A Review Study of Enhancement of Structural Stability of Concrete Using Coconut Fiber And Coconut Coir

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Abstract- *Concrete is the primary prerequisite for any infrastructure development. One of the real segments used in concrete production is aggregate, which is going to diminutive. To sustain construction activity, it is imperative to find alternatives to the natural aggregate. On the opposite side, the rate of solid waste is extended day by day, while the issue of disposal is additionally expanding because of the absence of landfill site accessibility. India is one of the leading coconut growers in the world and enormous quantities of solid waste are produced by coconut. In the replacement of traditional coarse aggregates, the waste coconut shell can be used. Besides, coir fibre (coconut fibre) in concrete additionally might be utilized. The present study carried out the work on concrete production using coconut shell and coconut fibre.*

The compressive strength holds well up to 5% CS & 1% CF addition and 10% CS & 1% CF addition in 07 days test. For the 28 days compressive strength, 5% CS replacement & 1% and 2% CF addition is the best mixes and its increase the compressive strength of concrete. The flexural strength is increases with the addition of coir fibre up to 6%, for 7 days and 28 days, respectively. Overall, Coconut shell can be used for the construction of low-cost housing society, as well as coir fibre can be utilized in concrete production to increase the mechanical properties of concrete. Both of them are cost-effective as well. Coconut waste can contribute to the economic production of concrete and at the same time, the problem of waste disposal is reduced as well.

I. INTRODUCTION

Worldwide concrete is generally utilized development material made out of cement, aggregates, water, and admixtures. Concrete is a powerful, simple, abundant, sturdy and extremely robust development material. The production of concrete requires its ingredients, for example, cement, coarse aggregate, fine aggregate, and water. The aggregate gives a volume of 66-78 percent of the concrete [Shetty, 2009]. In construction development, large scale manufacturing of concrete using traditional ground aggregates like granite reduces natural stone deposits immoderately and thus this is caused by ecological imbalance. For economic improvement & sustainable development, the colossal interest for natural aggregate raises a difficult issue to control the aggregate sources.

Almost everywhere throughout the world, various measures are being taken to decrease the utilization of aggregates that retreat to the reuse and recycling of solid waste where it is technically, monetarily, ecologically, and environmentally acceptable. In anticipation of this issue, the reuse of different sorts of waste items has been investigated and reported for concrete production, for example, waste plastic, consumed bricks, coconut shell, oil palm shell, fly ash, industrial slag, waste rubber tires, marble waste residue, broken glass pieces, glass powder, reused coarse aggregate, papercrete, etc [S.P. Ahirrao et. al. 2013]. The solution for controlling natural aggregate might be reuse coconut shell which can lead to the protection of the environment. Some works on the application of coconut shell waste for concrete production have been reported.

[Sangeetha G., 2016] reported that approximately 4.6 million tons of coconut shell solid waste produced annually which is expected to rise further day by day. Various sorts of coconut waste materials, e.g., coconut shell, coir fibre, coconut shell powder, coconut husk, etc have been utilized as in part or completely coarse aggregate substitution material in the concrete production and their properties have been differentiated with control concrete. A couple of studies demonstrate that agricultural waste coconut shell and coir fibre can be utilized in concrete. On the view that appropriate engineering properties are researched on a coconut shell and coir fibre, the investigation is probably going to take care of a huge issue of aggregate substitution in the development of construction and will likewise solve the disposal issues.

II. OBJECTIVE OF STUDY

Following are the major objectives of the dissertation:

- To explore the mixed impact of using Coconut Shell as aggregate & Coir Fibre as reinforcing material in concrete for compressive strength and workability.
- Studying of coconut shell and coir fibre characteristics as a concrete ingredient.
- Carry out mix design as per IS 10262:2009.
- Observe the compressive strength, density and workability of the concrete by partially replacing the conventional aggregate with coconut shell and coir fibre as reinforcing material by cement content.
- Finding out the flexural strength in which coir fibre utilized in different percentages by cement content.

III. LITERATURE REVIEW

E.A. Olanipekun, (2006) utilized the coconut shell and palm kernel shell, in the production of concrete as a coarse aggregate at a rate of 0%, 25%, 75%, and 100%, respectively. Water/Cement proportion of 0.75 and 0.50 was utilized, for mix proportion 1:2:4 and 1:1:2 for cement: sand: aggregate, individually. Cost decrease could be accomplished somewhere in the range of 30% and 42%. In perspective on the strength/economy proportion, coconut shells were observed to be more fitting than palm kernel shells.

K. Gunasekaran, (2010) considered the technical feasibility of utilizing coconut shell (CS) particles and testing the similarity with cement. Coconut shell-cement similarity appraisals might be completed by utilizing tests of Coconut Shell fines with cement and neat cement to quantify properties, for example, Normal consistency, Initial and Final setting time, Compressive strength and Hydration tests. On tests arranged utilizing every 100 grams of cement and 7.5 grams of CS fines, the effects of CS cement fines were evaluated.

K. Gunasekaran, (2011) The characteristics of the bonding were fixed by pull out the experiment. The outcomes demonstrated that the concrete of coconut shell experimental bond strength is much greater than the bond strength for the selected mix. The exploratory reveals that shells of coconut satisfied the needs for use as a lightweight aggregate.

K. Gunasekaran, (2012) considered the effects on the long-term execution of the coconut shell of three types of curing (complete watering immersion, discontinuous watering, and complete air drying, i.e. no curing). Over 365 days for the blend configuration were looked into for the impact of coconut shell aggregate concrete compressive strength and bond strength.

