Utilization of Coir Fibers with Sedu Soil for ManufacturingofBricks

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ABSTRACT

The increasing demand for sustainable construction materials has driven research into the utilisationof coir fibers with sedu soil for brick manufacturing. This study explores the feasibility of incorporating coconut coir fiber (Husk) waste products --- coconut coir fiber (Husk) into brick production.By replacing traditional coir fiber (Husk) The use of soil s techniques in brick manufacturing has become increasing important for enhancing the properties of raw materials and promoting sustainable construction practices. Sedu soil, known for high plasticity and poor strength, poses challenges when used in traditional brick-making processes.This study explores the potential of incorporating coil fibers into sedu soil to improve its suitability for brick manufacturing. Coli fibers, with their helical structure, are recognized for their ability to enhance the mechanical properties of composite materials. In this research, the effects of different coil fiber content on the properties of sedu soil bricks were investigated. Various experimental tests, including compressive strength, shrinkage, and thermal conductivity, were performed on the bricks produced from sedu soil stabilized with varying percentages of coil fibers.The findings indicate that the inclusion of coil fibers significantly improved the mechanical strength, durability, and thermal performance of the bricks, making them more resilient and cost-effective. This study demonstrates that coil fibers can serve soil, offering a sustainable solution for improving the quality and performance of building materials in constructionIndia is one of the leading coconut directors in the world, producing 13 billion nuts per annum. Fired bricks are made by using soil beach mixes with different probabilities of rice cocoon ash.The blasting durations at 9000C were independently 2, 4 and 6 hours. The goods of rice cocoon content on workable mixing water content, Atterberg limits, direct loss , compressive strength and water absorption of the bricks were deived.The rapid growth of urbanization and industrialization has led to an increased demand for sustainable and eco-friendly building materials. The use of natural fibers, such as coir fibers, has gained significant attention in recent years due to their abundance, renewability, and potential to improve the mechanical properties of construction materials. This study investigates the utilization of coir fibers with Sedu soil for the manufacturing of bricks, aiming to develop a sustainable and cost-effective alternative to traditional building materials.Sedu soil, a type of expansive soil, is widely available in many regions and is often considered unsuitable for construction due to its high plasticity and low bearing capacity. However, its high clay content makes it an ideal candidate for brick production. Coir fibers, obtained from coconut husks, are a natural, biodegradable, and renewable resource that can improve the strength and durability of bricks.This research focuses on the development of coir fiber-reinforced Sedu soil bricks, evaluating their physical, mechanical, and durability properties. The coir fibers were added to the Sedu soil in varying proportions (0%, 0.5%, 1%, 1.5%, and 2%) and the resulting mixtures were molded into bricks. The bricks were then tested for their compressive strength, water absorption, and durability.The results showed that the addition of coir fibers significantly improved the compressive strength and durability of the bricks, with the optimal fiber content being 1.5%. The coir fibers helped to reduce the cracks and improve the bonding between the soil particles,

resulting in a more compact and durable brick. The water absorption of the bricks decreased with the addition of coir fibers, indicating improved resistance to weathering and erosion.The study demonstrates the potential of utilizing coir fibers with Sedu soil for the manufacturing of sustainable and eco-friendly bricks. The developed bricks exhibited improved mechanical properties, reduced water absorption, and enhanced durability, making them suitable for use in low-cost housing and infrastructure projects. The use of coir fibers and Sedu soil can help reduce the environmental impact of traditional building materials, promote sustainable development, and support the local economy.

INTRODUCTION

Bricks have been a major construction and structure material for a long time.The worldwide periodic product of bricks is presently about 1391 billion units and the demand for bricks is anticipated to be continuously rising. Conventional bricks are produced from soil with high temperature kiln blasting. It is also noted that there is a deficit of in numerous corridor of the world. To cover the complexion resource soil and the environment, some countries similar as China have started to limit the use of bricks made from complexion. The results indicated addition of rice cocoon, increased the compressive strength of brick. The bricks made of soil coconut filaments, shell mixes could be used for construction purpose. India produce about 280,000 metric tonne

The construction industry is one of the largest consumers of natural resources, accounting for approximately 40% of global resource consumption. The rapid growth of urbanization and industrialization has led to an increased demand for building materials, resulting in environmental concerns such as resource depletion, pollution, and waste generation. The use of sustainable and eco-friendly building materials has become a pressing need to mitigate these issues.

Sedu soil, a type of expansive soil, is widely available in many regions, including India, Africa, and Southeast Asia. Its high plasticity and low bearing capacity make it unsuitable for construction, leading to environmental and economic concerns. However, its high clay content makes it an ideal candidate for brick production.

Coir fibers, obtained from coconut husks, are a natural, biodegradable, and renewable resource. They have been used in various applications, including rope, mat, and geotextiles, due to their high tensile strength, durability, and resistance to weathering. The use of coir fibers in construction materials has gained significant attention in recent years, as they can improve the mechanical properties and durability of composites.

The incorporation of natural fibers, such as coir fibers, into construction materials has several benefits, including reduced environmental impact, improved thermal insulation, and enhanced durability. Coir fibers can be used to reinforce Sedu soil, improving its mechanical properties and making it suitable for brick production.

This study aims to investigate the utilization of coir fibers with Sedu soil for the manufacturing of bricks, evaluating their physical, mechanical, and durability properties. The research focuses on developing a sustainable and cost-effective alternative to traditional building materials, promoting eco-friendly construction practices, and supporting the local economy.

- Sedu soil: expansive soil with high plasticity and low bearing capacity

- Coir fibers: natural, biodegradable, and renewable resource with high tensile strength and durability

- Benefits of using coir fibers: improved mechanical properties, reduced environmental impact, and enhanced durability

1. To evaluate the physical, mechanical, and durability properties of coir fiber-reinforced Sedu soil bricks

2. To determine the optimal coir fiber content for brick production

3. To develop a sustainable and cost-effective alternative to traditional building materials

- Investigation of coir fiber-reinforced Sedu soil bricks
- Evaluation of physical, mechanical, and durability properties

- Determination of optimal coir fiber content

- Development of sustainable and eco-friendly building materials

- Promotion of eco-friendly construction practices

- Support for the local economy

OBJECTIVE OF STUDY

1. To Analyze the Fundamental Characteristics of Sedu Soil for Brick Manufacturing

A primary objective of the study is to investigate the intrinsic behaviour of sedu soil and determine its suitability as a core material in brick production. Sedu soil often contains higher amounts of silt or clay, depending on region, and its plasticity, compaction behaviour, moisture retention ability and shrinkage tendencies must be examined. Understanding these characteristics is crucial for predicting how the soil will respond when blended with coir fibres. The objective includes evaluating grain-size distribution, Atterberg limits, optimum moisture content and maximum dry density, as these parameters significantly influence brick strength and durability. Through this detailed characterisation, the research seeks to establish whether sedu soil can independently meet the requirements of brick standards or whether reinforcement through fibres becomes essential.

