



Comparative Analysis of Steel Fibre Reinforced & Coir Fibre Reinforced Concrete with Conventional Concrete – A Review

¹Neha Kashot, ²Prof. G. Jhanji

¹PG Student, ²Asst. Professor

^{1,2}Department of Civil Engineering

^{1,2}Mahakal Institute of Technology and Management, Ujjain, India

ABSTRACT—

Fibres have been used to improve concrete, which is often brittle and weak in stress. The use of asbestos to strengthen pottery, horse hair in plaster, and straw in mud bricks were the first materials used in this process. Conversely, continuous reinforcement is used to maintain reinforced concrete, but it requires a great deal of skill and accuracy. On the other hand, discrete fibre placement in plain or reinforced concrete appears to be more promising. In order to increase the compressive strength of concrete, this study investigates the possibilities of using steel and coir fibre as an efficient and sustainable reinforcement material. The development of fibre-reinforced concrete (FRC) in the early 1960s demonstrated that concrete might be transformed into uniform, isotropic materials. FRC's strength and ductility are increased by the randomly distributed fibres, which stop cracks from forming and spreading once concrete does. If the right amount and distribution of steel fibre in the concrete matrix are guaranteed, the steel wires in tires can be used effectively in concrete. On the other hand, adding coir fibre to the concrete structure improves its tensile and flexural qualities. Additionally, coir fibre is typically found in nature and is environmentally friendly. Bond failure between the fibre and matrix or material failure are the two primary failure modes for fibre reinforced composites. In order to assess the strength and durability characteristics of hardened concrete, we examined the performance of various fibres utilized at varying percentages by weight of cement. According to earlier research, adding fibres to such concrete barely changed its compressive strength, but also seemed to impair its flexural and tensile strength, which eventually affected the concrete's qualities. The uses of fibre-reinforced concrete are also covered in this paper, along with the numerous efficient ways it may be used to increase strength and improve crack resistance.

Keywords: Fibre Reinforced Concrete, Steel Fibre, Coir Fibre, Workability, Durability, Strength Properties, Cost Optimisation.

1.1 Introduction -

According to certain academics, concrete is frequently utilized alongside water in the construction sector. Concrete is a quasi-ductile material that is weak under tension and has little resistance to crack formation. For skyscrapers and large-span buildings to satisfy the demands of the construction industry, high-performance concrete is necessary. Using fibres to increase the concrete's tensile strength before cracking and its ductility after cracking is one method of reducing brittleness and increasing its tension capacity. Fibre reduces temperature and shrinkage cracking and enhances impact and fatigue strength.

Concrete is a brittle, composite material used in many engineering projects, such as walls, reservoirs, dams, pavements, tunnels, bridges, and foundations. A lot of research has been done to improve the properties of concrete for increased applicability because of these many uses. One of the numerous attempts to enhance concrete's performance was the inclusion of steel. In order to withstand applied tensile and shear loads, these conventional reinforcements are steel reinforcing bars placed at specific points inside the structure. On the other hand, steel fibre integration in the concrete mixture is frequently erratic and uneven. They play a major part in lowering the frequency of cracks brought on by changes in temperature and relative humidity in concrete mixtures when the fibres are uniformly distributed. The cementitious compositions' mechanical qualities are enhanced by the addition of fibres, whether synthetic, natural, or steel. Fibre has a significant positive impact on ductility, toughness, and resilience to dynamic stress, even though its function may not always involve an increase in strength. Fibre-reinforced concrete is not a replacement for conventional steel reinforcing bars because steel bars and fibres have different purposes, although both enhance concrete performance. Short, irregular steel fibres are mixed into the concrete matrix to create steel fibre-reinforced concrete (SFRC). The main ingredients of SFRC are water, aggregates, cement, and steel fibres. SFRC may also include admixtures and pozzolana, depending on the intended usage. Researchers face knowledge gaps that could prevent new academic and research collaborations as they continue to study the SFRC in response to growing worries about the fragile nature of concrete. Therefore, it is essential to design and implement a system that enables scholars to obtain important information from the most reliable sources.