Shrikant M. Harle (2017) has carried out a study on partial substitution of coarse aggregates with a concrete coconut shell. Density, slump and pressure resistance of cement have been evaluated in this research. A substitution by coconut shell in three varying quantities (10%, 20%, and 30%) was carried out for the ground aggregate. M20 grade of concrete and water-cement ratio of 0.50 was carried out. The author concluded that the replacement of more than 20% leads to lightweight aggregate concrete. As the percentage replacement increases, the density is reduced, the slump to increases, and the compressive strength to be decreased.

Sravika V, (2017) researched a mixture of coconut shell and quarry dust to replace coarse and fine aggregate in part. The fine aggregate is substituted by 30% of quarry dust and the coarse aggregate is partially substituted by the coconut shell. The ground coconut aggregate is substituted by the 10%, 20%, 30% and 40% coconut shell.

Majid Ali, (2012) tentatively explored the bond strength between coconut fibre and cement on the impact of embedment length (10 mm, 20 mm, 30 mm, and 40 mm), diameter {0.15-0.20 mm (thin), 0.20-0.30 mm (medium), 0.30-0.35 mm (thick)}, pre-treatment (Soaked fibre, CaAl fibre, and Boiled fibre) and mix design (1:2:2, 1:3:3, and 1:4:4) relations.

Majid Ali, (2012) An examination is conducted between the static and dynamic modules. The 1%, 2% and 3% and 5% of the fibres are examined for their material mass, with their fibre length 2.5, 5 and 7.5 cm. The percentage of the mixed layout for concrete, sand, and aggregate was 1, 2, and 2 with a water-cement ratio of 0.48 individually. Furthermore, damping of the CFRC beams improves, while structural damage reduces its fundamental frequency.

Saravana Raja Mohan, (2012) researched an investigation embraced in improving properties of fly ash concrete composites with Coconut fibre. A composite with fly ash concrete and treated coconut fibre, tentatively explored the impacts of substitution of 43 grade Ordinary Portland Cement (by weight) with various rates (10%, 15%, 20%, 25%, and 30%) of fly ash and the impacts of expansion of prepared regular coconut fibre having 40 mm length with various rates (0.15%, 0.30%, 0.45%, and 0.60%) on structural properties were taken up. They reported that the fly ash based coconut fibre strengthened concrete demonstrates a superior execution than ordinary concrete.

Darsana P, (2016) carried out the study has resulted to the production of cost-efficient roofing tiles without compromising their quality by replacing 10% and 15% of the

cement with coir fibre. For that examination a 1:4 mix design (concrete: fine aggregate) and a 0.60 water-cement percentage were selected. They revealed the optimal composition to be considered a composite with a fibre quantity of 10 percent. Even more, fibres decrease the weight and price of themselves.

IV. MATERIALS

4.2.1 Cement

In this research work, ordinary Portland cement 53 grade is used. Cement tests were conducted in accordance with IS 12269:1987.

4.2.2 Water

Potable water has been used to make concrete throughout the experimental work. By combining water with cement, the hydration process forms a cement paste.

4.2.3 Natural Sand

In this research work, Sand confirming to Zone I is used. In order to discover the characteristics of natural sand, various experiments are carried out on natural sand as per IS 383-1970 and IS 2386-1963.

4.2.4 Crushed Coarse Aggregates

For the experimental work, crushed coarse aggregate of 10 mm and 20 mm dimensions are used. Two are so mixed to get a nominal aggregate of 20 mm in volume. The aggregates are screened for their characteristics in accordance with IS 383-1970 and IS 2386-1963.

4.2.5 Waste Coconut Shell

The coconut is split into two halves and circulated as Prasad to devotees. The inner fruit can be eaten raw or used in dishes, various other purposes like pure oil, manufacture soaps etc but its outer part i.e. coir or shell is thrown as a waste material somewhere else. Before using the coconut shell for concrete, it is broken into small pieces. All tests have been carried out according to IS 383:1970 and IS 2386:1963 to find out their properties.

4.2.6 Coir Fibre

Coir fibre is extricated from the external shell of a coconut. Before using the coir fibre they are being soaked in water for a period around 30 minutes and also being boiled to remove dust from the coconut.50 mm length is kept for fibres to be used in concrete work.

V. AVAILABILITY OF COCONUT SHELL

Coconut is grown in over 96 countries. India having development on a region of about 2.076 million ha for coconut creation and the yearly production of coconut is about 16.837 million tones [3]. Utilize these materials in concrete to lessen the environmental impacts of agricultural waste items, for example, coconut shell and coconut fibre, which are agricultural waste items. In addition to the fact that it improves concrete quality, yet it additionally prompts the best possible disposal of these materials, in this manner decreasing the environmental impacts of these waste materials.

Coconut shell can be used for crushed stones as an elective material. The chemical substances of coconut shell are like wood and contain 33.61% cellulose, 36.51% lignin, and 0.61% ash and as a result of low cellulose content, it retains less moisture when compared with other agricultural waste [29].

VI. COIR FIBRE

There are two sorts of coir filaments, darker (brown) strands expelled from natural coconuts and white filaments removed from youthful coconuts. Dark-coloured filaments are chiefly utilized in engineering. The coir industry in India has available large quantities of coir fibre waste of approximately 7.5 million tons annually [Source: TNAU Agritech portal].

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