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A Review on Coconut Fiber addition in concrete and Replacement of Aggregates by Marble Aggregates

[1]Mohit Sharma, Department of Civil Engineering, Arya College of Engineering & Research Centre, Jaipur, Rajasthan
[2]Hemant Kumar Sain, Department of Civil Engineering, Arya College of Engineering & Research Centre, Jaipur, Rajasthan

Abstract

Fibrous concrete (FRC) is a type of concrete that contains fibrous material. The structure and weight of this fibrous material continues to grow. Contains discrete short fibers evenly distributed and randomly oriented. The concept of using fibers for reinforcement is not new. Fiber-reinforced concrete can provide a convenient, practical and cost-effective way to overcome micro-cracks and similar imperfections. Due to the weakness of the concrete, certain measures must be taken to compensate for this defect. This article gives a detailed study as per various researchers on coconut fiber addition in concrete and replacement of aggregates by marble aggregates.

Keywords: Fiber Reinforced Concrete, Hybrid Fiber Reinforced Concrete, Coconut Fiber Reinforced Concrete, Steel Fiber Reinforced Concrete.

Introduction

Concrete is the most widely used synthetic building material in the world. It is obtained by mixing cementitious materials, water, aggregates and sometimes additives in the desired proportions. Fresh concrete or plastic concrete is a freshly mixed material that can be molded into any shape and hardened into stone-like material called concrete. Hardening is caused by the chemical reaction between water and cement. This chemical reaction lasts a long time and increases with age. Practical and built in the first half of the last century with normal Portland cement (OPC) and a simple low carbon round bar and ease of use of the concrete parts (regardless of performance). With aesthetic and durable concrete structures and practical knowledge, concrete.

Types of Fibers

1. Low Carbon Steel, Stainless Steel, Galvanized Iron, Aluminum (Metallic Fibers)
2. Asbestos, Glass, Carbon (Mineral Fibers)
3. Polyester, Nylon, Polypropylene, Polyethylene (Synthetic Fibers)
4. Bamboo, Coir, Jute, Sisal, Wood, Sugarcane Bagasse (Natural Fibers)

Why are fibers used in concrete?

Fiber is commonly used in concrete for the following reasons:

a) They reduce the permeability of the concrete, thus reducing the flow of water through the concrete.

b) Some types of fibers are also more resistant to impact, abrasion and cracking on concrete.

c) The fineness of the fibers can improve the mortar content of the concrete and delay the formation and expansion of cracks. This delicacy also prevents it from flowing into the concrete, reducing permeability and improving the surface properties of hardened surfaces.

d) Keep the concrete at an optimal temperature to avoid cracking.

Literature Review

N Kaarthik Krishna et.al. [2018]

In the present work, the author has used coir fiber and sisal fiber in the concrete to discuss and compare the results of them. The coir fiber has been used to boost the ductile property of the concrete. The sisal fiber has been used to improve strength of the concrete. The results of both will be collected and compared with the properties of plain concrete. Coir fibers were washed in hot water and sundried before adding in ordinary Portland cement of grade 53. Different batches with varying percentage of coir fiber were made for testing. The coir fibred concrete was casted into cubes, beams and cylinders. They were subjected to compression and deflection tests. It was found that with the increase in percentage of coir fiber, the compressive strength of concrete for 28 days curing was increasing. The sisal fibers were draped around cylindrical specimens in three layers. The axial load carrying capacity of the sisal fiber wrapped coir infused concrete was more than the plain concrete sample, coir fibred concrete, respectively. It was concluded that coir fiber postponements and controls the ductile cracking of the specimen. Also, addition of sisal fiber in the specimen resulted in better load carrying capacities of the concrete.

MahaparaAbbass et.al [2021]

The author has developed geopolymer concrete with four additions in the concrete. The added components are fly ash, rise husk ash, coconut fiber, ground granulated blast furnace slag (GGBFS). All the components were added in M30 concrete with different proportions to make as much as 168 samples. NaOH and Na2SiO3were used as alkali activators. The samples were casted and cured in sunlight for 48 hours, trailed by air curing for 48 hours, followed by natural water curing until they were tested. Fly ash is residual of the burnt coal in thermal plant. Rice husk ash is the leftovers of the outer husk of the rice. GGBFS are by product of iron ore, coke and lime stones burnt together in furnace. The result came out as. The compressive strength increases by 5.13 % after 7 days curing and by 5.6 % after 28 days curing. Initially, split tensile strength increased, but later with increase of coconut fiber it decreased. The same applied to flexural strength of the samples.