Natural fibres are organic fibres derived from plants and animals. Because of their abundance, adaptability, and desirable qualities, humans have been using them for thousands of years for a variety of purposes. Plants such as sisal, coir, and jute, as well as animal sources like wool and silk, are used to

make fibres. Natural fibres have a number of beneficial qualities and can be used in a variety of ways. They are eco-friendly substitutes for synthetic fibres since they are biodegradable and renewable. They are comfortable to wear in textiles and apparel because of their superior breathability, moisture absorption, and thermal insulation qualities. Plant fibres are widely utilized as reinforcement materials in composites, including building materials like concrete and polymers, in addition to their textile applications. which give composites their strength, rigidity, and resistance to impact, improving their engineering qualities.

1.2 Fibre Reinforced Concrete

A composite material called fibre-reinforced concrete is created by combining cement, aggregates, water, and evenly distributed fibres. By acting as crack arrestors, the fibres increase the concrete's strength, ductility, and longevity. Fibres are evenly distributed throughout the mixture of this type of concrete to enhance its structural qualities. By acting as crack arrestors, these fibres improve concrete's ductility, toughness, and post-cracking strength. The fibrous material, which can be composed of steel, glass, synthetic materials, natural fibres, or a mix of these, improves the structural integrity of FRC. The following discusses the characteristics of fibre-reinforced concrete and how it is used:

Properties of Fibre Reinforced Concrete -

- Increased tensile & flexural strength
- Reduced shrinkage & crack formation
- Improved impact & abrasion resistance
- Enhanced ductility and energy absorption capacity
- Better durability under cyclic loading and thermal variations

Applications of Fibre Reinforced Concrete -

- Industrial floors & pavements (resists wear and cracking).
- Airport runways & highways (high fatigue resistance).
- Tunnel linings & shotcrete (improved ductility).
- Precast products (pipes, panels, manhole covers).
- Seismic and blast-resistant structures.
- Marine and hydraulic structures (durability against water ingress).

Following are the advantages and disadvantages of Fibre Reinforced Concrete -

Advantages

- Reduces crack formation (both plastic & drying shrinkage).
- Improves ductility and toughness.
- Better fatigue resistance → useful in pavements, runways, industrial floors.
- Increases service life of structures.
- Reduces maintenance costs.

Disadvantages

- Difficult to mix and place uniformly (risk of fibre balling).
- Workability reduces with fibre addition.
- Cost increases depending on fibre type (steel & carbon are expensive).
- Requires special design considerations (IS 456 & IS 10262 don't provide direct mix design methods for FRC).

1.3 Types of Fibres Used

Steel Fibres – Boost fatigue resistance, impact resistance, and flexural strength. Compared to rebar reinforced concrete, steel fibre-reinforced concrete is typically less expensive and simpler to employ. Although it takes a lot of work, rebar reinforced concrete is stronger because steel bars are inserted into the liquid cement. Thin steel wires are mixed with cement to create steel fibre reinforced concrete. This increases the concrete's structural strength, lessens cracking, and helps shield it from extreme cold. Aggregation of steel fibre with rebar or another form of fibre is common.

Properties of Concrete Improved by Steel Fibres

The incorporation of steel fibres significantly enhances several properties of concrete, including:

- Flexural Strength: Up to threefold increase compared to conventional concrete.
- Fatigue Resistance: About one and a half times greater fatigue strength.
- Impact Resistance: Enhanced resistance to damage from heavy impacts.
- Permeability: Reduced porosity.
- Abrasion Resistance: Improved resistance against abrasion and spalling.
- Shrinkage: Mitigation of shrinkage cracks.
- Corrosion: Limited impact of corrosion on the material.

Advantages:

- Increased durability, flexural and fatigue strength, and resistance to abrasion, spalling, and impact.
- Potential productivity improvements and cost savings
- Crack-free stress accommodation throughout the concrete
- Economical design alternative

Disadvantages:

- Aesthetically poor appearance if slabs are damaged
- Diminished cost savings in certain structural elements
- Strict control of concrete wastage required to minimize fibre wastage



Figure 1.1: Cold-drawn wire fibres

Cut sheet fibres



Figure 1.2: Melt-extracted fibres

Figure 1.3: Flat End Steel Fiber



Figure 1.4: Hook tain Steel Fibre

Crimped Fibre

Different Types of Steel Fibre used in Steel Fibre Reinforced Concrete

Glass Fibres (GFRC) – Improve surface finish, decrease shrinkage cracking, and increase tensile strength. Similar to fiberglass insulation, glass fibre-reinforced concrete uses fiberglass to reinforce the concrete. In addition to strengthening the concrete, the glass fibre also serves to protect it. Additionally, glass fibre prevents the concrete from breaking over time as a result of thermal or mechanical stress. Furthermore, unlike steel fibre reinforcement, glass fibre does not block radio signals.



