Improving C.B.R. of black cotton Soil using threaded Jute Fiber

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Abstract : *In the present study, for California Bearing Ratio (CBR), Jute fiber are added in various dosage and 0%,0.5%, 1.5% , 2.0% and 2.5% for diameter 2mm and length 20mm, 40mm and 60mm with soil respectively and Modified Proctor Test, CBR has been conducted in laboratory.*
It has been concluded that increase jute fiber percentage of 0% to 1.5% decrease in OMC and then increase for 2.0% and 2.50% . Results also shown that MDD increase with increase in jute fiber 0% to 1.5% but again decrease for 2.0% and 2.50% .
IndexTerms - Jute fiber,

1. INTRODUCTION

For any land-based structure, the foundation is very important and has to be strong to support the entire structure. In order for the foundation to be strong, the soil around it plays a very critical role. So, to work with soils, we need to have proper knowledge about their properties and factors which affects their behavior. The process of soil stabilization help to achieve the required properties of in a soil needed for the construction work. From the beginning of construction work, the necessity of enhancing soil properties has come to the light. Ancient civilization of the Indians utilization various method to improve soil strength etc. some of these methods were so effective that their buildings and roads still exist.
Black cotton Soil stabilization is the process of altering some soil properties by different methods, mechanical or chemical in order to produce an improved soil material which has all the desired engineering properties.Soils are generally stabilized to increase their strength and durability or to prevent erosion, liquefaction and dust formation in soils. The main aim is the creation of soil material or system that will hold under the design use conditions and for the designed life of the engineering project. The properties of soil vary a great deal at different places or in certain cases even at one place; the success of soil stabilization depends on soil testing. Various methods are employed to stabilize soil and the method should be verified in the lab with the soil material before applying it on the field.

2. OBJECTIVES OF THE STUDY:

Black cotton soil is an expansive soil which undergoes swelling and shrinkage on addition and removal of water content. It may pose danger to any structure constructed on such type of soil. Such soil must be stabilized before used as foundation or construction material. The study area in the present work consists of black cotton soil, so efforts have been made to improve the geotechnical properties of soil in cost effective way.

3. METHODOLOGY

3.1 Materials:

3.1.1 Specification of Soil:

Nearly black highly plasticity clayey soil was used in this study, collected from Shingwa Tal- Chandwad, Dist- Nashik, and Maharashtra India. The collected soil was loose, wet and it was pulverized manually by hammer. Then the soil was screened through the sieve of 4.75 mm aperture before preparing the specimens for testing. and also oven dried the soil at 110 c for 24 hours before using specimen. According to the Unified soil Classification Systems, soil is MH (Clay with highly plastic silt).

3.1.2 Specification of jute

The jute fiber used is procured from the local market. The diameter of the thread varies between 2 mm t, 4 mm. & 6mm .These fibers are generally available in the threaded form. These are mechanically woven fibers with very fine threads. Specific gravity and diameter of the jute fiber are shown in Table 3.2. Jute industry is one of the oldest industries in India, has traditionally been used for packaging.

.Table.3.1.2 Properties and Constituent of Jute fiber

Color	Light brown
Specific gravity (G)	1.12
Diameter mm	2mm
Hoiocelluiose (%)	83-87
Lignin (%)	12-14
Wax (%)	0.41-0.81

Nitrogen (%)	0.4
Ash (%)	0.5 to 1.04

4. EXPERIMENTAL EVALUATION

Table.4.1 Index Properties of Soil

Colure	Dark brown
Natural water content (%)	6.25
Liquid Limit (%)	66.83
Plastic limit (%)	46.79
Shrinkage limit (%)	19.60
Free swell index (%)	41
Plasticity index of soil (%)	20.04
Maximum Dry Density (yd) (gm/cc)	1.504
Optimum moisture content (%)	22.74
Specific gravity	2.65
Soil classification (MH or CH)	MH

4.2 Modified Proctor CompactionTest :

Table.4.2 Variation of Compaction Characteristics with Percentage of Jute Fiber.