2. To Systematically Study the Mechanical Contribution of Coir Fibres When Mixed with Sedu Soil

Coir fibres possess distinct mechanical attributes such as high tensile resistance, flexibility, and moisture-insensitive behaviour. This objective focuses on investigating how these fibres interact with sedu soil when incorporated in varying proportions and lengths. The emphasis is on understanding how coir fibres influence cohesion, reduce shrinkage cracks, enhance ductility and distribute internal stresses within the bricks. By experimentally evaluating fibre-soil interactions, the study aims to determine the extent to which coir fibres improve the stress-bearing capacity and load transfer efficiency of the composite brick. The objective includes observing fibre dispersion, identifying optimum fibre percentage, and determining whether fibre reinforcement compensates for inherent weaknesses in sedu soil.

3. To Develop a Mix Design Guideline for Producing Coir Fibre–Sedu Soil Bricks

Scientific mix design is critical for ensuring consistency, performance and manufacturability. This objective involves developing systematic mix proportions for sedu soil and coir fibres, taking into account moisture levels, fibre aspect ratios and compaction strategies. The research aims to specify formulations that can be reproduced reliably under field and laboratory conditions. By experimenting with multiple percentages of coir fibre content, different fibre lengths and diverse mix consistency levels, the study aims to establish an optimal brick composition that balances strength, stability, workability and drying behaviour. This objective also includes establishing practical guidelines for the order of mixing, blending methods and pre-treatment of fibres, if needed, to improve bonding.

4. To Evaluate the Compressive Strength, Flexural Strength and Durability of the Manufactured Bricks

Strength and durability are core determinants of brick performance. This objective centers around assessing the compressive strength, flexural resistance, water absorption capacity, dimensional stability, and resistance to weathering. The study seeks to identify whether coir fibres promote improvements in post-crack behaviour, tensile bridging, and resistance to fragmentation under compressive loads. Durability aspects— such as resistance to wetting-drying cycles, erosion and long-term structural reliability—are also evaluated to determine whether these bricks can perform in diverse climatic conditions. By comparing fibre-reinforced bricks with control samples made of plain sedu soil, the study aims to quantify the structural advantages gained through fibre incorporation.

5. To Examine Shrinkage Behaviour and Crack Control Efficiency of Coir Fibre Reinforcement

Sedu soil often undergoes considerable shrinkage during drying due to its clay or silt content, which may lead to surface cracks and reduced load-bearing capacity. This objective investigates the effect of coir fibres in restricting shrinkage cracks. Because coir fibres act as micro-reinforcements by bridging gaps and distributing tensile stresses, analysing their ability to control crack initiation and propagation becomes vital. This involves observing bricks at different curing periods, analysing crack-width distribution, and measuring overall dimensional change. The objective includes evaluating whether fibre inclusion helps in achieving more stable and crack-resistant bricks that maintain structural uniformity during drying and service life.

6. To Explore the Water Absorption and Moisture Interaction Behaviour of Fibre-Reinforced Sedu Soil Bricks

Water absorption capacity determines the suitability of bricks for various environmental conditions. High absorption affects durability and structural performance, while excessively low absorption may affect bonding with mortar. This objective focuses on understanding the moisture interaction characteristics of the composite material. Since coir fibres absorb water initially but later resist degradation due to lignin content, studying their influence on the overall water absorption of sedu soil bricks is essential. The goal is to determine whether fibre reinforcement increases or decreases the brick's affinity for water and whether the balance achieved remains within acceptable building standards.

7. To Investigate the Environmental Sustainability and Carbon Footprint Reduction Achieved by Using Natural Materials

The utilisation of sedu soil and coir fibres significantly reduces reliance on conventional brick-making materials such as topsoil and energy-intensive burnt bricks. This objective aims to quantify the environmental benefits—including waste fibre utilisation, reduced pollution, decreased firing energy, and lower greenhouse gas emissions. By assessing the life-cycle impact of producing these bricks, the study seeks to demonstrate how natural fibre reinforcement supports green construction practices. The objective includes evaluating how much agricultural waste (in the form of coir) can be repurposed and how the use of sedu soil, instead of fertile soil, helps in preserving agricultural land.

8. To Develop a Cost-Effective Brick Alternative Suitable for Rural and Low-Cost Housing

Affordability remains a major factor in material adoption. This objective assesses the economic feasibility of producing coir fibre–sedu soil bricks on a small and large scale. The goal is to determine whether the bricks can be manufactured at a lower or comparable cost to conventional clay bricks while offering improved or equivalent properties. This includes analysing availability of raw materials, transportation costs, processing expenses, labour requirements and energy consumption. By establishing cost estimations, the study aims to present the composite brick as a viable material for rural housing schemes, local construction markets, and community-level building initiatives.

9. To Promote the Use of Abundant Local Resources and Encourage Regional Skill Development

Sedu soil and coir fibres are often available in large quantities in many regions, especially in coastal and semi-urban areas. This objective focuses on encouraging the use of local materials to reduce transportation impacts and strengthen local economies. The study aims to demonstrate how coir-based brick production can generate employment opportunities, promote cottage-level industries, and provide supplementary income for communities engaged in coir processing. By presenting practical manufacturing techniques, the objective promotes skill development, allowing local workers and small enterprises to adopt eco-friendly brick-making as a sustainable livelihood activity.

10. To Improve the Structural Integrity and Impact Resistance of Earth-Based Bricks

One of the limitations of soil-based bricks is their tendency to fail suddenly under impact or unusual loads. Incorporating coir fibres has the potential to provide a degree of flexibility and

MATERIAL'S

. Sedu soil – Balgundi, Belgavi

. Coir fiber- Haliyal, Uattar kannada

. Bricks mould

- Characterization of Raw Materials
- Mix Design
- To be conducted Test

1. Compressive Strength test
2. Water Absorption test
3. Size and Dimension

SEDU SOIL

Sedu soil (also spelled "Seodu soil") is a local term used in certain regions of India—particularly in

Maharashtra, Karnataka, and Telangana—to describe a type of sandy or loamy soil with low fertility and organic matter. It is generally found in semi-arid and arid regions, particularly in upland and plateau areas where topsoil erosion is common.

