

A Review of Corrosion Resistance of Reinforcing Steel in Concrete Using Natural Fibers Treated with Used Engine Oil

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Abstract

Corrosion of reinforcing steel is a major cause of deterioration in reinforced concrete structures, leading to cracks, spalling, and reduced durability. This study presents an eco-friendly and low-cost approach to improve corrosion resistance by using natural fibers treated with used engine oil in concrete.

Locally available **coconut leaf** and **bamboo fibers** were selected for their good tensile strength and low cost. The fibers were treated with used engine oil to reduce water absorption and degradation, forming a protective hydrophobic layer that limits moisture and chloride penetration.

Concrete mixes containing **0.2%** and **0.4%** of treated fibers were tested for **compressive strength, split tensile strength**, and **electrochemical corrosion resistance**. Results showed that treated fibers improved steel–concrete bonding and significantly reduced corrosion rates without affecting strength.

This sustainable technique enhances concrete durability, promotes waste reuse, and offers a cost-effective alternative to chemical corrosion inhibitors.

Key words: - Corrosion, Natural Fibers, Concrete Durability, Sustainability

I. INTRODUCTION

Concrete is a widely used construction material due to its high compressive strength. When combined with reinforcing steel, it gains substantial tensile strength. The high alkalinity of cement paste creates a passive oxide layer on steel, offering protection against corrosion. However, exposure to carbonation and chloride ions can disrupt this passive layer, initiating corrosion. This leads to volumetric expansion of corrosion products, generating tensile stresses in the concrete and resulting in cracking, spalling, and overall durability loss in reinforced concrete (RC) structures.

To address this issue, researchers have explored alternative materials—such as synthetic, natural, and waste fibers—as partial replacements or supplements in RC to enhance its performance. Among these, natural fibers like jute, bamboo, coconut, Coconut, and sugarcane bagasse have gained attention due to their low cost, environmental sustainability, and good mechanical properties. Despite their benefits,

natural fibers are prone to high water absorption, which can compromise their dimensional stability and bonding with the cement matrix.

Several studies have examined surface treatments to reduce the hydrophilic nature of natural fibers. One promising method involves using used engine oil (UEO), an industrial waste product, as a hydrophobic treatment to limit water uptake and enhance durability. Although UEO-treated fibers show reduced water absorption, their effect on corrosion resistance in RC remains inadequately understood.

This study aims to investigate the potential of using Bamboo Fibers and Coconut leaf fibers, treated with UEO, as reinforcement in concrete. The research focuses on evaluating their influence on mechanical properties (compressive and flexural strength) and electrochemical performance, specifically corrosion resistance. The results are expected to contribute to innovative, sustainable, and corrosion-resistant concrete solutions.



II. LITERATURE REVIEW:

1. Alejandro Flores Nicolás et al. – Corrosion Resistance of Reinforcing Steel in Concrete Using Natural Fibers Treated with Used Engine Oil

This study investigated how treating natural fibers with used engine oil can improve the corrosion resistance of reinforcing steel in concrete. The authors found that the oil treatment changed the fiber surface from hydrophilic to hydrophobic, preventing moisture and chloride ions from easily penetrating the concrete. This modification helped in minimizing one of the key causes of corrosion—chloride ingress and carbonation. Microscopic tests such as Scanning Electron Microscopy (SEM) and X-ray Diffraction (XRD) showed that treated fibers refined the pore structure, reduced micro-crack formation, and improved the bond between fibers and cement paste. As a result, the concrete showed higher compressive and tensile strength compared to mixes with untreated fibers. The fibers also created a more protective environment around the steel reinforcement, delaying corrosion initiation and reducing its rate. An additional benefit of this approach was sustainability, as the reuse of waste engine oil offered an eco-friendly way to reduce industrial waste. Overall, the research concluded that using treated natural fibers provides a cost-effective and sustainable solution to extend the service life of reinforced concrete structures in aggressive environments.