Percentage of jute Fibre	Fiber diameter 2mm					
	L- 20mm		L-40mm		L-60mm	
	OMC %	MDD gm/cm^3	OMC %	MDD gm/cm^3	OMC %	MDD gm/cm^3
0%	22.10	1.504	22.10	1.504	22.10	1.504
0.5 %	21.3	1.586	20.965	1.590	21.60	1.550
1.%	20.46	1.593	19.69	1.635	20.42	1.586
1.5	19.92	1.601	18.45	1.744	20.24	1.592
2.0	20.05	1.56	20.0	1.582	20.99	1.520
2.5	21.3	1.503	21.03	1.534	21.67	1.515

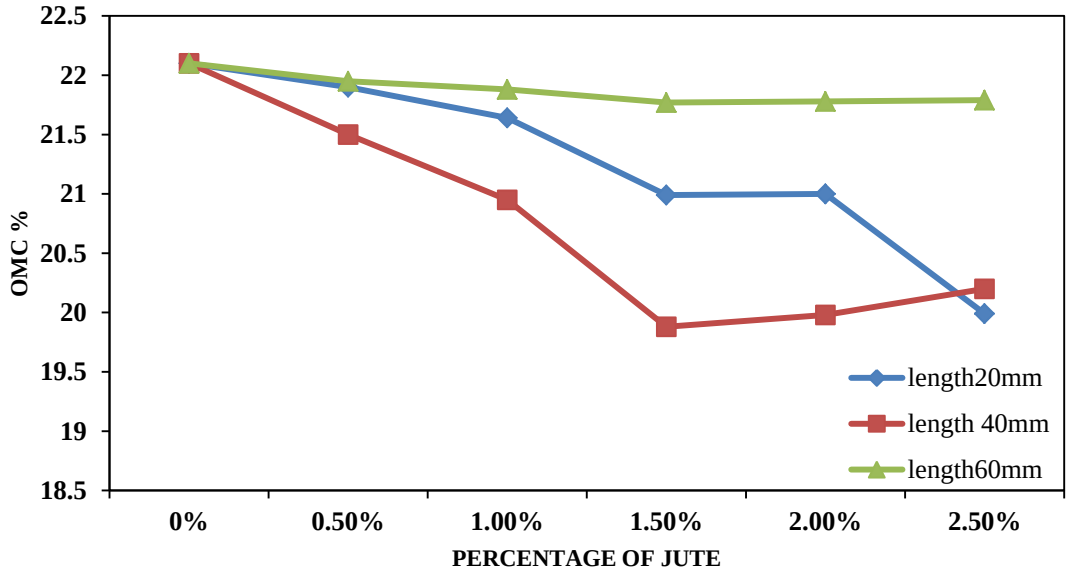

Figure 4.1 Variation of OMC value with jute content for different length

Discussion : Optimum Moisture Content decrease with increase in percentage of jute fiber from 0% to 1.5% and again increase from 1.5% to 2.5% of jute fiber for all variation in length of the fiber.