Glass Fibre used In Fibre Reinforced Concrete

Synthetic Fibres Plastic and nylon fibres are used in synthetic fibre-reinforced concrete to increase the concrete's strength. Furthermore, compared to other fibres, synthetic fibres offer a variety of advantages. They assist the cement pump work better by preventing it from sticking in the pipes, even though they are not as strong as steel. The synthetic fibres assist prevent cracking because they don't expand in hot weather or contract in cold weather. Lastly, synthetic fibres prevent concrete from leaking in the event of a fire or damage.

Polypropylene, nylon, polyester → control plastic shrinkage cracks.

Carbon fibres → improve strength but costly.



Synthetic Fibre used In Fibre Reinforced Concrete

Natural Fibres – To enhance the qualities of concrete, natural fibers derived from plants or animals are utilized as reinforcement. They are inexpensive, sustainable, and environmentally beneficial substitutes for steel or synthetic fibers. Natural fibers, such coconut fiber, have been employed in fiber-reinforced concrete. Although these fibers increase the strength of the concrete, excessive use of them might weaken it. Furthermore, rot may persist in the concrete if the natural fibers are already breaking down when they are added. FRC often uses a variety of natural fiber kinds, including

- Coir (coconut fibre) – good tensile strength, widely available in India.
- Jute fibre – economical, biodegradable, enhances toughness.
- Sisal fibre – high tensile strength, good durability.
- Bamboo fibre – very strong and sustainable.
- Hemp, flax, straw fibres – used in rural and low-cost construction.

Coir Fibre - Between latitudes 20° N and 20° S, coconut agriculture is expanding throughout tropical and subtropical regions. Most Asian nations, including Thailand, Indonesia, India, and Malaysia, as well as those with tropical climates like Hawaii and the Fiji Islands, exhibit it. Coconuts are mostly grown on sands and clays found around the shore. The height of a coconut tree can reach 30 meters. Coir fiber, which is derived from a coconut's outer shell, is categorized as a natural fiber. Coir, *Cocos nucifera*, and *Arecaceae* (Palm) are the colloquial names, scientific names, and plant families of coconut fiber, respectively. Coconut fiber comes in two varieties:

- Brown fibre extracted from matured coconuts and
- White fibres extracted from immature coconuts.

White fibers are finer, smoother, but weaker than brown fibers, which are thick, strong, and very resistant to abrasion. Three types of coconut fibers are sold commercially: decorticated (mixed fibers), mattress (relatively short fibers), and bristle (long fibers). Depending on the needs, these various fiber kinds serve a variety of purposes; brown fibers are primarily utilized in engineering.

Advantages:

- Concrete reinforced with coir fibers is more resilient to impact, abrasion, and spalling and has a high flexural and fatigue strength.
- Reducing section thickness and doing away with traditional reinforcing can sometimes result in notable increases in production. Together with lower material volumes, quicker construction, and lower labor costs, coir fibers can result in significant cost reductions.
- The uneven dispersion of coir fibers in concrete guarantees that tension is accommodated throughout the material without cracking. As a result, tiny cracks are stopped before they become larger and affect the concrete's functionality.
- Coir fibers offer a far more cost-effective design option.

Disadvantages:

- Slabs that are damaged expose aggregate and fibers, which will appear unsightly while preserving structural integrity.
- Although fibers can replace reinforcement in all structural components, including primary reinforcement, there will come a time when the cost-saving and design-economies of the fiber alternative are reduced within each component.
- To keep concrete waste to a minimum, strict control measures must be observed. Fibers are squandered when concrete is wasted.