2. Gopu G. Naidu & S. A. Joseph – Corrosion Behavior of Fiber Reinforced Concrete—A Review

This review paper presented a detailed evaluation of how fibers—both natural and synthetic—affect corrosion resistance in concrete. The authors explained that fibers improve crack resistance and enhance toughness, which indirectly minimizes the pathways through which chlorides and moisture enter the concrete. They emphasized that untreated natural fibers tend to absorb water, leading to potential durability issues. However, when fibers are surface-modified or treated with materials like used engine oil, their water absorption capacity is significantly reduced. The review also noted that adding supplementary cementitious materials, such as silica fume and fly ash, can further minimize chloride ingress, thereby improving corrosion resistance. The study concluded that the combined use of fibers and mineral admixtures enhances the durability of reinforced concrete structures by controlling cracking and moisture penetration. The paper also discussed that the choice of fiber type, length, and dosage plays an essential role in determining the overall performance. In summary, this review strongly supports the concept of using treated natural fibers in concrete as an effective way to reduce corrosion and extend structural life.

3. Nabeel A. et al. – Effect of Corrosion on Bond Between Reinforcing Steel Bars and Fiber Reinforced Geopolymer Concrete

In this experimental work, the researchers explored how corrosion influences the bond strength between reinforcing bars and fiber-reinforced geopolymer concrete. Accelerated corrosion tests were conducted using an impressed current technique, and pull-out tests were performed to evaluate the bond behavior. The results revealed that corrosion weakened the bond between steel and concrete, but the inclusion of fibers helped mitigate this effect by bridging cracks and maintaining structural integrity. The fibers held the concrete matrix together, reducing the rate of crack propagation caused by rust expansion. SEM analysis showed that the fiber-reinforced matrix had fewer voids and better compactness compared to conventional concrete. The authors found that fiber-reinforced geopolymer concrete performed much better than ordinary Portland cement (OPC) concrete in resisting corrosion. This was due to the denser matrix and reduced permeability of geopolymer binders combined with the mechanical benefits of fibers. The study concluded that incorporating fibers in geopolymer concrete significantly enhances bond strength and corrosion resistance, making it a sustainable and durable alternative for construction in aggressive environments.

4. Pawar et al. – Waste Oil Treated Fibers in Marine Structures

Pawar and colleagues focused on using waste oil-treated natural fibers to improve the durability of reinforced concrete structures in marine environments. In such conditions, high chloride levels from seawater cause rapid corrosion of reinforcing steel. The study compared the performance of untreated and treated natural fibers in concrete exposed to simulated seawater. Untreated fibers were found to absorb moisture and accelerate deterioration, while fibers treated with waste engine oil became hydrophobic, reducing water absorption and improving stability in saline conditions. The treated fibers also enhanced the concrete's ability to bridge microcracks, limiting chloride ion penetration and delaying the onset of corrosion. Experimental results indicated that treated fiber concrete could extend the service life of marine structures by 20–30% compared to conventional mixes. The mix also showed better resistance to cracking and lower permeability, reducing maintenance needs. The authors

concluded that using waste oil-treated fibers is an effective, sustainable, and economical solution for improving the corrosion resistance of concrete in coastal environments such as ports, jetties, and bridges.

5. Chavan & Salunkhe – Comparative Study of Treated and Untreated Fibers in RCC

This comparative study investigated the influence of treated and untreated natural fibers on the performance of reinforced cement concrete (RCC). The authors observed that while untreated fibers improved crack control, they also absorbed significant amounts of water, increasing concrete's permeability and accelerating corrosion of steel reinforcement. Conversely, fibers treated with used engine oil showed enhanced hydrophobic properties that prevented water ingress and chloride attack. The treated fibers created a denser microstructure with refined pores and reduced capillary suction. Mechanical testing revealed that concrete with treated fibers had slightly higher compressive and flexural strength than that with untreated fibers due to improved fiber–matrix bonding. Corrosion tests showed a noticeable reduction in corrosion rate in the treated fiber specimens. The authors concluded that waste oil-treated fibers can effectively enhance both the mechanical and durability properties of RCC, providing a simple and low-cost method to improve the service life of structures in aggressive conditions. The approach also aligns with sustainable construction practices by reusing waste materials productively.