Amgad Elbehiry et.al, [2020]

The use of sustainable components has increased in this era. This paper is about the addition of banana fibers in reinforced cement concrete. After the application of 1000 kN displacement load, it was observed that the banana fibers cannot withstand tension. It was concluded that addition of banana fibers increased shear strength of beams rather than flexural strength. To study the effect of concrete strength, three different types of concrete were taken, M25, M35, and M45. But there was no impact of concrete strength on ultimate load. After all the tests and discussion, it concluded that using banana fibers as reinforcement for gives about 25 % more flexural strength when compared to plain concrete. But no impact was observed on any other factors of the concrete.

Tahseen Ashiq Bhat et.al, [2019]

Sugarcane molasses are water educing agent. Addition of mere 5% of molasses resulted in reduction of water consumption by 12%. Therefore, the author has decided to investigate the outcome on sugarcane molasses on the properties of geopolymer concrete. The need for adding substitute aroused because Ordinary Portland cement is

responsible for producing approximately 7% of the atmospheric carbon dioxide. The mix design was obtained by adding fly ash, fine aggregates, coarse aggregates of 10mm and 20mm size, ordinary Portland cement grade 43, combined solution of sodium silicate and sodium hydroxide solution as an alkali activator and sugarcane molasses of 0.7% by cement weight were used. After conducting a number of tests, it was concluded that, with addition of admixtures workability increases, compressive strength also increases, including split tensile strength. Thus, addition of sugarcane molasses and fly ash was successful experiment which can be performed in future for better results.

S. Govindhan et.al, [2021]

Fiber reinforced concrete has given better results in tensile strength, durability and shrinkage. In this paper, the author has taken hooked steel fibers and chopped glass fibers as an addition to the concrete. When compressive strength test was done, there was no significant change in the results obtained from both plain concrete and fiber reinforced concrete. In tensile strength, the fiber reinforced concrete gave better results than plain concrete. To achieve a compressive strength of 49.34 MPa, 1.5% of steel fibers and 2% of glass fibers were used. Further addition of fibers increased the results by 10%.

A.E. Yurtseven et.al, [2006]

Addition of different types of fibers results in enhancement of properties. This paper is about discussing the mechanical properties of fiber reinforced concrete. Two types of fibers were introduced into the mixes, macro steel fibers and micro steel fibers. Altogether nine mixes were prepared, one with plain concrete and remaining with fiber infused concrete. For every mix, cubes and beams were casted and remolded a day after. They were cured till the day of testing. All the specimens were subjected to loading test and Impact resistance test. It was concluded that fiber infused specimen displayed better results, in which combination of both micro a macro steel fiber gave better flexural strength than macro steel fibers individually. Major impact was observed in Ultimate failure strength, it increased about 10 times than the plain concrete mix. But first crack strength showed no major change. It was detected that micro steel fibers donated to strength and toughness. Whereas, macro steel fiber provided ductility.

Sahar Y. Ghanem et.al, [2021]

Using of steel fibers increases the cost, so to overcome these synthetic fibers have been introduced to give better results at lower costs. In this paper, eight mixtures were prepared, one with plain concrete and remaining with macro and micro fibers with concrete. Polypropylene is one of the best synthetic fibers today. A number of tests were conducted on the samples, including splitting tensile strength, compressive strength, flexure strength, etc. After all the tests, it was concluded that higher the content of fiber in the concrete, the denser it is. And lesser content gives higher slump flow. The compressive strength decreases with increase in fiber content. Also, a mixture of macro and micro fibers results in improved tensile strength than single fiber concrete.

