

# A Review On Soil Stabilization with Natural materials " Jute and Gypsum "

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**Abstract** This review paper focuses on the use of jute and gypsum in soil stabilization. Jute, a natural fiber, is used as reinforcement to improve the soil's load-bearing capacity and control erosion. Gypsum, a mineral, is used as a binder to improve the soil's mechanical properties, including shear strength and water retention. Studies have also investigated the combined use of jute and gypsum, which significantly improves the soil's mechanical properties and reduces permeability. Overall, the use of jute and gypsum in soil stabilization is an eco-friendly and cost-effective solution with great potential in civil engineering. Further research is needed to explore their full potential.

**Keywords** —soil stabilization , Jute ,Gypsum , Minerals ,Comstruction , Strength

## I. INTRODUCTION

Soil stabilization is a process of improving the physical and mechanical properties of soil, which ultimately enhances its load-bearing capacity [1],[2] . Jute and gypsum have been recognized as suitable materials for soil stabilization due to their availability and low cost. This review paper will discuss the research conducted on the use of jute and gypsum in soil stabilization. [3]

### Jute as a soil stabilizer:



FIGURE NO: 1

Jute is a natural fiber obtained from the jute plant, and it is widely used in various industries due to its biodegradable nature and low cost [4]. In soil stabilization, jute fibers are used as reinforcement to increase the soil's strength and stability. Research has shown that the inclusion of jute fibers in soil improves its load-bearing capacity and reduces its compressibility. Jute fibers also help to control soil erosion, which is an important factor in slope stabilization [4],[5].

### Gypsum as a soil stabilizer:



FIGURE NO: 2

Gypsum is a naturally occurring mineral that is commonly used in the construction industry. In soil stabilization, gypsum is used as a binder to improve the soil's mechanical properties [4]. Gypsum reacts with soil particles and forms stable compounds that increase the soil's strength and stability. Research has shown that the addition of gypsum to soil increases its shear strength and reduces its compressibility. Gypsum also improves the soil's water retention properties, which is beneficial for plant growth [5].

### Combined use of jute and gypsum:

Several studies have investigated the combined use of jute and gypsum in soil stabilization [6]. The results have shown that the combination of jute fibers and gypsum significantly improves the soil's mechanical properties [7]. The inclusion of jute fibers in soil increases its tensile strength, while gypsum improves its compressive strength. The combined use of jute and gypsum also reduces the soil's permeability,

which is beneficial in preventing soil erosion and retaining water [6],[7].

## II. LITERATURE REVIEW

Soil stabilization is an essential technique in civil engineering to improve the properties of soil, including strength, stability, and durability, for construction purposes. In recent years, researchers have explored various materials to stabilize soil, including jute and gypsum.

- Jute is a natural fiber obtained from the stem of the jute plant. It is a biodegradable and eco-friendly material that has been used in various industries. Jute fibers have been shown to improve the mechanical properties of soil, including tensile strength, shear strength, and bearing capacity. A study by Islam et al. (2015) investigated the use of jute fiber as a reinforcement material in soil stabilization. The results showed that the inclusion of jute fibers in soil improved its compressive strength, modulus of elasticity, and shear strength. Another study by Biswas et al. (2016) showed that the addition of jute fiber to soil reduced its compressibility and improved its tensile strength.
- Gypsum is a naturally occurring mineral that has been used in the construction industry for various purposes, including soil stabilization. Gypsum reacts with soil particles and forms stable compounds, which improve the soil's mechanical properties. A study by Basha and Hashim (2009) investigated the use of gypsum as a soil stabilizer. The results showed that the addition of gypsum to soil improved its strength and reduced its compressibility. The researchers also found that gypsum improved the soil's water retention properties.
- Several studies have also investigated the combined use of jute and gypsum in soil stabilization. A study by Karthikeyan et al. (2014) showed that the combination of jute fibers and gypsum significantly improved the soil's mechanical properties, including its compressive and tensile strength, as well as its water retention properties. Another study by Khatibmoghadam et al. (2019) investigated the effect of different ratios of jute fibers and gypsum on soil stabilization. The results showed that the combination of jute and gypsum improved the soil's strength and reduced its permeability.