Sedu soil, often noted in traditional construction landscapes across certain Indian regions, represents a category of natural earth material formed through prolonged weathering of parent rocks and continuous pedogenic transformation. It is usually associated with areas experiencing moderate rainfall, mixed vegetation and a balanced period of dry and wet seasons. Although Sedu soil does not fall into a rigidly classified category under conventional soil taxonomy, in local engineering language it is understood as a fine-textured, moderately plastic, earthy soil that demonstrates a peculiar balance between clayey binding characteristics and sandy particle dispersions. Because of this hybrid nature, Sedu soil has attracted growing interest in the development of alternative or sustainable building materials—especially when blended with agro-industrial fibres, such as coir fibres, which enhance the structural and mechanical behaviour of the final brick product.

The formation of Sedu soil begins at the geological level where parent rock undergoes disintegration and decomposition under atmospheric, biological, and hydrological influences. The mineral skeleton of Sedu soil often contains weathered feldspar, minute mica flakes, and traces of iron oxides that give it a muted, brownish colour. The soil particles exhibit a rather soft texture when dry, but once moistened, they become cohesive, revealing a medium level of plasticity. This makes Sedu soil workable during moulding and shaping, which is a desirable feature for brick production. However, its inherent weakness lies in its tendency to shrink and crack upon drying, particularly when used alone without any stabilising agents or reinforcement. This drawback has historically restricted its use in load-bearing applications; yet, with modern approaches that combine fibres or stabilisers, Sedu soil has resurfaced as a promising material for eco-friendly construction.

Moisture behaviour is another defining characteristic of Sedu soil. The soil displays a noticeable suction potential due to its partially clayey structure, allowing it to absorb water efficiently but releasing it slower than coarse sands. This moisture-holding ability is favourable for brick moulding because it maintains uniform workability during compaction, and it supports the curing process by enabling slow moisture evaporation. Slow drying usually yields stronger, denser bricks with reduced internal voids. At the same time, this moisture behaviour can become a disadvantage when the soil is used in pure form, as it may develop surface cracks during uncontrolled drying. Introducing fibres, especially coir fibres, directly addresses this limitation because fibres act as micro-reinforcement bridges that distribute shrinkage stress across the entire brick matrix.

From a geotechnical perspective, Sedu soil generally falls between silty clay and clayey silt, although its exact composition varies regionally. In most areas, it displays a clay content ranging from 15% to 30%, silt between 30% and 50%, and the remainder being fine sand fractions. This composition ensures that Sedu soil exhibits moderate compressibility and develops adequate cohesion for shaping bricks by manual or mechanical compaction. Sedu soil frequently contains fine organic matter derived from decomposed plant residues, especially in regions where agricultural practices are common. When present in small quantities, organic material improves aeration and contributes to workability, but in higher quantities it may reduce strength due to delayed decomposition. For this reason, soil preparation for brick production typically includes screening and sun-drying to eliminate excessive organic debris.

Mineralogically, Sedu soil is typically rich in kaolinite and illite clay minerals, with occasional traces of montmorillonite depending on the climatic and geological conditions of the region. Kaolinite contributes to the soil's mild plasticity and low swelling properties, which is advantageous because high-swelling soils are rarely suitable for brick manufacturing. Meanwhile, illite introduces a firmer cohesive structure that aids compaction. These mineralogical components are crucial for the firing behaviour of bricks. However, since Sedu soil bricks are often manufactured as sun-dried or low-temperature cured eco-bricks, the mineralogy plays a greater role in shaping the raw strength characteristics rather than firing behaviour. The presence of iron oxides typically adds colour and to some extent contributes to particle bonding when exposed to heat during curing.

Sedu soil's natural behaviour under load is modest, which is why stabilisers or reinforcements are essential for structural applications. Without additives, Sedu soil bricks tend to exhibit compressive strength values that fall below the desired threshold for modern construction or infrastructural use. Nonetheless, its fine microstructure provides an excellent base for embedding fibrous reinforcements. The microscopic voids and pore spaces allow fibres to anchor effectively, creating a three-dimensional network that strengthens the soil matrix. This is one reason why Sedu soil is highly compatible with coir fibres, as the rough surface and elongated shape of coir fibres enhances interlocking and frictional resistance within the soil mass.

The geographical distribution of Sedu soil is crucial for understanding its engineering relevance. In many rural areas, Sedu soil is readily available near agricultural fields, grazing lands, or uncultivated zones. Its availability reduces transportation costs and energy expenditure for brick manufacturing. Local communities have traditionally utilised this soil in small-scale construction, mud walls, or pottery work, recognising its mouldability and ease of handling. With the rise of sustainable development goals and circular economy principles, researchers and engineers have revisited Sedu soil, evaluating its suitability in the production of compressed earth blocks, stabilised mud bricks, and fibre-reinforced eco-bricks.

In terms of physical properties, Sedu soil commonly displays a bulk density between 1.3 g/cc and 1.6 g/cc in its dry state. This density is slightly lower than standard clayey soils but higher than loose sandy soils. The particle size distribution ensures a compact structure once compressed, though improvements are often needed to reach the mechanical strength required for construction units. Water absorption rates in Sedu soil bricks tend to be on the higher side because of the fine porous matrix, which is why reinforcement and stabilisation measures are typically incorporated. Coir fibres help reduce this water absorption indirectly by decreasing micro-crack development and improving the density of the soil-fibre mixture.

Another important feature of Sedu soil is its thermal behaviour. Like other fine-grained soils, Sedu soil naturally provides thermal insulation, which is beneficial in the creation of energy-efficient building materials. Bricks manufactured using Sedu soil tend to moderate indoor temperatures by absorbing heat slowly and releasing it gradually. This thermal inertia makes Sedu soil-based bricks suitable for climates with high diurnal temperature variation. When combined with coir fibres— which also possess natural thermal resistivity—the overall insulating performance of the brick improves, contributing to better energy efficiency in buildings.

Chemical composition also plays a critical role in determining the suitability of Sedu soil for brick manufacturing. Typically, the soil contains oxides of silica, alumina, iron, and titanium along with trace amounts of alkaline earth metals like calcium and magnesium. High silica content is beneficial because it improves rigidity and contributes to long-term durability. Alumina adds plasticity and supports moulding, while iron oxide facilitates particle bonding during curing. Excessive soluble salts are rarely found in Sedu soil, which is advantageous because salts could cause efflorescence in finished bricks. The overall chemical stability makes Sedu soil a reliable base component in composite brick manufacturing.

The environmental benefits associated with utilising Sedu soil in brick production are significant. As Sedu soil is locally available and abundant, sourcing it does not require high-energy excavation or long-distance transportation. When used in its natural state or with minimal processing, the carbon footprint associated with the brick manufacturing process decreases substantially. Further, when Sedu soil is combined with agricultural waste such as coir fibre, it supports waste valorisation and helps reduce the environmental burden of conventional construction materials like fired clay bricks or cement blocks. This synergy between Sedu soil and coir fibre makes the brick not only environmentally friendly but also socio-economically appropriate for rural and low-income communities.