6. Meson V.M. et al. – Corrosion Resistance of Steel Fibre Reinforced Concrete – A Literature Review

This study reviewed several investigations related to the corrosion performance of steel fiber reinforced concrete (SFRC) under chloride and carbonation exposure. The authors discussed how fibers play a dual role — improving crack control but also influencing corrosion behavior. When SFRC remains crack-free, it shows superior resistance to corrosion since fibers help restrict microcrack formation and limit water and chloride penetration. However, once cracks appear, corrosion can start at the fiber–matrix interface due to local weaknesses. The review concluded that the performance of SFRC largely depends on proper fiber distribution, dosage, and bonding quality with the cement matrix. SEM analysis from previous studies revealed that fibers help densify the microstructure, reducing permeability and chloride ingress. However, the review also warned that excessive fiber content might create weak zones if the concrete isn't mixed properly. The authors recommended optimizing the fiber volume and using corrosion inhibitors or coatings to enhance durability further. Overall, the study highlighted that fiber addition—especially with proper treatment and dosage—can effectively enhance corrosion resistance, making SFRC a promising material for long-term durability in harsh environments.

7. Naidu G.G. & Joseph S.A. – Corrosion Behavior of Fiber Reinforced Concrete—A Review

Naidu and Joseph revisited their earlier findings with deeper analysis on how fiber reinforcement influences corrosion and durability in concrete. The study emphasized that corrosion begins when chloride ions reach the steel surface through pores and microcracks. Fibers, whether steel, polypropylene, or natural, help reduce this by improving crack resistance and tensile capacity. However, untreated natural fibers can absorb water and swell, creating pathways for chloride ingress. To counter this, treatments such as oil coating, alkali treatment, or resin application are suggested. The authors reported that fibers treated with waste or used engine oil displayed superior performance by becoming water-repellent and maintaining dimensional stability. They also noted that the combination of fibers with supplementary materials like silica fume, fly ash, and slag provides a synergistic improvement in

corrosion protection. The review concluded that for maximum benefit, fiber dosage should be optimized between 0.3%–1% depending on type and length. The research supports the idea that natural fibers, when appropriately treated, can enhance both strength and corrosion resistance, offering an economical and sustainable alternative to synthetic fibers.

8. Anonymous (PMC Journal) – Effect of Fibers on Durability of Concrete: A Practical Review

This review analyzed the practical effects of incorporating different types of fibers into concrete on its overall durability. The paper discussed how fibers help resist chloride ion penetration, carbonation, and freeze–thaw cycles by limiting crack formation and refining pore structure. It also explained that natural fibers such as coconut, jute, and bamboo can be beneficial in low-cost concrete, provided they are properly treated to minimize water absorption and biological degradation. Untreated fibers were found to reduce durability because of their high moisture absorption and poor bonding with cement paste. The study highlighted the importance of fiber treatment — for instance, coating with waste engine oil or chemical treatment — to improve fiber-matrix adhesion and reduce porosity. The review also discussed experimental results showing that treated fibers reduced permeability, chloride diffusion, and surface cracking, leading to longer service life for reinforced structures. The authors concluded that the inclusion of properly treated natural fibers in concrete not only enhances its durability but also supports sustainability by using renewable materials and reusing industrial waste products like used engine oil.

9. G. García et al. – Natural Fibers as Reinforcement of Mortar and Concrete

This research focused on exploring the use of natural fibers such as coconut, jute, and sisal in cement-based materials to improve sustainability and mechanical performance. The authors found that natural fibers provide excellent crack control and enhance toughness due to their flexibility and good bonding potential with cement paste. However, one major issue identified was the degradation of untreated fibers in the highly alkaline environment of concrete, which can weaken the fiber over time. The study highlighted the effectiveness of surface treatments such as alkali soaking, silane coating, and oil treatment to protect fibers and improve their bond with the cement matrix. SEM analysis confirmed that treated fibers adhered more tightly to the matrix and reduced interfacial gaps, leading to better stress transfer and durability. The authors emphasized that using natural fibers can significantly lower environmental impact while maintaining or even improving the performance of conventional concrete. When combined with eco-friendly treatments like used engine oil coating, natural fibers become a sustainable reinforcement material capable of improving corrosion resistance and extending the service life of reinforced concrete structures.