In summary, jute and gypsum are promising materials for soil stabilization. Jute fibers improve the soil's mechanical properties, including its strength and stability, while gypsum improves its water retention and binding properties. The combined use of jute and gypsum has shown significant improvements in soil properties. However, further research is needed to investigate the long-term effects of these materials on soil stability and durability.

## III. METHODOLOGY

The methodologies of studies on the use of jute and gypsum in soil stabilization vary, depending on the specific research questions and objectives. In general, studies often involve laboratory experiments or field trials to investigate the mechanical properties of soil before and after treatment with jute and gypsum [10].

In laboratory experiments, soil samples are prepared and mixed with jute fibers or gypsum to determine the changes in mechanical properties such as compressive strength, shear strength, and water retention. [11],[12]

The samples are then subjected to different loads and stresses to evaluate their performance [6]. In field trials, jute fibers or gypsum are applied to the soil surface, and the treated area is monitored for changes in soil properties such as stability, erosion resistance, and plant growth [13],[14].

These trials may also involve the construction of small-scale structures such as retaining walls or embankments to evaluate the effectiveness of the treatment in real-world scenarios [15].

## IV. RESULTS

The results of studies on the use of jute and gypsum in soil stabilization have generally shown positive outcomes in improving soil properties. Jute fibers and gypsum have been shown to increase the soil's strength and stability, reduce its compressibility, and improve its water retention properties.

In laboratory experiments, the addition of jute fibers or gypsum to soil has resulted in significant improvements in compressive strength, shear strength, and modulus of elasticity. The results have also shown that the combined use of jute and gypsum can have a synergistic effect in improving soil properties.

In field trials, the application of jute fibers or gypsum to soil has been shown to reduce erosion and increase plant growth. The treated areas have also demonstrated increased stability and resistance to external forces such as rainfall and traffic.

Overall, the results of studies on the use of jute and gypsum in soil stabilization indicate that these materials can be effective in improving soil properties and can provide a cost-effective and eco-friendly solution for soil stabilization.

## V. FUTURE SCOPE

The use of jute and gypsum for soil stabilization has shown promising results in improving the mechanical and physical properties of soil. However, there is still room for further research to explore the full potential of these materials in soil stabilization.

Optimal blend ratio: Further research can be conducted to determine the optimal blend ratio of jute and gypsum for different types of soil. This can help in achieving the

maximum stabilization effect with the least amount of material required.

**Long-term effects:** Long-term studies can be conducted to investigate the durability and longevity of the soil stabilization effect with jute and gypsum. This can help in determining the optimal maintenance schedule for treated soil.

**Combination with other materials:** The combination of jute and gypsum with other materials such as lime, fly ash, or cement can be explored to determine the synergistic effect in soil stabilization. This can help in developing cost-effective and environmentally friendly solutions for soil stabilization.

**Large-scale field trials:** Large-scale field trials can be conducted to evaluate the performance of jute and gypsum in real-world scenarios. This can help in validating the laboratory findings and providing practical solutions for soil stabilization.

**Ecological impact:** Further studies can be conducted to evaluate the ecological impact of jute and gypsum on soil and plant growth. This can help in ensuring that the use of these materials for soil stabilization is environmentally sustainable.

**Application in different fields:** The application of jute and gypsum in different fields such as agriculture, forestry, and construction can be explored to determine their potential for soil improvement and erosion control.

## VI. CONCLUSION

In conclusion, jute and gypsum are suitable materials for soil stabilization. Jute fibers improve the soil's tensile strength, while gypsum improves its compressive strength.

The combined use of jute and gypsum significantly improves the soil's mechanical properties and reduces its permeability.

The use of these materials in soil stabilization is an eco-friendly and cost-effective solution that has great potential in the field of civil engineering.

Further research is needed to explore the full potential of these materials in soil stabilization.

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