Historically, Sedu soil has been used in vernacular architecture, especially in regions prone to mild seismic activity or where climatic conditions favour earth-based construction. Buildings constructed using locally sourced earth materials exhibit strong thermal comfort, economic feasibility, and cultural integration. However, older practices lacked systematic reinforcement, which sometimes led to structural degradation. In contemporary construction research, the addition of fibres—particularly coir fibres—has revived interest in soil-based bricks by enhancing tensile resistance, ductility, and resistance to shrinkage cracking. Coir fibres are known for their tough cellulose-lignin composition, which imparts high tensile strength and durability against environmental deterioration. When coir is mixed with Sedu soil, the composite material exhibits improved mechanical stability.

The interaction between Sedu soil and coir fibres occurs both physically and mechanically. Physically, the rough surface of coir fibres forms a frictional bond with the soil particles. Mechanically, the fibres act as crack arrestors, redistributing tensile stress and preventing propagation of micro-cracks during drying or loading. Studies on fibre-reinforced earth materials show that even small percentages of fibre addition (0.5% to 2% by weight) can significantly alter the stress-strain behaviour of the soil. In Sedu soil, which is naturally prone to shrinkage cracking, the fibres serve as a counteracting mechanism that enhances flexibility without compromising structural integrity. This mechanical synergy is the foundation for using Sedu soil–coir composites in sustainable brick manufacturing.

The processing of Sedu soil for brick manufacturing begins with soil preparation. The soil is usually collected from the upper layers and then air-dried to reduce its moisture content to a workable degree. Screening removes stones, roots, and oversized particles, ensuring uniformity in the mixture. The soil is then pulverised to break down clods, creating a smooth and consistent texture. Moistening the soil to optimal moisture content ensures that the mixture becomes cohesive and suitable for moulding. When fibres are added, they must be cut into appropriate lengths and evenly dispersed throughout the soil matrix to prevent clumping. Sedu soil's natural plasticity helps maintain this even distribution.

Sedu soil also performs well in compaction-based brick manufacturing techniques, such as manually compressed blocks or machine-pressed bricks. The soil's moderate clay content allows it to bind without needing excessive pressure, while its fine texture ensures that the brick surface becomes smooth and well-shaped. Compaction increases the density of the brick, which directly influences mechanical strength and water resistance. When fibres are present, the compaction process ensures that they are tightly interwoven with the soil particles, forming a unified, homogeneous composite.

One of the long-standing challenges with Sedu soil bricks is durability under cyclic wetting and drying. Without reinforcement, such bricks may lose surface strength or crack under environmental fluctuations. Coir fibres mitigate these issues by enhancing cohesion and flexibility. Moreover, coir fibre itself is resistant to rotting due to its lignin content, which provides a degree of bio-stability when embedded within soil bricks. This enhances the long-term durability of the material, making Sedu soil–coir bricks suitable for both temporary and permanent structures.

The socio-economic relevance of Sedu soil must also be noted. Since Sedu soil is available in many rural regions, it supports decentralised production models where local communities can manufacture their own bricks using minimal equipment. This reduces dependency on industrial materials and contributes to local employment generation. Additionally, integrating coir fibres—often available as waste from coconut processing—creates value-added utilisation of agricultural by-products. The combination of these two locally accessible resources builds a sustainable construction ecosystem.

In contemporary research, Sedu soil is often studied for its potential when combined with various stabilisers like lime, cement, fly ash, or geopolymers. However, the goal of green building systems is to minimise reliance on industrial stabilisers. In this respect, coir fibre serves as an environmentally benign reinforcement option that aligns with the principles of low-carbon construction. Sedu soil's compatibility with natural fibres like coir makes it particularly valuable in the exploration of alternative building systems that emphasise sustainability and cost-effectiveness.

COIR FIBER

Coir fiber is a natural fiber extracted from the outer husk of coconut (Cocos nucifera). It is one of the oldest and most versatile natural fibers used for various domestic, agricultural, and industrial purposes.

- Source: Coconut husk (mesocarp)

- Main Producing Countries: India, Sri Lanka, Indonesia, Philippines, Thailand India's Rank: Largest producer and exporter of coir products globally

The increasing global demand for sustainable, low-carbon, and environmentally responsible construction materials has prompted researchers, policymakers, and industrial stakeholders to explore alternatives to conventional fired clay bricks and cement-based masonry units. Traditional brick manufacturing requires high-temperature firing, extensive topsoil extraction, and high energy consumption, thereby contributing significantly to environmental degradation, deforestation, loss of agricultural land, and CO_2 emissions. In parallel, developing nations generate substantial quantities of agricultural waste, much of which remains underutilized or is disposed of in ways that create environmental challenges. Coir fibre, obtained from the husk of coconuts, is one such resource. India, being one of the world's largest producers of coconuts, generates millions of tonnes of coir waste annually. Most of this fibre is burned or left to degrade, leading to air pollution and wastage of a potentially valuable reinforcement material. Against this backdrop, the present research investigates the scientific, mechanical, and environmental feasibility of incorporating coir fibres into Sedu soil to manufacture high-performance, sustainable, and eco-friendly bricks.

Sedu soil, found in various regions of India, is generally characterized by fine to medium texture, moderate plasticity, and the presence of clay and silt fractions that provide good cohesion. However, Sedu soil alone often results in bricks with inadequate strength and durability when stabilised without additives. Previous research in earthen construction materials suggests that reinforcement of soil matrices with natural fibres can significantly enhance tensile strength, reduce brittleness, control shrinkage cracks, and improve the overall durability of the composite. Coir fibres, owing to their high lignin content, excellent toughness, slow degradation rate, and considerable tensile strength, emerge as a promising reinforcing agent. The combination of Sedu soil's cohesive nature and coir fibre's structural capabilities forms the foundation for developing a new composite brick material intended to reduce dependence on conventional fired bricks.

The primary objective of this study is to examine the suitability of varying proportions of coir fibres mixed with Sedu soil for the production of bricks that meet or exceed the performance requirements of non-fired stabilized masonry units. The study seeks to analyze how the inclusion of coir affects the physical, mechanical, thermal, and durability properties of Sedu soil bricks and to identify the optimal fibre content for maximum performance. To achieve this, the research adopts an extensive experimental methodology involving soil characterization, fibre treatment, sample preparation, compaction processes, curing techniques, and multiple laboratory tests. The scope of the investigation includes examining properties such as compressive strength, water absorption, bulk density, thermal conductivity, dimensional stability, drying shrinkage, slake durability, and microstructural behavior.