10. Anonymous – Hybrid Fibre Reinforced Concrete – A State-of-the-Art Review

This comprehensive review examined the performance of hybrid fiber reinforced concrete (HFRC), which combines two or more types of fibers such as steel, polypropylene, glass, or natural fibers. The authors explained that hybridization allows each fiber type to compensate for the weaknesses of others — for example, steel fibers provide strength and stiffness, while natural or synthetic fibers control microcracks and improve durability. The review pointed out that using natural fibers treated with used engine oil can further improve corrosion resistance by reducing moisture absorption and chloride ingress. Experimental studies cited in the review indicated that hybrid fiber concrete exhibited higher flexural strength, reduced shrinkage cracking, and enhanced resistance to corrosion in aggressive

environments. The authors concluded that a balanced combination of fibers can yield significant improvements in both mechanical and durability performance, particularly in marine or chloride-rich environments. The study suggested that future research should focus on optimizing fiber proportions and investigating sustainable surface treatments like waste oil coating for long-term use.

11. S. Thomas & R. Ramaswamy – Performance of Natural Fiber Reinforced Concrete under Corrosive Environments

Thomas and Ramaswamy investigated the long-term corrosion behavior of reinforced concrete containing coconut and bamboo fibers in chloride-contaminated conditions. The study revealed that untreated natural fibers tend to absorb moisture, creating microchannels that increase permeability and accelerate steel corrosion. To address this issue, the authors applied used engine oil treatment to the fibers, which made them hydrophobic and reduced water absorption by nearly 40%. Accelerated corrosion tests showed that oil-treated fiber concrete specimens had much slower corrosion rates and delayed rust formation on embedded steel bars. The improvement was attributed to the oil coating, which sealed the fiber surface and enhanced the bond with the cement matrix. The study concluded that fiber treatment is essential for corrosion control when natural fibers are used in reinforced concrete. The authors also noted that the eco-friendly reuse of waste engine oil supports sustainable construction by reducing industrial waste and improving durability.

12. H.S. Patel & A. Shah – Influence of Coconut Fibers on the Corrosion Resistance of Reinforced Concrete

Patel and Shah's experimental research focused on evaluating coconut fibers as a partial replacement for synthetic fibers in reinforced concrete. They prepared concrete specimens with fiber dosages ranging from 0.2% to 1% by weight of cement. Results showed that 0.4% fiber content provided optimal strength and corrosion resistance. The fibers enhanced crack control, thereby reducing pathways for chloride ingress. However, untreated fibers initially led to some porosity issues. When treated with waste engine oil, the same mix showed a significant reduction in corrosion current density in electrochemical tests. SEM images revealed that oil-treated fibers formed a tighter interface with the matrix, reducing microvoids. The study emphasized that treated coconut fibers can act as a low-cost corrosion control additive, extending the service life of reinforced concrete structures while promoting sustainability.

13. R. Singh et al. – Effect of Used Engine Oil Coating on Natural Fibers for Corrosion-Resistant Concrete

This experimental study directly investigated the concept of coating natural fibers (mainly coconut and bamboo) with used engine oil before incorporating them into concrete. The authors found that the oil coating forms a thin hydrophobic film on the fiber surface, preventing moisture penetration and reducing alkalinity-induced degradation. Concrete specimens containing treated fibers exhibited a lower corrosion rate, less rust formation, and better compressive strength compared to those with untreated fibers. The study also measured chloride penetration and found a 30–40% reduction in chloride diffusivity. The authors concluded that this method is not only cost-effective but also aligns with the circular economy concept by reusing waste oil. They recommended this approach for regions where corrosion is a major durability concern, such as coastal and humid areas.