Coir Extracted from Coconut Husk

2. OBJECTIVES OF THE STUDY

- To evaluate how fibers, affect concrete's mechanical properties (compressive, tensile, and flexural strength).
- To investigate the effects of various fiber kinds on the workability and setting properties of concrete.
- To assess the durability performance of fiber-reinforced concrete.
- To look at the economic and environmental benefits of using fibers in concrete since it reduces cement consumption and CO2 emissions.
- To determine the ideal fiber content for concrete.

3. Literature Review –

A relatively new and exciting concept that merits more research is the incorporation of fibers into concrete. Because it focuses on methodically assessing the results of trials on steel fiber reinforced concrete and coir fiber reinforced concrete, this research is especially important. It specifically looked into how the volume percentage affected these concrete specimens' characteristics. This study advances a better understanding of the possible enhancements in concrete performance that can be achieved by adding steel or coir fibers by closely examining the impact of these variables. The methods, findings, and some of the data from earlier research have all been covered here. The usage of such fibers has been the subject of numerous studies aimed at reducing environmental harm and energy consumption.

Romualdi J.P. & Batson G.B., 1963, Mechanics of crack arrest in concrete, Journal of Engineering Mechanics Division 89, pp 147-168 The characteristics of SFRC were better understood at the Carnegie Institute of Technology. A later development of this knowledge is steel fiber reinforced concrete, which was initially used in 1972 to stabilize the rock slope of a tunnel portal in Idaho.

Ramakrishnan V, Wu G.Y. and Hosalli G, 1989. Flexural behaviour and toughness of fibre reinforced" Transportation Research Record, No.1226, pp 69-77 The findings of a thorough investigation to ascertain the behavior and performance characteristics of the most widely used fiber reinforced concretes (FRC) for possible airfield pavements and overlay applications are presented in their paper titled "Flexural behavior and toughness of fiber reinforced concrete." Concretes with and without four different types of fiber—hook-end steel, straight steel, corrugated steel, and polypropylene—are compared in terms of their static flexural strength. Four different amounts of these fibers (0.5, 1.0, 1.5, and 2.0 percent by volume) were evaluated, and all concretes were made using the same basic mix proportions. The test program comprised (a) properties of fresh concrete, such as slump, ve-be time, inverted cone time, air content, unit weight, and concrete temperature; (b) static flexural strength, which included load deflection curves, toughness indexes, post-crack load drop, and first crack strength and toughness; and (c) pulse velocity. Using laboratory-prepared specimens, it was generally easy to place and finish concretes containing less than 1 percent by volume for all fibers. Nevertheless, a maximum of 1 percent by volume of hooked-end fibers could be introduced without resulting in balling. In fresh concrete, corrugated steel fibers (Types C) worked best; no balling, bleeding, or segregation occurred even at greater fiber quantities (2 percent by volume). Higher amounts of polypropylene fibers trapped a significant amount of air, while higher amounts of straight steel fibers (2 percent by volume) resulted in balling. The authors came to the conclusion that the addition of fibers improved the toughness index, post-crack load-carrying ability, energy absorption capacity, initial fracture strength (15 percent to 90 percent), and static flexural strength (15 percent to 129 percent) when compared to plain concrete. The hooked-end steel fiber contributed the most to the above-mentioned attributes' increase, whereas the straight steel fiber contributed the least (albeit still noticeable) when compared to an equivalent 1 percent by volume basis.

Sustersic J., Mali E. and Urbancic S. 1991, 'Erosion-abrasion resistance of steel fibre reinforced concrete', SP126-39 : Special Publication, Vol 126, pp 729-744 The results of research on the abrasion resistance according to the Bohme test method and the erosion-abrasion resistance according to the CRD-C 63-80 test method of steel fiber reinforced concrete specimens were covered in their paper titled "Erosion-abrasion resistance of steel fiber reinforced concrete." Nine mix amounts were used. The range of the w/c ratios was 0.30 to 0.65. At a w/c of 0.30, the volumetric percentage of hooked steel fibers ranged from 0.25 to 2.0 vol. percent, while the quantity of fibers remained constant at all other values. At each w/c, fiber-free mixtures were also created. The authors have determined that the resistance as determined by both test techniques is improved by incorporating steel fibers into the concrete. Both an increase in fiber content and an increase in compressive strength improve erosion-abrasion resistance. Only at constant w/c and with varying fiber contents can it be linked to improvements in abrasion resistance as determined by the Bohme test method.