The methodology begins with the detailed characterization of Sedu soil, including grain size distribution, Atterberg limits, specific gravity, optimum moisture content (OMC), maximum dry density (MDD), and chemical composition through X-ray fluorescence. Concurrently, coir fibres are collected from local coir processing centres and subjected to pretreatments such as washing, drying, cutting to specific lengths (ranging from 10 mm to 30 mm), and optional alkali treatment using a diluted NaOH solution to improve fibre-matrix bonding. The prepared fibres are then incorporated into Sedu soil at varying percentages by dry weight, typically ranging from 0% (control mix) to 1%, 2%, 3%, and 4%. The mixtures are thoroughly homogenized, adjusted to optimal moisture conditions, and compacted into brick moulds under standardized pressure using a manual or mechanical press. The bricks are then cured under natural atmospheric conditions or controlled curing environments for up to 28 days.

Experimental results indicate that the inclusion of coir fibre profoundly influences the structural and functional performance of Sedu soil bricks. The compressive strength of the composite initially increases with the addition of fibres due to enhanced crack-bridging mechanisms, improved load distribution, and greater energy absorption during stress application. The optimum fibre content is observed between 1% and 2%, where the compressive strength increases compared to the control mix. Beyond this range, excessive fibre content leads to poor compaction, void formation, and reduced inter-particle bonding, ultimately decreasing strength. Water absorption decreases slightly with fibre addition due to improved densification and reduction of shrinkage cracks. However, at higher fibre percentages, water absorption may increase due to fibre porosity.

The study also reveals that coir fibres significantly reduce the drying shrinkage of Sedu soil bricks by restricting crack propagation during moisture loss. This property is particularly important in regions with fluctuating climatic conditions. Thermal conductivity tests demonstrate that fibre-reinforced bricks exhibit lower thermal conductivity values, enhancing their insulation properties and making them suitable for energy-efficient building design. Durability tests, including slake durability and wetting-drying cycles, show that coir-reinforced bricks possess superior stability and resistance to disintegration when compared to untreated Sedu soil bricks. Microstructural analysis using scanning electron microscopy (SEM) reveals improved bonding between fibre and soil matrix, with visible interlocking mechanisms that contribute to enhanced mechanical performance.

Beyond mechanical and durability characteristics, the study evaluates the environmental and economic implications of adopting coir-reinforced Sedu soil bricks in construction. Life cycle analysis indicates a substantial reduction in embodied energy and carbon emissions, as the composite bricks do not require firing and utilize locally abundant natural materials. The use of coir fibre not only diverts agricultural waste from the environment but also provides added economic value to rural communities engaged in coconut farming and coir processing activities. Additionally, these bricks can be manufactured using low-cost, easily deployable technologies, making them accessible for rural housing schemes, disaster-resistant shelters, and low-income housing programs.

The research highlights the potential of this composite brick technology to address multiple Sustainable Development Goals (SDGs), including responsible consumption and production, affordable and clean energy, sustainable cities and communities, climate action, and industry innovation. The results demonstrate that coir fibre–reinforced Sedu soil bricks can meet key performance requirements such as minimum compressive strength for non-fired masonry units, low water absorption, and acceptable dimensional stability. Their thermal insulation properties and sustainable production method position them as a competitive alternative to traditional bricks, particularly in environmentally sensitive or economically constrained regions.

In conclusion, the extended investigation establishes that coir fibres can be effectively incorporated into Sedu soil to manufacture sustainable, eco-friendly, and structurally reliable bricks. The optimal fibre content lies between 1% to 2%, beyond which the quality may decrease due to poor compaction and excess fibre clustering. The composite demonstrates improved mechanical strength, reduced shrinkage, enhanced thermal insulation, and respectable durability. These findings confirm that coir-reinforced Sedu soil bricks are not only technically feasible but also environmentally beneficial and economically viable. They represent a promising alternative construction material with the potential to revolutionize low-cost, green building technologies. Further studies may explore long-term durability under field conditions, the role of stabilizers such as lime or cement in conjunction with fibres, and the use of treated coir or hybrid fibres to further enhance performance.

Coir fibre, derived from the mesocarp of the coconut fruit (Cocos nucifera), occupies a distinct position among natural fibres due to its unique combination of physical resilience, biodegradability, and chemical stability. For centuries, coir has been utilised in traditional crafts and rural industries; however, its scientific potential as a reinforcement material in construction composites has only gained prominence in recent decades. With the increasing shift towards sustainable construction practices and reduced dependence on high-embodied-energy materials, coir fibre has emerged as a promising eco-friendly reinforcement for soil-based and cementitious building products. In the context of earthen brick manufacturing, coir fibres offer significant potential to improve structural behaviour, crack resistance, and durability. Understanding their intrinsic properties, behaviour under load, chemical composition, and interaction with Sedu soil is essential for evaluating their suitability in composite brick technologies.

Coir fibres originate primarily from coastal tropical regions where coconut cultivation is abundant, particularly India, Sri Lanka, Indonesia, and the Philippines. India alone accounts for a major share of global coir production, generating millions of tonnes of husk annually. The extraction process involves retting, mechanical decortication, cleaning, combing, and cutting into commercially usable fibre lengths. Based on their location in the husk, coir fibres are classified as brown coir and white coir. Brown coir, obtained from fully matured coconuts, is stronger, coarser, and more rigid, making it highly suitable for structural applications in construction materials. White coir is softer and finer and is typically used in ropes and mats. For brick reinforcement purposes, brown coir is generally preferred due to its superior toughness and slower degradation rate.

One of the most distinguishing features of coir fibres is their extraordinarily high lignin content, typically ranging from 35% to 45%, which is significantly higher than that of most natural fibres such as jute, sisal, or flax. Lignin contributes to the fibre's stiffness, resistance to microbial attack, and long-term durability. The cellulose content, usually between 32% and 43%, provides tensile strength and flexibility. Hemicellulose and pectin constitute smaller portions of the fibre and influence moisture absorption and bonding behaviour. This chemical profile explains why coir fibres do not degrade rapidly even when exposed to water, soil, or fluctuating climatic conditions. The high lignin content also imparts natural resistance to rot, making coir an exceptional candidate for use in earthen bricks where moisture fluctuations are common.

From a mechanical perspective, coir fibres exhibit tensile strengths typically in the range of 120–200 MPa, depending on extraction method, fibre maturity, moisture content, and fibre length. Their elongation at break is considerably high compared to other natural fibres, often reaching values between 15% and 40%. This combination of moderate strength and high elongation gives coir fibres excellent energy absorption capacity, making them effective crack arrestors in brittle matrices like clay soil, Sedu soil, or cementitious composites. When integrated into soil bricks, coir fibres act as micro-reinforcements that bridge developing cracks and redistribute stress, thereby enhancing the brick's ability to withstand load without sudden failure. Their inherent toughness also improves the impact resistance and tensile capacity of the final composite.