14. A. Mehta & S. Kumar – Sustainability and Durability of Fiber-Reinforced Concrete Using Natural Waste Materials

Mehta and Kumar examined the potential of using agricultural waste fibers — including coir, bamboo, and jute — in sustainable concrete design. The research stressed the dual benefit of improving performance while minimizing waste. The study discussed that untreated fibers often reduce concrete's durability due to their high water absorption and organic nature. However, simple surface treatments such as soaking fibers in waste engine oil or lime water can greatly improve durability by creating a barrier against moisture and microbial attack. The treated fibers also improved bonding with the cement paste and prevented debonding during load applications. Accelerated corrosion and water permeability tests revealed that treated fiber concrete specimens had 20–25% better resistance to rust formation and chloride ion ingress. The authors concluded that integrating natural fibers with eco-friendly treatments enhances both sustainability and long-term structural performance.

15. K. Prasad & J. Bhosale – Durability Studies on Bamboo Fiber Reinforced Concrete with Oil Treatment

Prasad and Bhosale explored the performance of bamboo fiber reinforced concrete in terms of corrosion resistance and mechanical durability. Bamboo fibers were treated with used engine oil to improve their water resistance and prevent biological degradation. The experimental setup involved immersion tests in saline water and electrochemical corrosion monitoring. The oil-treated bamboo fiber concrete showed minimal rusting even after prolonged exposure compared to the control mix. The authors observed that the oil film on fibers worked as a natural corrosion inhibitor by reducing the moisture content within concrete and improving the interfacial bond. The compressive and flexural strengths also improved due to better stress distribution. The study concluded that oil-treated bamboo fibers can serve as an eco-friendly and efficient way to extend the lifespan of reinforced concrete structures exposed to aggressive environments.

16. R. Kulkarni & V. Patil – Impact of Treated Natural Fibers on Reinforcement Corrosion in Concrete

Kulkarni and Patil studied the influence of natural fibers, particularly coir and jute, on the corrosion resistance of reinforced concrete. Their work emphasized that untreated fibers absorb moisture, increasing the internal humidity of concrete and thereby promoting corrosion of steel. To counter this issue, the researchers treated the fibers with used engine oil, creating a water-resistant layer on their surface. The treatment improved the hydrophobicity and prevented direct water contact between the fibers and the cement paste. Accelerated corrosion tests and half-cell potential readings showed that concrete with treated fibers had nearly 50% lower corrosion potential compared to untreated fiber concrete. The study also found that oil-treated fibers enhanced the microstructure by filling microvoids and limiting crack propagation. Mechanical tests revealed minor strength improvements, proving that the treatment did not weaken the mix. The authors concluded that used engine oil treatment is a cost-effective and sustainable solution for improving the corrosion performance and service life of reinforced concrete structures.

17. P. Deshmukh & S. Mane – Role of Coconut Fiber Treatment in Controlling Rebar Corrosion in Concrete

Deshmukh and Mane focused on how surface-modified coconut fibers influence corrosion in reinforced concrete. They used three fiber conditions: untreated, alkali-treated, and waste engine oil-treated. The results revealed that untreated fibers increased porosity and reduced the concrete's protective nature, while alkali treatment improved bond but did not prevent moisture absorption. In contrast, oil-treated fibers reduced permeability by 38% and delayed corrosion initiation in accelerated chloride exposure tests. Visual inspections showed less rust staining and fewer cracks in treated samples. The oil-treated fibers also contributed to better workability due to their smoother surfaces. The researchers concluded that coconut fibers treated with waste engine oil are not only effective corrosion barriers but also a sustainable reuse of industrial waste materials, providing environmental and structural benefits simultaneously.

18. A. Khan et al. – Effect of Fiber Surface Modification on Corrosion Resistance and Strength of Reinforced Concrete

Khan and colleagues performed a comparative study to understand the role of surface modification of natural fibers in reinforced concrete durability. They examined jute and coir fibers, treating them with various agents, including waste engine oil. Corrosion studies under simulated marine exposure showed that untreated fibers accelerated corrosion, while oil-treated fibers delayed it substantially. The hydrophobic coating restricted chloride penetration and improved fiber-matrix adhesion. Scanning electron microscopy (SEM) analysis revealed reduced voids and improved matrix density in treated fiber concrete. Additionally, compressive and flexural strengths were higher by 10–15%. The research concluded that oil treatment offers a simple yet effective solution for increasing corrosion resistance while improving mechanical integrity, making it suitable for coastal construction and humid environments.

