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Study on Strength Behaviour of Jute Reinforced CH Soil

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Abstract - *In case of soft soil, problems were occurring during the construction of heavy structures on it. The properties of soft soil have to be improved for better performance. Natural fibers such as jute fiber are reinforced into the soil to make it stronger. The main aim of the study is to investigate and evaluate the effect of jute fiber on the strength characteristics of CH clay. Jute fibers of length 15mm and 30 mm were used in this study. The optimum moisture content and dry density variation were studied.*

Key Words: CH clay; Dry density; Jute Fiber; Optimum moisture content; Strength characteristics.

1.INTRODUCTION

The shortage of suitable construction sites has led to the increased use of problematic areas and it has become difficult to find sites with good foundation soil suitable for building activities. Due to this, structures are being constructed on land having weak or soft soil, which is highly risky on geotechnical grounds because such soil is having low shear strength, high compressibility and therefore susceptible to different settlements. Stability of any structure depends upon the characteristics of soil above which they are constructed.

The stabilisation of soils has been performed for a long time. There were utilization of some of the natural materials including wood, bamboo, wheat straw and rice straw for the improvement of soil strength. The presence of plant roots is a natural means of natural inclusion of soil. These plant fibres improve the strength of the soil and stability of natural slopes.

The primary purpose of reinforcing a soil mass is to improve its stability by increasing its bearing capacity and tensile strength, and by reducing settlement and lateral deformation.

The construction of fibre reinforced soil is easily achieved by simply mixing with soil with fibres . Fibre reinforced soil have behaves as a composite material in which fibres of relatively high strength are embedded in a matrix of soil. Shear stress in soil mobilizes the tensile resistance in fibre, which in turn imparts greater strength to soil. Generally, the high tensile strength and extendibility of the added fibres help to effectively reduce the compressibility and brittleness of the parent soil which is generally superior to traditional soil improvement approaches such as using cement. Fibre reinforced soil exhibits grater extensibility and small losses of post peak strength ie, greater ductility in the composite material compared to the unreinforced and reinforced soil with high modulus inclusions.

The paper mainly aims to determine the strength strength characteristics of CH clay. Jute fibers of length 15mm and 30 mm were used in this study. The optimum moisture content and dry density variation were studied for fibres of length 15mm and 30mm.fibres mixed with soil in different percentages such as 0.25%, 0.5%, 0.75%, 1% and 1.25%.

2. LITERATURE REVIEW

Many studies have been conducted relating to the behaviour of soil reinforced with randomly distributed fiber. Gray and Ohashi (1983) conducted a series of direct shear tests on dry sand reinforced with different synthetic, natural and metallic fiber to evaluate the effects of parameters such as fiber orientation, fiber content, fiber area ratios, and fiber stiffness on contribution to shear strength. Based on the test results they concluded that an increase in shear strength is directly proportional to the fiber area ratios . Aggarwal and Sharma (2010) studied the application of Jute fiber in the improvement of subgrade characteristics. From this study it was concluded that Jute fiber reinforcement reduces the maximum dry density and increases the optimum moisture content of the subgrade soil.

3. OBJECTIVES

- To study the effect of jute fibre content on strength characteristics of soil having fibre length 15mm and 30mm of different percentages.
- To study the variation of optimum moisture content and maximum dry density of the soil mixed with different percentages.

4. MATERIALS AND METHODS

Materials used for preparing the soil samples were soft soil and jute fibre.

a) *CH clay*

The material was collected from a site near Neyatinkara; Thiruvananthapuram district from a depth of 2 m from ground surface. The basic properties of the collected soil samples are determined through laboratory tests as per the standard procedures recommended by the IS specifications. Table 1 below represents the soil properties.

Table -1: Properties of clay

Properties	Values
Specific gravity	2.6
Percentage of clay,%	62%
Percentage of silt,%	34%
Liquid limit(%)	56
Plastic limit(%)	28
Optimum moisture content (%)	29.37
Maximum dry density, γ_{dmax} (kN /m^2)	15.2
Unconfined compressive strength (KN /m3)	108
Soil classification	CH

b) *Jute fibre.*

The jute fibre used in this study was purchased from Jute board, Kolkata. The initial properties of the jute fibre were determined from various tests conforming to ASTM codes as shown in Table 2.

Table -2: Properties of jute

Properties	Values
Specific gravity	1.29
Density (kN/m^3)	13
Micro fibril angle (degree)	8.1
Cellulose / Lignin content (%)	61/12
Tenacity (MN/m^2)	525
Elongation (%)	1.1

c) *Preparation of sample*

In present study the strength of CH soil reinforced with jute fibre was studied. Fibre lengths of 15mm and 30mm were used for the determination of strength. Fibre mixed in soil with varying percentages such as 0.25%, 0.5%, 0.75%, 1% and 1.25%. The effect of jute fibre on optimum moisture content and max dry density was also studied.