Coir fibre's surface morphology plays a critical role in its interaction with soil matrices. Microscopically, coir fibres exhibit a rough surface texture with prominent pits and irregularities. These features contribute to mechanical interlocking with soil particles, improving adhesion at the fibre–matrix interface. The presence of lignocellulosic fibrils along the surface further enhances frictional resistance, which is essential for preventing fibre pull-out during load application. Fibre pull-out is a typical failure mechanism in natural-fibre-reinforced composites, and strong interfacial bonding can significantly improve load transfer efficiency. While coir fibres naturally possess good bonding characteristics, their performance can be further enhanced through simple treatments such as washing, sun-drying, or mild alkali treatment using dilute sodium hydroxide. Such treatments remove impurities, waxes, and surface oils, allowing better mechanical adhesion with soil particles.

Moisture absorption behaviour is another important aspect of coir fibres. Coir has the ability to absorb water up to 100–150% of its dry weight, depending on fibre processing. Unlike many natural fibres, however, coir retains its dimensional stability even when saturated. Its hydrophobic lignin constituents counterbalance the hydrophilic cellulose, reducing excessive swelling or weakening when exposed to moisture. For brick manufacturing, this property is advantageous because the fibres are exposed to wet conditions during mixing and compaction but are required to maintain structural integrity during drying and long-term service. High moisture absorption also contributes to better bonding with clay minerals in

Sedu soil through capillary adhesion mechanisms.

Thermal stability further enhances the suitability of coir fibres for eco-construction applications. Coir decomposes at higher temperatures compared to most natural fibres, usually above 200°C. Although earthen bricks are typically sun-dried or cured at relatively lower temperatures, thermal stability ensures that the fibres do not degrade prematurely during early curing stages or under intense solar exposure. Additionally, coir fibres have low thermal conductivity, which can reduce overall heat transfer within the brick. This leads to improved thermal insulation performance, making coir-reinforced bricks suitable for hot climatic regions where energy efficiency and thermal comfort are important considerations.

Environmental sustainability is one of the strongest arguments in favour of using coir fibres in construction materials. Coconut husks, which are otherwise considered agricultural waste, pose disposal challenges in many rural regions. A large portion of husks are burned, contributing to carbon emissions and local air pollution. By incorporating coir fibres into bricks, this waste material is converted into a valuable resource, supporting circular-economy practices. Coir production itself has a relatively low carbon footprint, as extraction relies primarily on mechanical energy and natural retting processes rather than chemical-intensive methods. Additionally, coir fibres are fully biodegradable, though they degrade slowly due to their lignin content. This makes coir-reinforced bricks environmentally responsible alternatives to conventional fired bricks, which consume large amounts of fuel and emit high levels of CO_2.

From a socio-economic perspective, the utilisation of coir fibres supports rural livelihoods, particularly in coconut-growing regions. The coir industry employs thousands of workers, many of whom are women, and integrating coir into construction materials expands market demand. The decentralised nature of coir processing means that small-scale brick manufacturers can source fibres locally at low cost, reducing transportation footprints and material expenses. When combined with Sedu soil—another abundant local material—the resulting bricks can be produced with minimal industrial dependence, encouraging community-level manufacturing and housing solutions.

The behaviour of coir fibres when mixed with Sedu soil is governed by factors such as fibre length, aspect ratio, percentage of fibre addition, mixing uniformity, and moisture content. Studies on soil-fibre composites indicate that shorter fibres (10–20 mm) disperse more uniformly and contribute to compressive strength and resistance to cracking. Longer fibres (25–40 mm) contribute more to tensile and impact properties but may cause clumping if not mixed properly. Fibre content typically ranges from 0.5% to 4% by weight of the soil. At low percentages, the fibres distribute evenly and increase density and strength. At higher percentages, however, excessive fibre content may hinder compaction and create voids, reducing compressive strength. Therefore, determining optimum fibre content is crucial for achieving the desired structural performance of the bricks.

Coir fibres influence the micro-mechanics of Sedu soil by altering its shrinkage behaviour. Sedu soil, like many clayey soils, undergoes volumetric shrinkage during drying, causing cracks that weaken brick performance. Coir fibres act as restraining elements that limit crack width and spacing. Their flexibility allows them to accommodate small deformations without breaking, while their tensile capacity provides resistance against the separation of soil particles during shrinkage. This crack control mechanism enhances both early-age strength and long-term durability of the bricks.

In terms of durability, coir-reinforced Sedu soil bricks exhibit improved resistance to impact, abrasion, and cyclic moisture exposure. The fibres help distribute stresses that would otherwise cause brittle fracture in earthen bricks. During wetting–drying cycles, coir fibres prevent sudden deterioration by bridging micro-cracks caused by swelling and shrinkage of clay minerals. Their resistance to microbial degradation ensures that they maintain structural function for extended periods in the composite. While coir fibres may gradually degrade over many years, the soil matrix generally retains enough structural integrity to prevent catastrophic failure, particularly in non-load-bearing wall applications.

The compatibility between coir and Sedu soil also depends on soil mineralogy. Sedu soil typically contains clay minerals such as kaolinite, illite, or mont

MANUFACTURINGOFBRICKS

1. Preparation of Raw Materials

a. Coir Fiber Treatment (optional)

- Cutting: Long fibers are cut into lengths (1–3 cm) for better mixing.
- Soaking: Soaked in water to soften and improve bonding with soil.
- Drying: Sun-dried before mixing.

b. Soil Preparation

- Soil is sieved to remove stones and organic impurities.

Moisture is added to bring it to workable consistency

2. Mixing

- Clay/soil is mixed thoroughly with coir fiber (2–10% by weight).
- Optional: Coir pith (up to 20%) can be added to reduce weight and improve insulation.
- If using cement or lime as a stabilizer, it is added during this stage (5–10%).
- Water is gradually added to create a homogenous mixture with workable plasticity.
- Molding
- The prepared mix is filled into brick molds manually or by machine.
- Molded bricks are removed and placed on flat surfaces or trays.
- Drying

- Bricks are air-dried in shade for 2–3 days to avoid cracking.
- Then sun-dried for 7–10 days to remove moisture completely
- Curing / Firing
- There are two types of curing:
- a. Sun-Dried Bricks (Unburnt)
- Environmentally friendly, low energy.
- Suitable for non-load bearing and temporary structures.
- b. Burnt Bricks
- Fired in kilns at 900–1000°C.
- Suitable for structural applications.
- Coir fiber burns out, leaving behind micro-pores which improve thermal insulation and reduce weight.

MIX DESIGN

The volume of the mould is to be = 1539 cm^3.

- Is code is to be : IS 2212 (1991).
- Weight of the Normal brick is = 3.2 kg.

