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A REVIEW ON USING BAMBOO REINFORCE IN CONCRETE

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ABSTRACT

Indeed, bamboo reinforced concrete is a novel approach in the building sector, drawing upon the material properties of bamboo to advance the efficiency of concrete structures. Having a remarkably fast growth rate and compared to steel as reinforcement in concrete, the tensile strength of bamboo has made it increasingly sought after for some environmentally friendly purposes. This paper assesses the feasibility of bamboo in concrete reinforcement, particularly focusing on its mechanical properties, durability, and environmental benefits.

1. INTRODUCTION

Several experimental studies have found that under specific applications, bamboo can satisfactorily replace traditional steel reinforcement, providing characteristics similar in strength but improved sustainability within concrete structures. The study encompasses the problems that emerge due to the susceptibility of bamboo towards environmental deterioration, enhancement processes by treatment, and the need for standardization in techniques of reinforcement through bamboo-based concrete. The findings of this paper indicate the possible role that bamboo-reinforced concrete could play towards sustainable construction approaches due to the increased availability of bamboo across regions, and it may be a decisive contribution towards the reduction of carbon footprint within the construction industry itself.

2. LITERATURE REVIEW

There has been a lot of interest in using bamboo as concrete reinforcement because it is environmentally friendly, highly available, and has favorable mechanical characteristics. Established reinforced concrete structures depend very heavily on steel reinforcement, which is energy-intensive and environmentally unfriendly. Bamboo is viewed as a source of renewable material with a high strength-to-weight ratio and can grow into trees within a very short cycle. This literature review studies researches focused on the mechanical, environmental, and practical aspects of bamboo-reinforced concrete. Therefore, it shows both potential and limitations.

Ibedu Kenneth Ejike and other authors (2023) :-

Carried out experimental study to know the flexural behavior of bamboo-reinforced concrete beam as sustainable steel reinforcement. Specimens prepared with 1% steel and 1%, 2%, 3% bamboo reinforcements. Maximum load and displacement of 3% bamboo in close resemblance to 1% steel indicated that bamboo is likely to replace steel reinforcement. Bamboo can be considered as a material viable for longitudinal reinforcement in light structures and provides a cost-effective and sustainable solution.

Ika Bali (2021):- in his experimental study shows Bamboo as a Green Steel Alternative in Reinforcement of Concrete. Bamboo has high tensile strength with less energy consumption. Researchers indicate that this can be a perfect candidate for concrete beams, slabs, and columns reinforcing agents. The durability and bonding strength should be at its highest because after applying Sikadur 32-Gel as a treatment agent, the performance increases highly. In principle, bamboo can replace steel during construction activities hence promoting green development and reducing the effects on the environment. Additionally, more research is needed to allow for standardization and testing for durability.

Khosrow Ghavami (2005):-In his investigation the viability of using bamboo instead of steel as reinforcement in concrete because costs of steel rise. Experimental tensile test on Moso bamboo and four-point bending test on bambooreinforced concrete beams. There is significant scatter in properties of bamboo. The slip between bamboo and concrete is very difficult to quantify, which could lead to an overestimation of capacity in design using current methods. A new design methodology for bamboo-reinforced concrete is required.

Bibek Bhardwaj and other author (2023):-Compare the flexural properties of concretes reinforced with bamboo strips and steel bars.96 beams (100x 100 x 450 mm) tested at various curing ages (7, 14, 21, 28 days).Bamboo is a promising alternative to steel in lightweight construction applications. Flexural strength of concrete beams, reinforced with steel bars was more than that reinforced with bamboo strips. Concrete grades more than 30 enhanced the flexural property both. Bamboo can be suited for low-cost, lightweight construction but may not replace conventional steel whenever a superior load carrying capacity is the main aim.

Kent A. Harries and other author (2019):- Bamboo has been proposed as a 'green' and economical steel substitute to reinforce concrete. Severe problems with its durability, strength, and stiffness drastically limit its applicability in load-carrying structures. Environmental benefits cannot be claimed since life cycle assessments have proven higher emissions than steel. A few practical applications could be possible in crack-controlled slabs and light cement bamboo frame

panels; the problem there is reliability with the element's durability. Bamboo-reinforced concrete is simply impractical for structural primary elements based on mechanical limitations and demands placed on the material by required treatments.

Mritunjay Kumar Singh and other authors (2020):- In his studies they find that the efficiency of Bamboo as Alternation of Steel Rebar in Concrete. Like steel, the tensile strength of bamboo is similar. Has the potential to score on economic and environmental fronts too. People have been consuming it; however not so systematically in modern application. Suggested ratio for optimum bamboo reinforcement. Test results indicate that it may be used to reduce the weight and cost incurred in the construction process.

Masakazu Terai & Koichi Minami, Fukuyama (2012):- The paper studies the mechanical properties of bamboo reinforced concrete as an eco-friendly alternative for steel. Bamboo promises cost-effective and green construction advantages. Corrosion and bond characteristics of bamboo in concrete are studied. The BRC has a comparable strength of bonding to that of steel. Effective treatments to the surface enhance its performance. Strength and bond integrity of concrete also depend on curing conditions. BRC has promise for practical applications; research is still needed in design and for it to be durable.

Dr. Vijaya Kumar Y M, Dr. Meena Y R (2022):- In his study they find that to evaluate the potentiality of bamboo as a low-cost reinforcement to replace steel in concrete. Pre-treatment and coating of bamboo to give it water-resistance. Tension and flexural tests were conducted on concrete beams. Bamboo reinforcement is approximately three times cheaper than steel. Bamboo beams had 39% lesser load-carrying capability than that of steel, but it has more flexural strength. They suggested modifications were better waterproofing and greater reinforcement to enhance overall performance.

3. CONCLUSION

It promises an alternative to steel reinforcement as used traditionally, presenting significant environmental, economic, and sustainability advantages. High strength-to-weight ratio, low cost, rapid renewability, and attractive aspect in terms of being a component for low-cost, lightweight structures make it very resourceful in areas where there are ample resources of bamboo. However, for similar or greater levels of flexural strength, this performance may be attainable in specific applications by bamboo compared with conventional reinforcement; its concrete performance is influenced by variability in materials, durability issues, and the requirement for appropriate treatment to avoid environmental degradation. Although these issues pose specific challenges, bamboo offers promising opportunity as a sustainable reinforcement material, especially in non-load bearing or low stress applications, such as lightweight housing and infrastructure. Research in greater detail is necessary before standardization of the treatments in order to enhance the efficiency of the bond in the bamboo concrete system as well as in the design procedures. Although, in the near future, it will not replace steel for structural structures working under heavy loads at very high performance levels, for many environmentally friendly construction projects, it can save the carbon footprint of the built environment to a great extent. So, with advancing material science and construction techniques, the future of green construction might be bamboo-reinforced concrete.

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