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Application of Recron 3's Fibre in Improving the Soil Strength to Prevent Landslide

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ABSTRACT: The general aim of soil treatment in construction engineering is to improve soil properties such as stability, strength, and erosion resistance. Conventional soil treatment materials have several shortcomings, especially from an environmental standpoint. As a result, a suitable eco-friendly replacement for conventional materials is required. Recron 3s Fibre commonly used as a stabilizer. It has been used as a soil improvement material in the present study, and experimental tests were performed with the Landslide Soil using Recron 3s fibre in varying percentages. In the present study, soil is mixed with Recron 3s fibre in varying percentages and checked for its strength properties. Through experiments with varying concentrations of Recron 3s fibre, it was found that the soil's strength was enhanced.

KEYWORDS: Landslide soil and Recron 3's Fibre.

I. INTRODUCTION

The Soil improvement is a process in which soil is improved in a site to enhance the prospects of on-time and safe project delivery. Soil improvement is crucial in the construction industry because, it enhances the density and stiffness of the soil; hence, preventing liquefaction which can damage the structures around earthquake-sensitive regions. It also prevents excessive settlement of reclaimed land when it is being used for roads, bridges, airports, and other construction purposes. It stabilizes contaminants in dredged soil to mitigate and consequently eliminate environmental impacts. Soil improvement can improve the shear strength of the soil; hence, preventing slips failure and increasing the bearing capacity of the soil.

Numerous soil treatment methods are already in practice; among these, cement is the most commonly used material for soil treatment. However, even with the many benefits that ordinary cement provides, it has several shortcomings, especially when viewed from an environmental perspective. The most critical of these problems are CO₂ and NO_x (nitrogen oxides) emissions and particulate air suspensions.

Biopolymers are organic polymers that are produced by different biological organisms. In nature, biopolymers can be found in large amounts. They are biodegradable and have no negative effects on the environment; therefore, they might be favorable soil-improvement material. Biopolymers can increasingly replace the conventional admixtures for the application of soil improvement and soil stabilization. Numerous studies have been conducted in the past decades to investigate the suitability and efficiency of various biopolymers for soil improvement.

The purpose of this study was to verify the engineering performance and efficiency of Recron 3s Fibre-treated soil. Experimental tests were carried out to identify the strengthening characteristics of soil treated with a Recron 3s fibre. The effect of Recron 3s Fibre treatment on the consistency limits, compaction characteristics, permeability, shear strength, ageing and durability of the soil are studied at various percentages of Recron 3s Fibre i.e., 0.5%, 1%, 1.5% and 2%. The results of the study show promising applications of Recron 3s Fibre as a sustainable and economical option for improving soil properties.

II. MATERIALS

Landslide Soil

soil is a mixture of organic matter, minerals, gases, liquids, and organisms that support life. Soil samples are collected from Chamundi Hill (Mysuru) and are tested for their geotechnical properties and strength.

Recron 3's Fibre

The Recron 3S is a modified polyester fibre. It is generally used as secondary reinforcing material in concrete and soil

to increase their performance. Recron 3S sample used in experiment was of 12mm length and manufactured by Reliance Industries Limited. Use of Recron-3S as a reinforcing material is to increase the strength in various applications like cement based precast products, filtration fabrics etc. It also provides resistance to impact, abrasion and greatly improves the quality of construction during foundation, retaining wall design etc. Polypropylene fibre is the most widely used inclusion laboratory testing of soil reinforcement. Currently Polypropylene fibre is used to enhance the soil strength properties, to reduce the shrinkage properties and to overcome chemical and biological degradation.

III. METHODOLOGY

Step 1: Suitable soil sample will be collected for Testing.

Step 2: Basic tests are conducted on the materials to know its index and engineering properties.

Step 3: The mix proportion: A suitable cohesive soil sample is treated with Recron 3s Fibre by varying percentage of 0.5%, 1%, 1.5% and 2%.

Step 4: The above mix proportion is tested for index and engineering properties.