Anantha Lekshmi M L et.al. [2021]

A number of types of fibers have been used in concrete to reduce the cement content and enhance its properties. Amongst all the fibers, natural fibers are extremely low on cost and eco-friendly. One of the natural fibers used in concrete is jute. The main cause to find alternative in fibers was due to tensile strength. The mixture was prepared with coarse aggregates, cement and jute fibers. Jute fibers were of three different heights 7mm, 14mm, 21mm and thickness was 165 kg/m3. Four

specimens were prepared, two cubes and two cylinders. Cubes for consideration of compressive strength and cylinders for consideration of tensile strength. The result indicated that, the addition of jute fibers creates positive impact on the mechanical properties.

Subramanian Shanmugapuram Vivek et.al [2020]

Using natural waste as fibers in concrete is eco-friendly and cost effective. One of them is coconut fibers. This paper has taken coconut fibers with ordinary Portland cement 53 and mixed them to test for physical properties, chemical properties and mechanical properties. The coconut fibers have been prepared by three ways- by soaking in tap water for 30 minutes and then sun dried, by putting them in boiling water for 2 hours and sun-dried, and by immersing them in adherent solution. The results stated that the tensile strength of concrete increased with adding coconut fibers, similarly the flexural strength also increases. The soaked fibers of concrete decreased the compressive strength, and improved tensile strength. The boiled fibers improved mechanical properties by showing greater bond strength. Also, addition of coconut fibers has improved impact resistance.

NaraindasBheel et.al. [2020]

Addition of fibers has been done to enhance the property of concrete. Among all the fibers, the lesser used is human hair. In this paper, the author has introduced human hair in five percentages to examine its effect on physical and mechanical properties. A total of 180 specimens were prepared of cubes, cylinders and prisms comprising 0%, 1%, 2%, 3%, 4% human hair by volume of cement. The cubes were casted and cured after 7th, 28th and 90th day. The results were obtained as decrement in workability with increased hair proportion. Lower the percentage of human hair more was the compressive strength. Contrary, density decreased with increase in human hair content.

JawadAhmad1, Osama Zaid, Muhammad Shahid Siddique [2021]

Concrete requires considerable tensile reinforcing to increase tensile strength and prevent an unacceptably brittle character. This investigation is being funded in order to determine the properties of coconut fiber-reinforced concrete with the introduction of marble. Marble waste was utilized as a binding agent in the proportions of 0 to 30% in a 5.0 percent enhancement by weight of cement to increase compressive ability, while coconut fiber was utilized in the proportions of 0.5 percent, 1.0 percent, 1.5 percent, 2.0 percent, 2.5 percent, and 3.0 percent by weight of cement to increase tensile capacity of concrete. Mechanical efficiency was assessed using compressive, flexure, and split tensile strengths. To test the durability qualities of a fall mix, many metrics such as acid attack resistance, carbonation barrier properties, and water absorption are investigated. In this study, marble waste [0 percent,5.0 percent,10 percent,15 percent and20 percent,25 percent and30 percent by weight of cement] and coconut fibers [0 percent,0.5 percent,1.0 percent,1.5 percent and2.0 percent,2.5 percent and3.0 percent by weight of cement] are employed in the manufacturing of concrete. It has been determined that the optimal dosage for wastes marble and coconut fiber replacement is 18% and 1.8 percent by weight of cement, respectively.

Anandh Sekar and Gunasekaran Kandasamy [2019]

Coconut fiber was utilized to make coconut shell concrete [CSC], and its durability was investigated. Water absorption, volume of permeability pore voids, fast chloride penetrating test, sorptivity, and resilience at increased temperature are

among the features. These qualities were also investigated in conventional concrete [CC] containing coconut fibers for comparative purposes. Except for the temperature resistance investigation, which involved just full water immersing, three other curing situations have been used: complete water immersion, site curing, and air-dry conditions. The findings of the tests demonstrate that the durability qualities of the CC mixes were superior in complete water immersion conditions and in site curing conditions for the CSC mixes. Temperature resistance tests provided a minimal guarantee of 2 h resistance for both CC and CSC mixtures without and with coconut fibers, and so they were certified safe for construction. The purpose of this investigation was to compare standard concrete with coconut fibers.