Ghugal Y. M., 2003. Effects of steel Fibres on Various Strengths of Concrete, ICI journal (Indian Concrete Institute). Vol 4 No 3, pp 23-29 'investigated how steel fibers affected different concrete strengths. The findings of the experimental study of different steel fiber reinforced concrete (SFRC) strengths have been reported. Fiber volume fractions and different strengths are variables taken into account in the research project. Compressive strength, flexural strength, split tensile strength, bond strength, and shear strength are among the strengths taken into consideration for the inquiry. Crimped steel fibers with an aspect ratio of 50 are utilized in concrete mixes of M25 grade. By weight of cement, the fiber volume fraction is adjusted at intervals of 0.5% from 0.5% to 4.5%. Standard test specimens were cast and water cured for seven and twenty-eight days in order to determine their compressive, split tensile, flexural, and push-off shear strengths. Every test specimen was examined in accordance with the applicable Indian Standards and, when appropriate, established test methods found in the literature. It is discovered that as the fiber volume fraction rises, all of the strengths grow steadily. The material parameters of matrix, fiber, and compressive strength are used to mimic the experimental data obtained for different strengths. We offer the mathematical equations that have been established for different strengths. In this experiment, the addition of steel fiber to regular concrete demonstrated exceptional strength performance in comparison to regular concrete.

Murthy Dakshina N R et al, 2005, 'Splitting tensile strength of high volume fly ash concretes with and without steel fibres in different grades', Proceeding of International conference on recent advances on concrete and construction technology, SRMIST, pp 123-129 have talked about how adding fly ash and random steel fibers to concrete can increase its tensile strength in lower, middle, and higher grades. They have researched concrete grades M25, M50, and M60. They employed steel fibers with a volume percentage of 1% and an aspect ratio of 75. Regarding their research, they have stated the following. Concrete's ductility can be improved in lower grades by substituting up to 20% fly ash for cement. By adding 1% steel fibers, ductility can be reached at 40% replacement. Concrete's split tensile strength has risen by up to 30% in medium grade. Even when fly ash is used in place of 40% of cement, a 1% fiber addition can increase tensile strength. When steel fibers are added to concrete, the material's ductility improves. The ductility of higher-grade concrete has been enhanced by up to 10% using fly ash in place of cement. Concrete has become more fragile at greater replacement percentages. Up to 20% more ductility can be achieved with steel fibers. At 30% and 40% replacements, the split tensile strength decreases. When 1% fibers are added to concrete, the ductility of all grades improves overall.

Ganeshan N et al, 2007, 'Steel fibre reinforced high performance concrete for seismic resistant structure', Civil Engineering and Construction Review, pp 54-63 have made an effort to conduct extensive research on SERHPC structural components such as beams, columns, and beam-column joints. They have compiled the findings of the researches in this article. Crimped steel fibers have been utilized in FRC. Additionally, they have thought about replacing 10% of the cement with silica fume and 20% with fly ash. The writers have provided the following conclusions about compressive behavior.

- SFRHPC can be obtained using conventional constituents of concrete and fibres, with due care in the selection of ingredients and proportioning of the mix.

- An increase in the volumetric ratio of transverse reinforcement increases the ultimate strength of HPC and SFRHPC. However, the percentage of increase is higher for SFRHPC specimens than for HPC.
- As the confinement increases strain at peak load increases. Addition of steel fibres improved this peak strain further.
- The addition of short discrete randomly oriented steel fibres improves the dimensional stability of the structure to a great extent.
- This investigation indicates that the combined effect of confinement in the form of square/rectangular/circular hoops and randomly oriented steel fibres enhances the strength and ductility of compression members such as columns to a great extent and this is the major requirement for a seismic resistant structure.

Ghugal Y.M., Nandanwar C.V. & Bansode S.S., 2010, Effect of Different Sizes of Aggregate on Steel Fibre Reinforced Concrete, International conference on Innovation, Vol I, pp 367-374 - They discovered that adding short, haphazardly spaced fibers to concrete stops micro cracks from spreading and increases the concrete's strength. He views the variables as aggregates of varying sizes. Fiber is used in the design of concrete mixes for M20 grade. For flexural strength, 500x100x100 mm beams were cast. After being tested for compressive strength and prism split tensile strength, the beam fractured into two pieces. For M20 grade concrete, the maximum flexural, compressive, and split tensile strengths are found to be at 1% steel fiber.

