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Analysis of Improvement in Soil Properties Using Sugarcane Bagasse Ash

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Abstract
Clay undergoes high enlargement and contraction due to variation in water content. Swelling and shrinkage properties of cotton soil can be improved by reinforcing it with different materials. We need to use stabilization and reinforcement techniques to enhance the geotechnical properties of such soils. Sugarcane Bagasse Ash (SCBA) is used as stabilizer for the improvement of the geotechnical properties of clay soil Sugar cane bagasse Ash has beneficial engineering purposes of using it as stabilizer material. In this project analysis of improvement of clay by replacing a portion of clay with sugarcane bagasse ash at different ratios (4%, 8%, 12%, 16%, 20%) and examining the effects on the performance of the resulting brick a building material. Various tests were conducted on the brick to evaluate their performance. Sugarcane bagasse ash (SCBA), a byproduct of sugarcane processing, has emerged as a promising material for soil stabilization and enhancement in construction projects. This study investigates the potential use of SCBA as an additive to improve soil properties and optimize the performance of construction materials. By utilizing SCBA, an industrial waste product, in construction applications, the industry can achieve sustainable practices and contribute to a circular economy. Additionally, the use of SCBA in soil stabilization offers an environmentally friendly solution for managing industrial waste while enhancing the performance of construction projects. This research provides valuable insights for civil engineers and construction managers aiming to implement sustainable materials in infrastructure development.
***Keywords*—sugarcane bagasse ash, clay soil, soil properties**

I. INTRODUCTION

Sugarcane bagasse ash (SCBA) is a byproduct of sugarcane processing that can offer valuable benefits to soil health. Comprising silica, minerals, and organic matter, SCBA has potential as a soil amendment to enhance soil properties and support agricultural productivity. Using SCBA as a soil additive can improve nutrient levels, adjust soil pH, and enhance soil structure and water retention. By recycling SCBA into the soil, we can contribute to sustainable waste management and resource use. This study aims to analyze the impact of SCBA on soil properties and assess its potential benefits for soil quality and crop yield. Through careful application and monitoring, the analysis seeks to provide insights into the effectiveness of SCBA in improving soil health and agricultural outcomes..

II. MATERIALS AND METHODS

Fig : Sugarcane bagasse ash

In this study, the impact of sugarcane bagasse ash (SCBA) on soil properties was analyzed in the context of civil engineering applications. SCBA was sourced from a local sugarcane producing shops and characterized for its chemical composition and particle size. Soil samples were collected from the field in Kalady and tested for initial properties such as pH, moisture content, and particle size distribution. SCBA was then mixed into the soil at predetermined ratios based on the desired engineering properties, such as improved soil strength and compaction.

Post-application, soil samples were taken at regular intervals to assess changes in properties like compaction, bearing capacity, and permeability. Standard geotechnical testing methods, such as Proctor compaction tests and unconfined compressive strength tests, were used to evaluate the soil's performance. Additionally, the potential use of SCBA as a

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stabilizing agent in soil for foundation and pavement applications was explored.

Data analysis focused on quantifying improvements in soil properties and assessing the viability of SCBA as a sustainable and cost-effective alternative for soil stabilization in civil engineering projects. The results provide insights into the benefits of using SCBA in soil for enhanced construction materials and infrastructure durability.

III. RESULTS AND DISCUSSIONS

The analysis of soil properties following the application of sugarcane bagasse ash (SCBA) yielded notable improvements across various parameters. SCBA treatment led to a measurable increase in soil pH, effectively neutralizing acidity in the soil and enhancing its suitability for plant growth. Nutrient levels, particularly phosphorus and potassium, showed significant improvement, providing essential elements for healthy plant development. Soil structure also benefited from the introduction of SCBA, as the ash improved soil texture and porosity, facilitating better water retention and drainage.

In terms of civil engineering applications, the enhanced soil properties can contribute to improved ground stability and load-bearing capacity, potentially impacting foundation design and other structural considerations. The addition of SCBA may also reduce soil erosion risks due to its ability to bind soil particles and improve cohesion.

Despite these positive outcomes, careful consideration of SCBA application rates and potential long-term impacts on soil health is necessary. Continuous monitoring and follow-up studies are recommended to optimize SCBA use in civil engineering projects and agriculture. Overall, the results indicate that SCBA is a viable and effective soil amendment with potential benefits for both agricultural and civil engineering applications

Finally, the addition of SCBA to soil used in brick manufacturing led to enhanced properties such as increased compressive strength and durability of the resulting bricks. SCBA's fine particle size and high silica content contributed to better bonding with other materials, improving the bricks' mechanical performance. Additionally, SCBA usage in construction materials presented potential environmental benefits, such as waste reduction from sugarcane processing and decreased carbon footprint due to reduced reliance on traditional raw materials. The improved quality and performance of bricks produced with SCBA suggest its viability as a sustainable alternative in the construction industry. Further research may focus on optimizing SCBA proportions and its long-term impact on construction materials.

Fig 2 : Bricks made from soil and SCBA mixture

Fig 3 : Testing of strength of the new made SCBA brick

IV. CONCLUSION

The analysis of the improvement in soil properties using sugarcane bagasse ash (SCBA) has demonstrated its potential as an effective soil amendment in civil engineering projects. SCBA can enhance soil quality by improving pH balance, increasing nutrient content, and bolstering soil structure, which can benefit construction and land reclamation efforts. Its ability to immobilize heavy metals and support soil stabilization makes it a valuable material in geotechnical engineering applications. Additionally, SCBA's use aligns with sustainable practices by recycling industrial waste and reducing environmental impact. This study provides strong evidence that SCBA can be a cost-effective and eco-friendly option for improving soil properties in various civil engineering contexts. Further research is recommended to optimize application methods and explore its long-term effects on soil health and structural integrity.

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