5.RESULTS AND DISCUSSONS

Table -3: Properties Unconfined Compressive Strength of Soil Reinforced With Jute Fibre

Fibre content (%)	Unconfined compressive strength (kN/ m^3)	
	15 mm	30mm
0	108	108
0.25	119	127
0.5	126	140
0.75	134	138
1	139	124
1.25	125	111

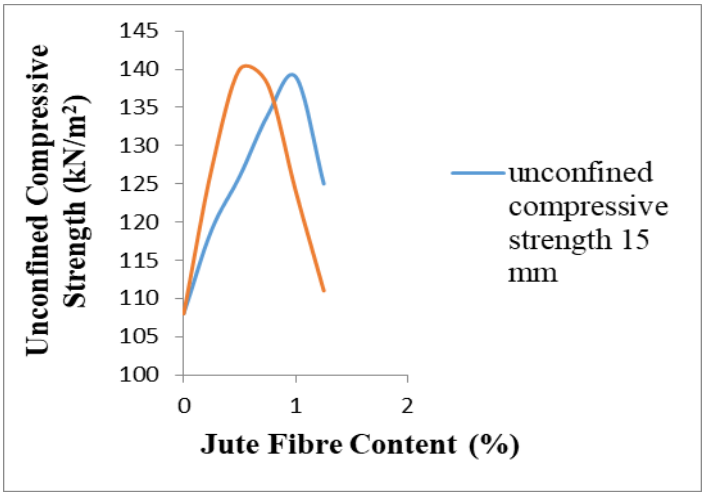

Chart -1: Variation of unconfined compressive strength with increase in jute fibre.

From the results of unconfined compressive strength tests , it is concluded that the addition of jute fibre increased the compressive strength with a maximum gain at 1% fibre content for 15mm long fibres. When 30 mm long fibres were added, the maximum strength was obtained at 0.5%fibre content. Further increase in fibre content show a decrease in compressive strength. The increase in compressive strength attributed to the increase in total contact area between the fibres and soil particles. The increase in fibre content consequently increase the friction between soil particles, which contribute to increasing resistance to force applied.

Table -2: Compaction characteristics of 15 mm long jute fibre reinforced soil

Fibre content (%)	Optimum moisture content	Max dry density (kN/m²)
0	29.37	15.2
0.25	33.16	13.1
0.5	34.92	11.2
0.75	36.21	10.6
1	38.31	9.9
1.25	39.86	9.4

Table -2: Compaction characteristics of 30 mm long jute fibre reinforced soil

Fibre content (%)	Maximum dry density (kN/m²)	Optimum moisture content
0	15.2	29.37
0.25	14.6	30.08
0.5	14.1	31.25
0.75	13.4	32.61
1	12.6	33.48
1.25	11.9	35.13

As the percentage of fibre increases, the optimum moisture content increases. This is due to the fact that a portion of soil is replaced by the jute fibres. The jute fibre is having specific gravity very lower than clay. Thus the maximum dry density decreased. As the percentage of fibre increases, the optimum moisture content increases because jute fibre absorbs more water.

6. CONCLUSIONS

The paper discusses the effect of jute fibre on strength characteristics of CH soil was studied. With the addition of jute fibre increased the compressive strength with a maximum gain at 1% fibre content for 15mm long fibres. When 30 mm long fibres were added, the maximum strength was obtained at 0.5%fibre content. Further increase in the fibre content show a decrease in compressive strength. . As the percentage of fibre increases, the optimum moisture content increases. As the percentage of fibre increases, the optimum moisture content increases.

REFERENCES

1. Arvind, “Significance of geotextile in unpaved roads with special reference to stress analysis”, International Journal of Erath Science and Engineering,Vol. 6, 2013,pp: 251-268.

2. BarnaliGhosh, Dr. V. Ramesh, Rajarajeswari B. Vibhuti,“Improvement of soil characteristics using Geo-textile”, International Journal of Science and Technology Research, Vol.3, 2014,pp:1278-1286.

3. Dipa Ray, “Study on alkali coated jute fibres”, International Journal of Engineering and Technology” Vol.5,2001,pp: 95-103.

4. Dr. Dixit M. S. and Dr. Patil K. A., “Effect of Reinforcement on Bearing Capacity and Settlement of Sand”, Electronic Journal for Geotechnical Engineering, Vol.19,2014,pp:1034-1046.0

5. Donald H. Gray, A.M. andTalal Al-Refaeai, “Behaviour of fabric versus fibre reinforced sand”, ASCE ,1986,pp: 804-820.