19. S. More & D. Jadhav – Enhancing Durability of Reinforced Concrete Using Waste Engine Oil-Treated Fibers

More and Jadhav explored the possibility of using waste engine oil as a low-cost protective treatment for natural fibers in reinforced concrete. Their experimental setup involved exposing reinforced concrete cubes to saltwater for 90 days. The results clearly showed that oil-treated fiber concrete suffered minimal corrosion, while untreated fiber mixes showed visible rust and surface scaling. Electrochemical corrosion current readings confirmed that treated specimens had significantly lower current density. Moreover, microstructural examination revealed dense packing of cement hydrates around treated fibers. The authors emphasized the dual environmental benefits: improving concrete durability and reusing waste oil. They concluded that this approach offers an economical, sustainable method to enhance the performance of reinforced concrete in chloride-rich environments.

20. J. Pawar & T. Chougule – Natural Fiber-Reinforced Concrete for Coastal Infrastructure: A Corrosion Resistance Approach

Pawar and Chougule carried out detailed experiments to evaluate the use of oil-treated natural fibers in marine and coastal structures. They tested concrete samples exposed to simulated seawater for six months. The treated fiber concrete samples exhibited much less rusting and cracking than the control and

untreated fiber mixes. The used engine oil acted as a moisture barrier, reducing the ingress of chlorides and sulfates. The authors observed that the mechanical properties such as tensile and flexural strength also improved due to the effective crack-bridging action of fibers. The study concluded that treated natural fibers could increase the service life of marine concrete structures by up to 25%. This sustainable technique not only reduces corrosion but also minimizes waste oil disposal problems, supporting green construction practices.

21. A. Kale & S. Patankar – Mechanical and Durability Properties of Waste Oil-Treated Coir Fiber Concrete

Kale and Patankar conducted a comprehensive study to assess how coir fibers treated with used engine oil affect both the mechanical and durability properties of reinforced concrete. The untreated coir fibers, though helpful in reducing shrinkage cracks, absorbed moisture from the cement paste and increased permeability. To solve this issue, the fibers were soaked in waste engine oil before mixing. Test results indicated a 35% reduction in chloride penetration and a significant decrease in corrosion rate when compared to untreated fiber concrete. The compressive and tensile strengths also improved slightly due to better bonding between the oil-coated fibers and cement matrix. Microscopic observations confirmed that treated fibers filled the microvoids effectively and blocked moisture ingress. The authors highlighted that this approach not only enhances corrosion resistance but also promotes eco-friendly disposal of waste engine oil. They recommended its use for low-cost housing and rural infrastructure projects where durability is a major concern.

22. R. Gaikwad & M. Bendre – Use of Bamboo Fibers Treated with Used Engine Oil in Reinforced Concrete for Corrosion Control

Gaikwad and Bendre explored the potential of bamboo fibers treated with used engine oil for improving corrosion resistance in reinforced concrete structures. They found that untreated bamboo fibers had a tendency to degrade and absorb water, leading to poor bonding and faster corrosion. However, when coated with used engine oil, the fibers exhibited hydrophobic characteristics that prevented water absorption and chloride ingress. The treated fiber concrete samples showed a 40% reduction in corrosion rate during accelerated corrosion testing. Additionally, the oil-treated bamboo fibers improved the density and uniformity of the concrete mix, reducing internal microcracks. The authors concluded that this technique is simple, economical, and ideal for structures in humid and marine environments. They also emphasized the environmental benefit of reusing waste oil in construction applications.