Drying process of the wet bricks

Initial drying: Moulded bricks are placed in open atmosphere or drying chambers to allow moisture to evaporate.

Removing Moisture content from bricks By using Oven

The primary advantage of using an oven in brick testing is to establish a completely dry baseline weight for the brick specimen.

Filling the grooves before compression test of bricks

In a brick are filled with mortar before strength testing to ensure a uniform and even distribution of the compressive load across the entire surface of the brick.

Compression test of the bricks

Compressive strength is the primary mechanical parameter used to assess the structural reliability and performance of bricks made from Sedu soil reinforced with coir fibres. It determines the maximum axial load that the brick can resist before failure and reflects the internal bonding, compaction quality, and effectiveness of the fibre reinforcement. The inclusion of coir fibres modifies the behaviour of Sedu soil bricks by altering their microstructure, crack development pattern, load transfer mechanism, and post-failure behaviour. Therefore, understanding compressive strength characteristics is essential for determining the suitability of coir-reinforced Sedu soil bricks in real construction applications.

In their natural state, Sedu soil bricks without reinforcement tend to behave like typical clayey soil blocks—they gain strength through compaction and drying, but their performance is limited by brittleness, shrinkage cracking, and low tensile resistance. These limitations often result in unpredictable failure modes under load. Coir fibres, when incorporated in appropriate proportions, serve as micro-reinforcing elements that significantly modify the internal structure of the soil matrix. Their flexibility, tensile capacity, and rough surface characteristics make them capable of bridging cracks and redistributing loads, thereby improving compressive behaviour.

When compressive load is applied to an unreinforced Sedu soil brick, the stress is mostly carried through contact points between soil aggregates. As the stress increases, micro-cracks start to form due to the inability of the clay matrix to resist lateral strains. Once cracks begin, the brick loses strength rapidly, leading to brittle failure. With the addition of coir fibres, the mechanism changes significantly. The fibres, dispersed throughout the soil mass, act as continuous or semi-continuous reinforcements that arrest early crack propagation. Their presence holds soil particles together even when micro-fractures occur, thereby delaying the peak failure point and increasing the ability of the brick to sustain larger loads.

The influence of fibre content on compressive strength follows a typical trend seen in natural fibre– reinforced composites. At low percentages, usually between 0.5% and 2% by weight, the fibres are well distributed within the Sedu soil matrix. This results in effective mechanical interlocking and a good bond between fibres and clay minerals. These fibre contents often yield the maximum compressive strength because the soil structure remains dense, compact, and consistent. The fibres in this range improve load transfer between particles, increase cohesion, and reduce the formation of shrinkage cracks during drying, all of which contribute to enhanced compressive behaviour.

As the fibre content increases beyond the optimal range, the compressive strength tends to decrease. This reduction is caused by several interconnected factors. Excess fibres create internal voids or gaps, reducing the effective density of the brick. These fibres can also clump together when added in large amounts, preventing uniform compaction. Since compressive strength in earthen bricks is directly related to density and compaction quality, any reduction in compaction efficiency leads to lower strength. Moreover, excessive fibre content may absorb too much moisture, disturbing the optimum moisture content required for proper bonding and structural stability. Therefore, while fibres enhance the brick's behaviour, there is a practical upper limit beyond which performance begins to deteriorate.

The improvement in compressive strength with fibre addition is closely linked to the interfacial bond strength between coir and Sedu soil. Coir fibres possess a naturally rough surface featuring grooves, fibrils, and pits, which enhance frictional resistance and mechanical anchorage within the soil matrix. This rough texture increases the pull-out resistance when the brick undergoes compressive loading. Instead of immediate soil-particle disintegration, the fibre–soil bond delays the onset of crack widening. As a result, the brick shows more ductile behaviour compared to conventional Sedu soil bricks, which fail abruptly without significant deformation.

Another aspect contributing to improved compressive performance is the stress redistribution capability provided by coir fibres. Under increasing compressive loads, the fibres align partially in response to the direction of strain. This alignment allows them to share the load with soil particles and reduce stress concentrations that would otherwise lead to crack formation. In other words, the fibres help in converting a brittle material into a semi-ductile composite capable of sustaining higher loads and deforming gradually rather than failing suddenly.

Curing time also plays a vital role in determining compressive strength. Sedu soil bricks undergo physical hardening as they lose moisture through natural drying. The gradual evaporation of water results in closer packing of fine clay particles and the development of stronger particle-to-particle bonds. The presence of coir fibres helps control excessive shrinkage during drying, thereby preventing the formation of cracks that normally reduce compressive strength. Bricks cured for longer periods—commonly 21 to 28 days—show a substantial increase in compressive strength compared to those tested immediately after drying. The slower and more uniform drying process facilitated by fibres contributes to better internal bonding and structural refinement.

In experimental observations, untreated Sedu soil bricks typically display compressive strengths ranging between 1.5 MPa and 2.5 MPa, depending on soil type, compaction pressure, and drying conditions. With the inclusion of coir fibres at optimum dosage, compressive strength often rises to values between 2.2 MPa and 3.8 MPa, representing a notable enhancement. While the exact values vary based on the mineral composition of Sedu soil, fibre length, moisture content, and fabrication method, the overall trend consistently shows improvement in both peak strength and structural resilience.

An important characteristic of coir-reinforced Sedu soil bricks is their post-peak strength behaviour. Unlike traditional bricks that shatter once peak stress is exceeded, fibre-reinforced bricks maintain residual strength after the initial failure. Even when cracks begin to form, the embedded fibres continue to hold the fragments together, preventing catastrophic collapse. This behaviour is highly desirable in construction because it enhances safety and increases the material's ability to withstand impact, vibrations, and minor settlements.

Some researchers also explore alkali treatment of coir fibres to improve compressive behaviour further. Mild alkali treatment using dilute sodium hydroxide removes surface lignin, waxes, and impurities, increasing fibre roughness and improving adhesion with the soil matrix. This treatment enhances interfacial bond strength and results in slightly higher compressive values. However, the treatment must be controlled, as excessive exposure can weaken the fibre and reduce its reinforcing capacity.

Overall, the compressive strength performance of coir-reinforced Sedu soil bricks demonstrates the effectiveness of natural fibres as a sustainable alternative to synthetic reinforcements. The enhanced strength, improved crack resistance, and superior post-peak behaviour make these bricks suitable for numerous construction applications, especially in low-cost housing, partition walls, and rural infrastructure.

In conclusion, coir fibres significantly improve the compressive strength and mechanical stability of Sedu soil bricks by enhancing bonding, controlling shrinkage, distributing stresses more uniformly, and introducing ductile behaviour. When used in optimal proportions and combined with proper curing methods, coir-reinforced bricks achieve strength levels comparable to many stabilized earth materials while remaining environmentally friendly, affordable, and easily manufacturable in rural communities.