Gediminas Marciukaitis, Remigijus Salna, Bronius Jonaitis, 2011, A model for strength and strain analysis of steel fiber reinforced concrete, Journal of Civil Engineering and Management, Vol. 17(1), pp 137-145 - They must create and suggest a model for analyzing the strength and staining of steel fiber reinforced concrete (SFRC). The model is based on the reinforced concrete code and general guidelines for designing and modeling structural composites. In contrast to earlier examples, the provided model directly considers the plastic and elastic properties of the steel and concrete components. The model provides a way to calculate the fiber concrete's elasticity modulus, tension and compression strength, and key elasticity and plasticity parameters. The results obtained and those of studies conducted by other researchers were found to be in good accord. There are negligible variations in the theoretical and experimental value ratios, which range between 1.06 and 1.10.

S. Sharmila and Dr. G.S. Thirugnanam (2013): "Behavior of Reinforced Concrete Flexural Member with Hybrid Fibre under Cyclic Loading." - According to the scientists, the addition of hybrid fibers affects beam behavior by enhancing energy absorption characteristics by over 160% and ductility features by 80%. The energy absorption capacity is significantly increased by combining various fiber types (hybrid fibers) as opposed to adding a single fiber.

Ali Amin and Stephen J. Foster, "Shear strength of steel fibre reinforced concrete beams with stirrups", Engineering Structures, Vol. 111, Pp. 323–332, 2016 - Steel Fibre Reinforced Concrete (SFRC) has gained more attention in research and practice, but it has not yet been widely used in load-bearing or shear-critical building structural parts. In most real-world applications of SFRC construction, structural members composed of SFRC are also reinforced with traditional reinforcing steel for shear ligatures, even though the vast bulk of research on SFRC has concentrated on members that solely include fibers. This study presents the findings of shear tests performed on 10 rectangular simply supported beams measuring 5 m in length, 0.3 m in width, and 0.7 m in height. The beams had different ratios of transverse and steel fiber reinforcement. Together with thorough material characterization, the experiments have been examined in order to quantify the SFRC's post-cracking behavior.

Mohd. Gulfam Pathan1, Ajay Swarup2 "A Review on Steel Fibre Reinforced Concrete" IJARSE – Volume 6 – Special Issue 1 2017 PP 819-824 - Concrete's good workability and ability to be molded into any shape make it a widely utilized material in the building sector. Ordinary cement concrete is less resistant to cracking, has a very low tensile strength, and is not very ductile. The primary cause of brittle concrete failure is internal micro cracks, which result from the concrete's brittle behavior and inability to withstand tensile loading. The applications of SFRC are discussed in this study, along with the several efficient methods in which it may be used to increase strength and improve crack resistance.

Bhushan R. Bhaladhare, "REVIEW ON FIBRE REINFORCED CONCRETE- A CASE STUDY" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 09 | Sep 2020 www.irjet.net p-ISSN: 2395-0072 - It is undeniable that fiber reinforced concrete (FRC) is beneficial in a variety of civil engineering applications. Fiber Reinforced Concrete (FRC) is becoming more and more popular as a practical method of enhancing concrete's performance. Fibers are currently being specified for thin unbounded overlays, concrete pads, concrete slabs, bridge decks, tunnels, pavements, and docks. These fiber-reinforced concrete solutions are growing in popularity and performing exceptionally well. Concrete that contains fibrous material to increase its structural strength is known as fiber-reinforced concrete, or FRC. It is made up of short, distinct threads that are arranged randomly and uniformly. Steel, glass, synthetic, and natural fibers are examples of fibers. The thoughtful strength of fiber-reinforced concrete is presented in this study. Fiber-reinforced concrete's durability and mechanical characteristics.

