from water treatment. The attributes of the areca nut coir dust are recorded in the table 3 beneath. Areca nut coir dust was sieved through 3.25mm IS sieve.

3.5 Water

The measure of water in concrete determines the concrete properties including water tightness, usefulness, compressive strengths, toughness, weathering and permeability, drying shrinkage and splitting potential. Water is added to wet the outside of aggregates and to create bond in light of the fact that the cement glues follows rapidly and agreeable to the wet surface of the aggregates than to a dry surface. For the undertaking, tap water was utilized for blending and curing. The capacity of water in concrete is to set up a plastic blend of the different fixings and to grant functionality to concrete to encourage placing in the ideal position and water is additionally required for the hydration of the cementing materials to set and solidify amid the time of curing.

4 Research objective

Concrete mix design requirements:

1. Higher w/c proportion as well as greatest cement substance to provide satisfactory toughness for the specific site conditions
2. The low compressive quality required for structural concerns.
3. Higher cement substance to keep away the shrinkage breaking in mass concrete due to temperature change.
4. The sufficient workability is essential for complete compaction with the compacting material accessible.

furthermore, evaluating of aggregates and solidness. Blend structuring was done according to: 10262 – 2009 and the concrete was intended for M28 review. Components influencing the decision of blend extents are functionality, compressive quality of concrete, workability, shape m and measure.

4.1 Volumetric Analysis of Areca nut coir Dust

Since the particular volume of fine aggregates and areca nut coir dust are extraordinary and the blend configuration depends on load batching, the comparable measure of areca nut coir residue to be supplanted was resolved utilizing volumetric investigation. The volumetric proportion was observed to be 1: 0.85.

4.2 Casting of Specimens

The compressive strength test, specimens of concrete were thrown in 250mm x 250mm x 250 mm 3D shape and for split strength chambers were thrown. Three concrete 3D squares were thrown at 3 ,7,14 and 28 days and two barrels at 28 days for every rate replacement of areca nut coir dust (0%, 12.5%, 25% and half).

4.3 Curing of Specimens

The specimens were permitted to stay in the mold of the steel for the initial 24 hours at surrounding condition. Following 24 hours specimens were demolded by slackening the screws of the steel molds with consideration and put in the curing tank for curing until the testing date.

4.4 Workability Tests on Fresh Concrete

Concrete is said to be serviceable when it is effectively put without draining or Segregation and is surveyed by Slump cone test. The concrete workability was observed to diminish as the level of the areca nut coir was expanding.

Table 3 Types of concrete Vs Obtained slump Value

Type of concrete	obtained -slump value
CC	82

CCD-12.5 %	76
CCD-25%	67
CCD-50%	56

4.5 Compressive Strength Test On Hard Concrete

The concrete compression strength is the heap which causes specimen failure partitioned by the territory of the cross area in uniaxial pressure, under a given rate of loading and communicated in N/mm². The weight was connected on a uniform rate with no shock. The compressive quality test was led on an immediate pressure testing machine with a limit of 3000 KN.

4.6 Split Tensile Strength on Hard Concrete

The experimental specimens of the parametric size is 150mm x 200 height were cast .The specimen conducted at the end of 28 days of curing and the average of two specimen samples was have with highly expertly split tensile strength of the mixture.

5.Result and Discussion

Table 4 Types of concrete Vs Compressive strength /Split tensile strength

Type of concrete	Compressive strength [N/mm^2]				Split Tensile Strength [N/mm$^{2]}$
	3 days	7 days	14 days	28days	
CC	14.21	25.1	31.1	36.21	3.21
CCD-12.5 %	10.2	16.1	19.2	24.31	2.32
CCD-25%	8.21	8.21	12.12	12.45	1.76
CCD-50%	3.4	5.21	6.1	8.36	0.87

Depending on the outcomes acquired it tends to be inferred that areca nut coir dust isn't a powerful substitute of fine aggregates, however it is seen that thickness diminishes as the level of areca nut coir dust increments. Along these lines, we can utilize the concrete having 12.5% replacement of areca nut coir for non-auxiliary individuals since the quality is practically equivalent to traditional concrete.

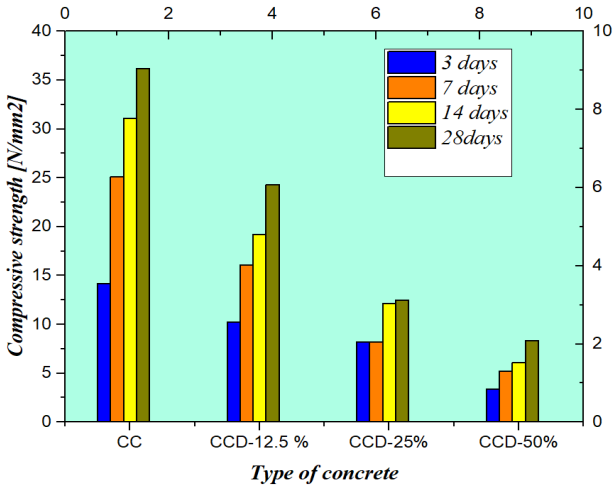

Figure 1 Types of concrete Vs Compressive strength

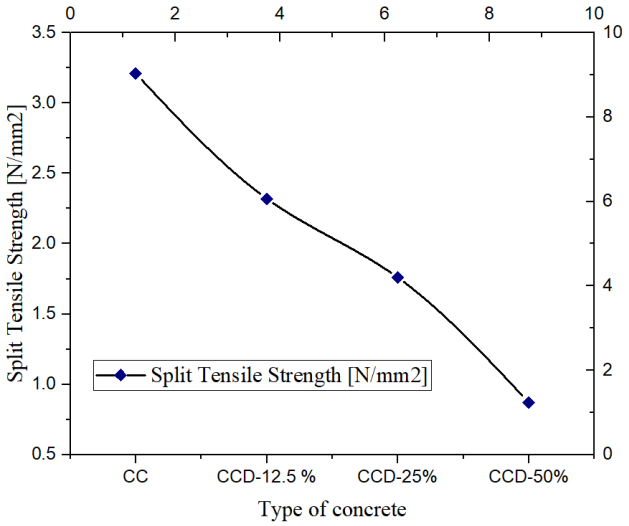

Figure 2 Types of concrete Vs Split Tensile Strength

6.Conclusion

The functionality of the concrete abatements by 3.3 mm when the level of areca nut coir dust increments by 12.5%. The expense of fine aggregates with 12.5% replacement of areca nut coir dust is about 7% lesser than regular concrete per cubic meter. The compressive quality of the concrete reductions straightly as the areca nut coir rate increments. The test was led towards 28 days of curing and the normal of two tests was taken as the agent split rigidity of the blend.

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