P. Srinidhi, K. Gokulapriya, P. Parthiban [2019]

Concrete is one of the most often utilized building materials. The most important construction problem is to increase the strength and durability of the concrete. Water contains a large quantity of Nacl. As a result, the steel in concrete corrodes. Furthermore, coconut fibers were included in the concrete to reduce the heat of hydration. Magnetic water, a novel technique, was used in the production of the concrete. It has been discovered that using magnetic water instead of regular water significantly boosts compressive strength. Almost all of the coconut fiber's components were utilized. Fiber consumption is 0.5 percent, 1.0 percent, and 1.5 percent. This coconut fiber is both strong and light. It reduces heat conductivity and is also cost effective. Based on the results of an experimental investigation, the combination of magnetic water with extra coconut fiber determines the maximum compressive, split tensile, flexural strength and tensile strength.

R. Prakash, R. Thenmozhi, Sudharshan N. Raman, C. Subramanian [2020]

The purpose of this research is to look into the impact of adding polypropylene fiber to eco-concrete manufactured using fly ash, an industrial by-product, as a partially cement substitute material and coconut shell, an agricultural waste, as coarse aggregates, on the mechanical qualities of the concrete. 2 separate mixes were created: one with solely coconut shell as coarse aggregates and another with include normal aggregates and coconut shell as coarse aggregates. The inclusion of fiber improved the split tensile and flexural strength of coconut shell concrete. The adding of 0.75 and 1.0 percent volume fractions of polypropylene fibers diminishes compressive strength marginally. According to the findings of this study, polypropylene fibers can be employed to enhance the mechanical qualities of coconut shell concrete.

Stephen Adeyemi Alabi [2020]

The exorbitant expense of traditional construction materials has prompted academics to look for alternatives construction materials that are both economical and environmentally benign. This study focuses at the effect of crushed sandcrete blocks as fine reused aggregate [RFA] and crushed cube as recovered coarse aggregate [RCA] with a constant amount of coconut fiber [CF] on the properties of concrete. The properties of fresh and hardened concrete for all specimen kinds were investigated using a standard approach to get an optimum mix design. According to the study's findings, the workability of all alternatives was determined to be poorer than that of standard aggregate concrete. Compressive and splitting tensile strength tests revealed that at optimal substitution values of 25% RCA and 25% RFA, concrete outperformed NAC in terms of strength.

Sudarshan D. Kore*, A.K. Vyas [2016]

During the extraction and processing phases of the marble business, a substantial amount of waste is generated. This trash is discarded on open ground, causing a slew of environmental issues. The primary goal of this research was to use marble debris as a replacement for typical natural coarse aggregate in concrete. The viability of using marble debris as a coarse aggregate in concrete was investigated experimentally. Marble aggregate was used to substitute conventional natural coarse aggregate in varying quantities ranging from 0 to 100 percent by weight. The concrete compositions had a constant water–cement ratio of 0.60. The workability of concrete mixtures incorporating marble aggregate was found to be 14% higher than those of control concrete. At 7 and 28 days, the average compressive strength among all concrete mixtures including marble aggregate improved by 40% and 18%, respectively.

Research Gap and Findings

Fibrous concrete (FRC) is a type of concrete that contains fibrous material. The structure and weight of this fibrous material continues to grow. Contains discrete short fibers evenly distributed and randomly oriented. The concept of using fibers for reinforcement is not new. Fiber has long been used as a reinforcing material. At the beginning of the 20th century, asbestos fiber was used for concrete. Due to the associated health risks, the use of asbestos to reinforce concrete was subsequently thwarted. New materials such as steel, glass and synthetic fibers have replaced asbestos for reinforcement. Fiber is a small piece of reinforcing material with specific characteristics. Adding fibers to concrete will affect its mechanical properties, and the mechanical properties largely depend on the type, length and percentage of fibers. Concrete is generally not very stressed and brittle. Therefore, fibers are added to increase tensile strength and improve the performance of building materials.

Future Scope

This study can be carried out with other more resistant and durable types of concrete

- This study can be carried out with other more resistant and durable types of concrete (egg M30 and M40).
- This Study can also be carried out with 5% increment in coconut fiber with self compacting concrete.
- Further evidence of alternative wave comparisons between the use of aggregates and all marble aggregates for M25 cement.
- Comprehensive pollution counter and soft cut glass powder.

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