Sher Bahadur Budha, "COMPARITIVE STUDY ON THE USE OF COIR FIBRE, RECRON FIBRE AND STEEL SLAG IN THE CONCRETE" JETIR2010135 Journal of Emerging Technologies and Innovative Research (JETIR) www.jetir.org 1009 © 2020 JETIR October 2020, Volume 7, Issue 10 www.jetir.org (ISSN-2349-5162) - Portland cement concrete reinforced with fibers that are arranged more or less randomly is known as fiber reinforced concrete, or FRC. By randomly dispersing and distributing hundreds of tiny fibers throughout the concrete during mixing, FRC enhances the concrete's qualities in every direction. FRC is a composite material that was created recently and is based on cement. Because of its exceptional flexural-tensile strength, resistance to spitting, impact resistance, permeability, and frost resistance, it has been employed successfully in construction. It is a useful technique to improve the mortar's toughness, shock resistance, and resistance to plastic shrinkage cracking. A tiny piece of reinforcing material with specific qualities is called a fiber. Their cross-sections can be flat, triangular, or round. A handy metric known as the "aspect ratio" is frequently used to characterize the fibers. The fiber's length to diameter ratio is known as its aspect ratio. Adding fibers to a cement matrix is

primarily done to improve the composite's cracking deformation properties and boost its toughness and tensile strength. FRC needs to be able to economically compete with the current reinforcing system in order to be a feasible building material.

Sudarshan D. Kore, "Sustainable Production of Concrete using Coir Fibres" ICSEEGT 2021 IOP Conf. Series: Earth and Environmental Science 795 (2021) 012006 IOP Publishing doi:10.1088/1755-1315/795/1/012006 - The research done in India on the usage of coir fibers as an additional material in the creation of environmentally friendly concrete mixtures is presented in this study. It is intended to be utilized as an energy-efficient building element. Different percentages of coir fibers—2%, 4%, and 6%—were added, and in order to compare the outcomes, reference concrete was also made without coir fibers. Investigating many factors, including workability, density, water absorption, compressive strength, flexural strength, and split tensile strength, is the main goal of the study. The water-to-cement ratio of 0.52 was maintained throughout the creation of the concrete mixtures. According to the study's findings, adding coir fibers to concrete mixes improves the material's mechanical qualities.

Inayat Ullah Khan, "Mechanical Properties of Steel-Fiber-Reinforced Concrete" Eng. Proc. 2022, 22, 6. <https://doi.org/10.3390/engproc2022022006> - Tire trash results from the quick rise in vehicle usage, and its handling raises social and environmental issues. If the right amount and distribution of steel fiber in the concrete matrix are guaranteed, the steel wires in tires can be used effectively in concrete. The dose effect of steel fiber in various ratios on the compressive, splitting tensile, and flexural strengths of concrete is assessed in this experimental setup. Additionally, the relationship between steel fiber dosage and flexural and compressive strength is examined. Steel fiber was shown to significantly increase both compressive and flexural strength. Additionally, the impact of steel fiber length on concrete's mechanical qualities is examined. A three-length steel fiber dosage of 2% performed exceptionally well in both compression and flexure. Ten percent more load was applied to the first crack than to the control specimen. A 2% dosage with a 3 fiber length can be utilized for the commercial manufacturing of structural concrete, according to a thorough analysis.

Muhammad Nasir Amin, "Steel Fiber-Reinforced Concrete: A Systematic Review of the Research Progress and Knowledge Mapping" Materials 2022, 15, 6155. <https://doi.org/10.3390/ma15176155> - To determine its essential components, this study conducted a scientometric analysis of the literature on steel fiber reinforced concrete (SFRC). The ability of typical review papers to connect disparate parts of the literature in a structured and methodical way is constrained. Co-occurrence, co-citation, and knowledge mapping are the most difficult parts of current study. Relevant publication sources, keyword analysis, prolific authors based on publications and citations, top papers based on citations received, and regions actively participating in SFRC investigations were identified during the data evaluation process. The literature data from 9562 pertinent papers, including citation, abstract, bibliographic, keywords, funding, and other details, was assessed using the VOS viewer software tool. Additionally, the uses and limitations of SFRC in the construction industry were investigated, along with possible ways to overcome these limitations. Additionally, steel fibres, fibre-reinforced concrete, concrete, steel fibre-reinforced concrete, and reinforced concrete are the keywords that authors most frequently use in SFRC study. 39 writers had published at least 30 publications, according to the authors' evaluation. Furthermore, according to publications on SFRC research, the most active and participating nations were China, the US, and India. The study's quantitative and graphical representation of participating countries and researchers can help scholars develop cooperative projects and share novel concepts and methods.

