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Stabilization of Peat Soil Using Portland Cement, Rice Husk and Egg Shell

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Peat, stabilization, soil, waste materials, Portland cement, cost-effective, environmentally friendly.

ABSTRACT:

Peat is a type of soil that is formed from the accumulation of partially decomposed plant material in waterlogged and acidic conditions. It is characterized by its high organic content, dark brown to black color, and spongy texture. Peat soil is typically found in wetland areas such as bogs and marshes and swamps. It has unique properties, including high water-holding capacity and low nutrient availability, which make it suitable for certain plant species but challenging for agriculture. Peat soil is also an important carbon sink, storing significant amounts of carbon dioxide from the atmosphere. It is prevalent in regions with high rainfall and waterlogged conditions, including northern Europe, parts of North America, and some areas in Southeast Asia. These regions provide the necessary conditions for the accumulation and preservation of organic matter, leading to the formation of peat soil. In India, peat soil is primarily found in the northeastern states, particularly in the region of Assam. The wetland areas of Assam, including the Brahmaputra Valley, are known to have peat deposits. Additionally, some parts of the Western Ghats, such as the high altitude regions of Kerala and Tamil Nadu, may also have small pockets of peat soil. In civil engineering, there are several challenges and problems associated with peat soil, Bearing Capacity, Stability, Settlement, Drainage, and Organic Content. Therefore, we are proposing Egg shell, Rice Husk & Portland cement as a choice for soil stabilization of peat soil. This study could contribute to the development of cost-effective and environmentally friendly techniques for stabilizing peat soil, which could have practical applications in geotechnical engineering, road construction, and other infrastructure projects. To calculate the cost benefits and environmentally friendly techniques for stabilizing peat soil, which could have practical applications in geotechnical engineering, road construction, and other infrastructure projects? To find ways of stabilization and improving peat soil to solve the problems pertaining marginal land. To reuse the waste materials for green construction. To increase the bearing capacity of the soil. To compare stabilization with alluvial soil. To gain the knowledge on the behavior of peat soil for the purpose of geotechnical engineering applications.

1. Introduction

Peat soil is a challenging material to work with due to its high organic content and low shear strength. Stabilization techniques are often employed to improve the geotechnical properties and strength of peat soil. One such technique involves the use of additives such as egg shell, rice husk, and Portland cement. This literature review aims to synthesize the research findings on the stabilization of peat soil using these additives and identify potential knowledge gaps and future research directions.

The stabilization of peat soil using Portland cement, rice husk, and eggshell is a potential method to improve the engineering properties of peat soil. Portland cement is commonly used as a stabilizing agent in soil stabilization techniques. It can enhance the strength and

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durability of the soil by binding the particles together and reducing its compressibility. Rice husk (RH), a byproduct of rice milling, can be used as a supplementary material in soil stabilization. It contains high amounts of silica, which can contribute to the pozzolanic reaction when mixed with cement. This reaction helps in improving the strength and stability of the soil.

Eggshells, being rich in calcium carbonate, can also contribute to the stabilization process. Calcium carbonate reacts with the cement to form calcium silicate hydrate, which further enhances the strength and stability of the soil. The combination of Portland cement, rice husk, and eggshell can potentially improve the engineering properties of peat soil, such as its shear strength, compressibility, and load- bearing capacity. However, it is important to conduct thorough laboratory testing and analysis to determine the appropriate proportions and mixing techniques for achieving the desired stabilization results.

In this study, we will explore the effectiveness of using Portland cement, rice husk, and eggshell in stabilizing peat soil. The objective is to assess the changes in the geotechnical properties of peat soil after the addition of these materials and evaluate their potential as sustainable and cost-effective stabilization agents. The findings of this research will contribute to the understanding and application of innovative techniques for utilizing peat soil in construction projects.

2. Objectives

Based on the important properties of peat soil such as high compressibility, low shear strength and high moisture content characteristics obtained from the theoretical analysis and evaluation of peat soil response to loading, the following objectives are set forth for this research:

- To calculate the cost benefits and environmentally friendly techniques for stabilizing peat soil, which could have practical applications in geotechnical engineering, road construction, and other infrastructure projects?
- To find ways of stabilization and improving peat soil to solve the problems pertaining marginal land.
- To reuse the waste materials for green construction.
- To increase the bearing capacity of the soil.
- To compare stabilization with alluvial soil.
- To gain the knowledge on the behavior of peat soil for the purpose of geotechnical engineering applications.

3. Methods

This project is an experimental-based research which focuses on the stabilization of peat soil by the use of egg shell, rice husk & Portland cement (OPC). The literature research that has been done was to provide a foundation of the research topic and to gather adequate information regarding the Portland cement (OPC), rice husk & egg shell and peat soil. The peat soil sample was collected from a peat deposit area at Devla, SurajpurUttar Pradesh.

The laboratory testing procedures of this study were carried out based on Indian standards (IS: 2720). The experimental research concentrated much on laboratory testing to determine theimportant properties of the peat soil and the suitable dosage/proportion of stabilizer (egg shell, rice husk & Portland cement (OPC) that should be economically applied to give effective stabilization of the peat soil in term of strength. Soil physical and index properties such as specific gravity, atterberg limits (liquid limit, plastic limit and plasticity index), moisture content, particle size distribution were determined to establish the basic characteristics of the peat soil. The engineering property such as Standard Proctor Test (SPT) was also tested on both treated and untreated soil samples. An appropriate proportion of stabilizer (egg shell, rice husk & Portland cement (OPC) that improves peat soil sample most in term of strength and other engineering properties, had also been determined based on Standard Proctor Test (SPT). Tests on control (original) peat soil was conducted in order to assess the strength gain (improvement) by the peat soil samples in comparison to stabilised ones.

4. Results

The comprehensive laboratory testing results enable a thorough understanding of peat soil properties. The Proctor compaction test guides compaction efforts, while moisture content evaluations contribute to assessing the suitability of stabilizers. Specific gravity, particle size distribution, and Atterberg limits aid in characterizing the soil's physical and engineering

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properties. Overall, these findings are vital for formulating effective stabilization strategies and improving the understanding of peat soil behavior in geotechnical engineering applications.

5. Discussion

Modification and improvement of peat soil should start after analyzing the index and physical properties of it. This will put researcher in better position to choose the right modification method . Study also needs to be conducted at site to have full knowledge of peat soil nature as this can also justify the laboratory test results. The accuracy of the laboratory results is only achieved by avoiding any single error when carrying out the laboratory test. Incorrect way of taking readings, wrong way of recording data and errors due to wrong calculation are examples that contribute to inaccuracy of the results. These can be avoided through reading data and practices more than one time. Other errors such as improper symbols can be avoided by using correct symbols and the utilization of proper standards.

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