Table 3.1: Tests Conducted on Materials

Materials	Test Conducted
1. Normal Landslide Soil	<ul style="list-style-type: none"> ➤ Specific Gravity ➤ Grain Size Analysis ➤ Atterberg Limits ➤ IS Light Compaction ➤ Direct Shear Test
2. Soil mixed with Recron 3s Fibre	<ul style="list-style-type: none"> ➤ IS Light Compaction ➤ Atterberg Limits ➤ Direct Shear Test

IV. EXPERIMENTAL RESULTS

The soil sample was mixed with Recron 3's Fibre by varying percentage of 0.5%, 1%, 1.5% and 2%. And tested for its Consistency limits, Maximum Dry Density, OMC and Shear Strength Parametes. The following results were obtained.

Table 4.1: Test results on soil and Mix proportions

Test Conducted	Normal soil	0.5%	1%	1.5%	2%
Liquid limit(%)	45	39	35	32	38
Plastic limit(%)	18	20	21	23	25
Plasticity index(%)	27	19	14	9	13
IS Light Compaction MDD(g/cc)					
OMC(%)	16 12.5	17.5 12.1	18.2 11.7	19.4 11	18.5 11.5

Direct Shear Test C (KN/m ²) ϕ (Degree)	15.69	21.58	28.44	33.35	30.41
τ	25	28	30	31	26
	15.92	21.84	28.72	33.65	30.65