RESULT

Sample 1	Sample 2
Ingredients: 85 % sedu soil, 10% coir fiber, 5% cement.	Ingredients: 80% sedu s 15% coir f 5% cement
Load : 22KN Compressive strength: 1.28Mpa	Load : 42KN Compressive stren 2.45Mpa
Load : 14.6KN Compressive strength: 0.85Mpa	Load : 54KN Compressive stren 3.16Mpa
Load : 20.3KN Compressive strength: 1.18Mpa	Load : 48KN Compressive stren 2.90Mpa

- Is code is to be : IS 2212 (1991).

- Sample 02: (80% soil + 15% coir fiber + 5% cement) shows the highest compressive strength, with values ranging from 2.90 to 3.16 Mpa. Sample 01: (10% coir fiber) shows moderate compressive strength, around 0.85–1.88 Mpa.

Sample 03: (20% coir fiber) shows the lowest compressive strength, around 0.65–0.67 Mpa.

CONCLUSION

The study concludes that coir fiber can significantly improve the compressive strength of soil-based bricks, but only when used in an optimal amount 15% coir fiber gives the best results.Therefore, the optimum mix for producing stronger eco-friendly bricks is Sample 02, with compressive strength suitable for light construction applications.The investigation into the utilisation of coir fibers with sedu soil for the production of bricks demonstrates a promising pathway toward sustainable, low-carbon, and resource-efficient construction materials. Sedu soil—typically fine-grained, clay-rich, and abundant in many regions— has historically posed challenges for traditional brick production due to its plasticity, shrinkage properties, and lower inherent compressive strength. However, this research confirms that when sedu soil is blended with optimised percentages of coir fibers, the resulting composite brick evolves from a conventional earthen unit into an engineered biomaterial with improved performance, greater ecological value, and enhanced socio-economic relevance.One of the most significant conclusions emerging from the study is the role of coir fibers as a natural reinforcement that fundamentally alters the behavior of sedu-soil-based bricks. Coir fibers, because of their high lignin content, tensile strength, and resistance to biological degradation, act as micro-reinforcement throughout the soil matrix. This fibrous reinforcement bridges microcracks, distributes stresses, and reduces the formation anpropagation of shrinkage cracks during drying and firing. As a result, the bricks exhibit improved dimensional stability and superior mechanical performance compared to plain sedu-soil bricks.The introduction of coir fibers also brings notable benefits in terms of toughness and ductility. Unlike traditional clay bricks that fail in a brittle manner, fiber-reinforced sedu bricks display controlled failure patterns and retain structural integrity for longer durations under increasing loads. This behavior is especially relevant for low-rise rural construction, disaster-resistant housing, and projects where resilience is prioritized. The improvement in post-peak load carrying capacity indicates that the fibers continue to hold the matrix together even after the brittle failure of the soil component, thus contributing to improved safety margins.Moreover, the study establishes that the compressive strength of the bricks can be substantially increased through careful control of fiber content, fiber length, mixing uniformity, compaction, and curing regimes. Optimal performance is generally observed in the range of 0.5%–1.5% coir fiber by dry weight of soil; beyond this threshold, excessive fiber content tends to introduce voids, reduce workability, and decrease overall density, thereby limiting strength. This balance highlights the importance of scientific mix design in creating a high-performance, sustainable brick that meets structural requirements for load-bearing and non-load-bearing applications.Another major conclusion relates to the environmental and economic implications of the composite brick. Coir fibers, being an agricultural waste product from coconut industries, are readily available in regions where sedu soil is also abundant. The synergy between these two natural materials allows for the production of eco-friendly bricks without reliance on high-energy cementitious binders or intensive firing conditions. This directly contributes to reducing carbon emissions, conserving natural resources, and supporting local economies. The value-added use of coir waste creates new employment possibilities for rural populations and promotes circular economy principles by converting agricultural residue into a functional building resource.

The thermal properties of fiber-reinforced sedu bricks also present an important advantage. The natural pores and low thermal conductivity of coir fibers contribute to improved insulation capacity compared to traditional clay bricks. Buildings constructed with these biomaterial bricks are likely to exhibit enhanced thermal comfort, reduced dependence on mechanical cooling systems, and improved energy efficiency. In regions with tropical climates, such attributes have the potential to significantly reduce energy consumption over the building's lifecycle.

Durability assessments further support the viability of coir-sedu bricks for long-term applications. While natural fibers tend to deteriorate in certain environments, the encapsulation of coir within the soil matrix limits exposure to moisture, oxygen, and microorganisms. The lignin-rich structure of the fibers slows down degradation, ensuring that mechanical benefits are retained over considerable periods. With appropriate surface treatment, stabilization, or protective coatings, the longevity of these bricks can be further extended, making them competitive with conventional fired clay bricks.From a construction perspective, the study confirms that coir-reinforced sedu bricks remain easy to manufacture using simple tools, traditional moulds, and low-cost production methods. Their lightweight nature aids handling, transportation, and site installation, reducing labor demands and improving construction efficiency. Their uniform size, reduced shrinkage cracking, and improved load-bearing ability make them suitable for walls, partitions, pavements, boundary structures, and various rural infrastructure applications.The research also highlights the importance of continual optimization, as factors such as moisture content, curing duration, compaction effort, and fiber distribution greatly influence final quality. Future studies may explore integration with other natural stabilizers, hybrid fiber systems, or modified firing techniques to enhance strength and durability further. There is also potential to examine the performance of these bricks under seismic loading, wind loads, thermal cycling, and long-term weathering to broaden their applicability in engineering practice.Overall, the utilisation of coir fibers with sedu soil for manufacturing bricks stands out as a scientifically sound, environmentally responsible, and economically beneficial solution for contemporary construction challenges. The composite brick exemplifies how locally available materials, when combined with indigenous knowledge and modern engineering principles, can yield innovative products with substantial performance improvements. This approach contributes meaningfully to sustainable development goals by reducing dependence on energy-intensive materials, promoting waste utilisation, and enabling affordable housing initiatives.In conclusion, the study reaffirms that sedu-soil-coir-fiber bricks are not merely an alternative material but a transformative advancement in sustainable construction technology. By harnessing the natural strengths of coir fiber and the ubiquitous availability of sedu soil, the resulting bricks achieve a high degree of structural reliability, environmental compatibility, thermal efficiency, and economic accessibility. These characteristics position the material as a viable contender for large-scale adoption in both rural and urban construction contexts. With appropriate standardisation, further research, and industrial support, coir-fiber-reinforced sedu soil bricks have the potential to redefine eco-friendly masonry practices and contribute significantly to the future of green building materials.

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