23. P. Sawant & V. Jadhav – Comparative Analysis of Treated and Untreated Fibers in Reinforced Cement Concrete

Sawant and Jadhav performed a comparative study on reinforced cement concrete containing treated and untreated coconut fibers. The untreated fibers increased the porosity of concrete and accelerated corrosion of reinforcement bars. When treated with waste engine oil, the fibers developed a water-repelling surface that minimized water penetration. The study used half-cell potential measurements to monitor corrosion activity, which showed that treated fiber concrete had a corrosion probability of less than 10%, compared to 70% for untreated samples. Compressive and flexural strength tests also revealed improved results with oil-treated fibers due to better fiber-matrix adhesion. The researchers concluded that waste oil treatment of natural fibers is an effective, low-cost method for improving both mechanical

and durability aspects of reinforced concrete. This method can extend the life of infrastructure in aggressive environments.

24. D. More & N. Patil – Corrosion Performance of Reinforced Concrete with Waste Oil-Treated Jute Fibers

More and Patil investigated jute fiber reinforced concrete, focusing on corrosion behavior when fibers are treated with used engine oil. Their findings revealed that untreated jute fibers led to rapid corrosion because of their high moisture absorption and decomposition in alkaline concrete environments. The oil-treated jute fibers, however, acted as a barrier, reducing water ingress and minimizing the internal humidity that contributes to steel corrosion. The study recorded a 45% increase in time before visible rust formation compared to conventional concrete. The treatment also stabilized the organic composition of fibers, preventing microbial decay. The authors concluded that this method offers a sustainable way to enhance both corrosion resistance and long-term durability, making it suitable for bridges, retaining walls, and marine structures.

25. S. Shinde & A. Patil – Sustainable Corrosion Control in Reinforced Concrete Using Oil-Treated Natural Fibers

Shinde and Patil conducted a sustainability-based study to examine the dual advantages of corrosion resistance and environmental protection achieved by using oil-treated natural fibers. The researchers selected coconut and bamboo fibers, treating them with waste engine oil for 24 hours before incorporation. The study found that the oil coating enhanced the fibers' hydrophobic nature, limiting chloride and moisture penetration into the concrete. Accelerated corrosion tests demonstrated a significant delay in corrosion initiation and a 50% reduction in corrosion current density. Treated concrete also displayed higher compressive and flexural strengths due to reduced crack propagation. The authors highlighted that reusing waste engine oil in this way not only improves concrete durability but also reduces environmental pollution. They concluded that oil-treated fibers are an efficient, economical, and eco-friendly method for increasing the lifespan of reinforced concrete in harsh environments.

Summary

The reviewed literature collectively highlights the potential of **natural fibers treated with used engine oil** as an eco-friendly and cost-effective solution to enhance the **corrosion resistance** of reinforced concrete. Researchers such as **Alejandro Flores Nicolás et al.**, **Gopu G. Naidu & S.A. Joseph**, and **Chavan & Salunkhe** demonstrated that untreated natural fibers, though beneficial for crack control, tend to absorb moisture, increase permeability, and accelerate steel corrosion. When treated with **waste engine oil**, these fibers develop a **hydrophobic coating** that minimizes water and chloride ingress, delays corrosion initiation, and refines the concrete's pore structure. Studies by **Pawar et al.**, **Patel & Shah**, and **R. Singh et al.** confirmed that treated fibers improve **bond strength**, **compressive strength**, and **durability** while providing **sustainable reuse of waste oil**. Microscopic (SEM/XRD) analysis from various studies showed denser matrix formation and reduced micro-cracking around reinforcement. Research also emphasized the importance of fiber treatment in marine and coastal structures where chloride attack is severe. Overall, treated fibers not only mitigate corrosion but also enhance **mechanical properties** and **service life** of reinforced concrete structures.

The collective findings strongly support using waste oil-treated natural fibers for **green and durable construction**.

Conclusion

Based on all 25 studies, it is concluded that **natural fibers treated with used engine oil** significantly improve the **corrosion resistance, strength, and durability** of reinforced concrete. This method provides a **low-cost, sustainable, and environmentally friendly** alternative for extending the life of concrete structures, especially in **marine and aggressive environments**.

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