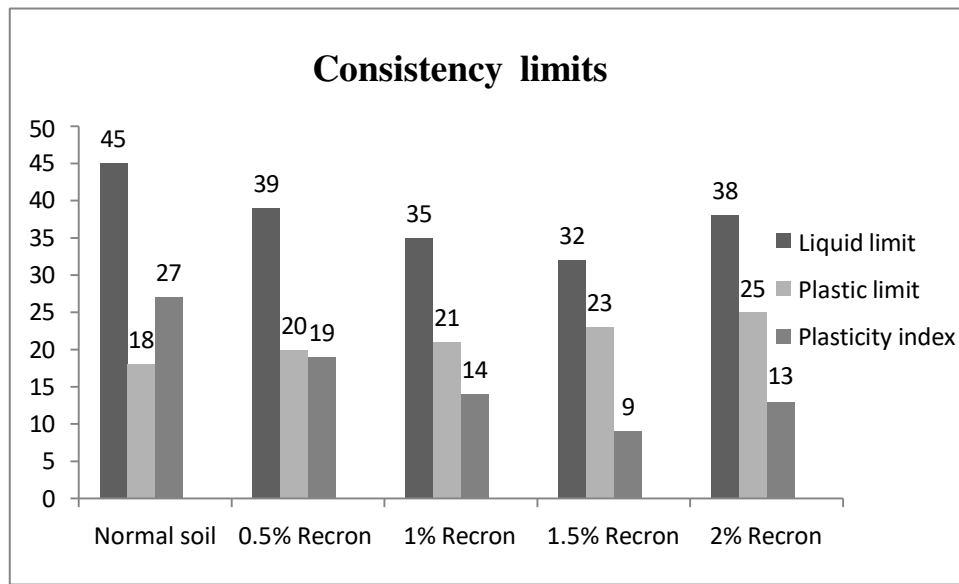


Fig 4.1: Variation of consistency limits in soil and treated mixture

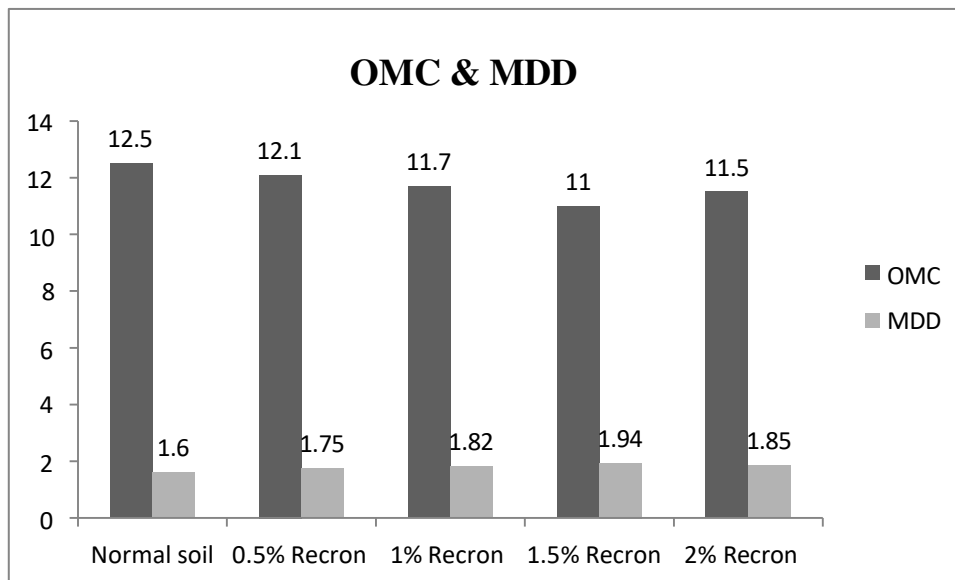


Fig 4.2: Variation of OMC and MDD in soil and treated mixture

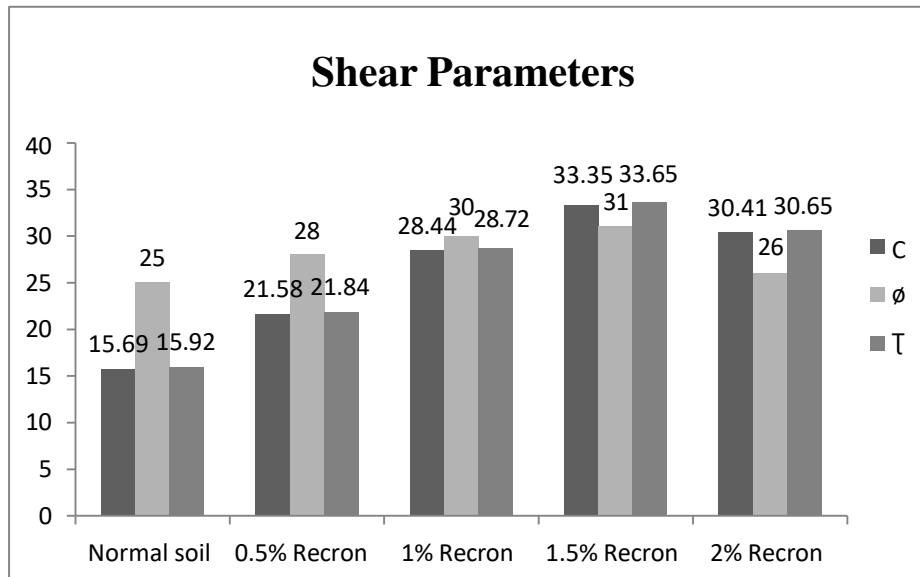


Fig 4.3: Variation of shear parameters in soil and treated mixture

V. CONCLUSION

- From this study it is clear that Recron 3's fibre have significant strength improvement in landside soil.
- By incorporating Recron 3's fiber into the landside soil, the liquid limit decreases to 40%, while the plastic limit and plasticity index increase by 25% and 26% accordingly.
- The addition of 1.5% Recron 3's fiber to the landside soil results in a decrease in the optimum moisture content (OMC) from 12.5% to 11% and an increase in the maximum dry density (MDD) from 1.6 g/cc to 1.94 g/cc.
- The addition of 1.5% Recron 3's fiber to the landside soil results in an increase in cohesion and angle of internal friction to 32% and 30% respectively. As a result, the shear strength of the soil increases to 33%.
- Based on these observations, the addition of 1.5% of Recron 3's fiber has been found to result in the most favorable increase in the index, compaction, and shear characteristics of the soil. Therefore, it can be concluded that Recron 3's fiber is a suitable stabilizer for landside soil.
- On comparison it is observed that, though Recron 3's Fibre is an eco-friendly and cost effective material.

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