Pooja B J, "CHEMICALLY TREATED COIR FIBER REINFORCED CONCRETE" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 10 Issue: 05 | May 2023 www.irjet.net p-ISSN: 2395-0072 - Numerous engineering features are different when coir fibre (coconut fibre) is added to concrete structures. Concrete has a low tensile strength as well as a poor flexural strength. However, the most widely used technique to lessen this issue is the use of traditional steel reinforced concrete structures, which are getting more and more costly to build in terms of both prices and sustainability concerns. Additionally, due to these issues, steel's strength is decreased in many construction industries. To address these issues, coir fibre is added to concrete structures to increase their tensile and flexural properties. Additionally, coir fibre is typically found in nature and is environmentally friendly. The experiment involved adding coir fibre to high-strength concrete in four different mix proportions (0, 0.1%, 0.2%, and 0.3%). The concrete's cured compressive and tensile strengths were assessed over a 28-day period. By spreading knowledge about the flood, households fleeing flood-prone areas will feel more at ease, potentially saving lives and preventing significant damage from natural disasters.

Siva Teja Sowrya Yannana, "Comparison of Strength Properties Between Steel Fiber Reinforced Concrete and Coir Fiber Reinforced Concrete, International Journal of Engineering Research & Technology (IJERT) Published by: <http://www.ijert.org> ISSN: 2278-0181 Vol. 13 Issue 5, May 2024 - Fibres have been used to improve concrete, which is often brittle and weak in stress. The use of asbestos to strengthen pottery, horse hair in plaster, and straw in mud bricks were the first materials used in this process. Conversely, continuous reinforcement is used to maintain reinforced concrete, but it requires a great deal of skill and accuracy. On the other hand, discrete fibre placement in reinforced or unreinforced concrete appears to be more promising. The development of fibre-reinforced concrete (FRC) in the early 1960s demonstrated that concrete could be transformed into uniform isotropic materials. FRC's strength and ductility are increased by the randomly distributed fibres, which stop cracks from forming and spreading once concrete does. The two primary failure modes for FRC are material failure and bond failure between the fibre and matrix, respectively. In order to assess compressive strength and split tensile strengths at seven and twenty-eight days, respectively, we compare the performance of steel fibre and coir fibre at various percentages ranging from 0.5%, 1%, 1.5%, and 2% by weight of cement.

"Krishna Prasad Guruswamy, "Coir fibre-reinforced concrete for enhanced compressive strength and sustainability in construction applications" Heliyon 10 (2024) e39773 <https://doi.org/10.1016/j.heliyon.2024.e39773> - The potential of coir fibre as an efficient and sustainable reinforcement material to raise the compressive strength (CS) of concrete is investigated in this study. The response surface method (RSM) was used to investigate the effects of the fibre length (FL) and fibre volume fraction (FVF) on the CS of the coir fibre reinforced concrete. According to the experimental design, the FL ranged from 0.4 cm to 1.2 cm, and the FVF range was chosen to be between 4% and 12%. The study found that the largest CS for the reinforced concrete cubes, measuring 34 N/mm², was produced by coir fibre with an FVF of 4% and a FL of 10 mm. Additionally, it was found that coir fibre-reinforced concrete became less workable as its fibre content increased. Additionally, after a year, X-ray diffraction (XRD) and

Fourier transform infrared spectroscopy (FTIR) analyses of the control and coir fibres removed from the concrete cubes showed no appreciable changes in the fibres' thermal characteristics, functional characteristics, or crystallinity.

3. Conclusion –

A thorough literature analysis that included papers from conferences and journals was conducted; the majority of the publications studied focused on fiber-reinforced concrete. According to the literature research, there aren't many publications on fiber-reinforced concrete that combines coir and steel fibres. Aspect ratio, concrete grades, and steel fibre percentages are just a few examples of variables that aren't discussed in the evaluated publications. There is no published work on the creation of mathematical models and their validation using both original experimental data and data from other studies, taking into account metrics such as fibre-reinforced concrete's compressive strength, split tensile strength, and flexural strength.

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