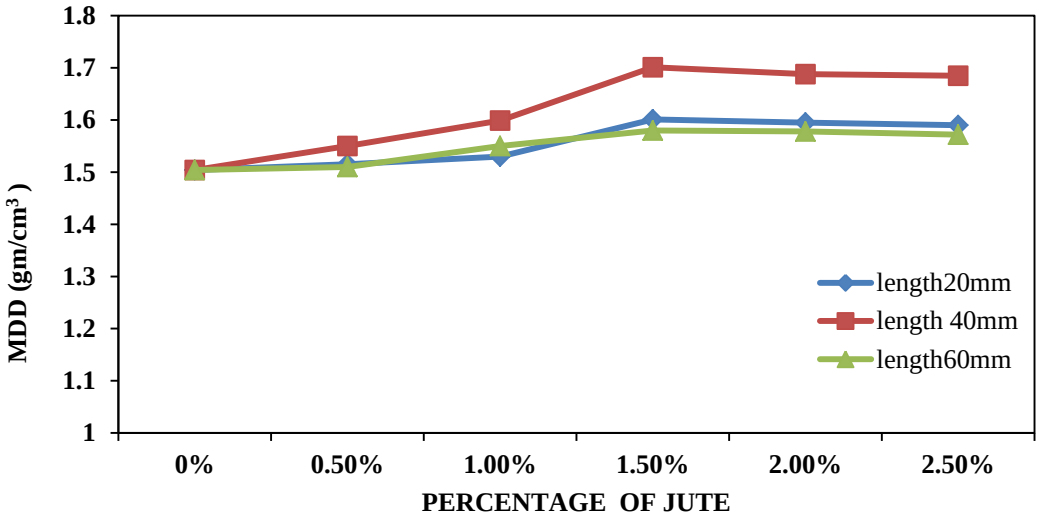

Figure 4.2 Variation of MMD value with jute content for different length

Discussion : Maximum dry density increases with increase in percentage of jute fiber from 0% to 1.5% and again decreases from 1.5% to 2.5% of jute fiber for all variation in length of the fiber.

4.3 California bearing ratio

4.3.1 (Unsoak C.B.R.)

Table.4.3 Variation of unsoak CBR value with jute content for different length

Percentage of jute fiber by dry weight of Soil (%)	Fiber diameter 2mm		
	Length-20mm	Length-40mm	Length-60 mm
0	2.740	2.74	2.740
0.5	3.290	4.100	3.500
1.0	3.840	4.500	4.860

1.5	5.110	6.080	5.450
2.0	4.950	5.800	5.150
2.5	4.820	5.760	5.0

Discussion : Research including unsoak CBR. The combination of soil and optimum percentage is added with varying percentage of jute fiber of 2 mm diameter. The percentage of fiber content varied from 0.0 % to 2.50 % on different aspect ratios of 20, 40, 60 and unsoak CBR value in each case was determined. The percentage of fiber given maximum strength at pick point 1.5% of jute fiber effective.

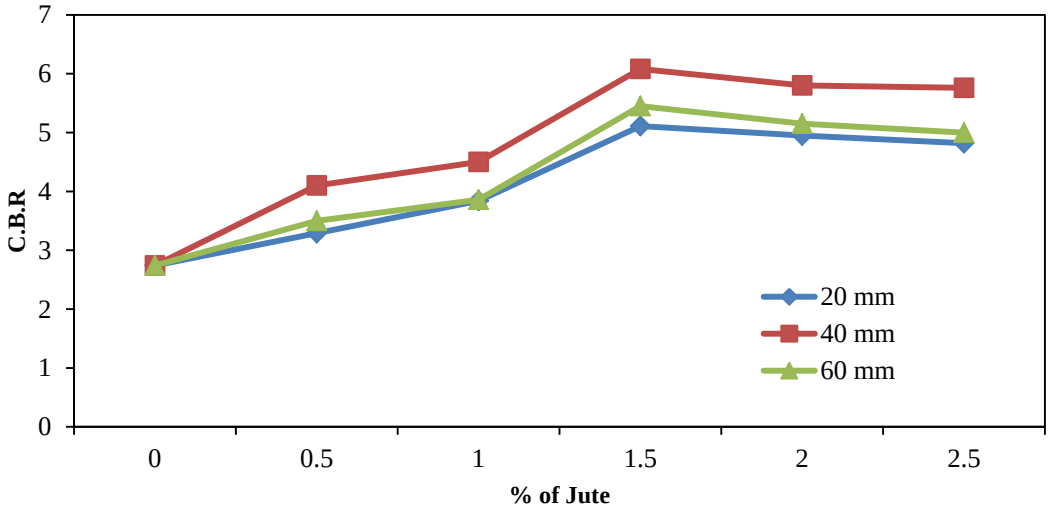

Figure 4. 3 Variation of unsoak CBR value with jute content for different length

CONCLUSION

The following conclusions may be drawn from the study:

1. Optimum Moisture Content in all variation of jute fiber decreases from0.% to 1.5% with increase in percentage of jute fiber& again increases from 1.5 % to 2.5 % .

2. Maximum Dry Density (MDD) in all variations increases from 0.5%to 1.5% of jute fiber and again decreases at 2.0% and 2.50% of jute fiber. But for 20mm and 40mm length of fiber, MDD increases. But in case of 60mm length Maximum Dry Density (MDD) decreases from 2.0 % to 1.5 %

3. The decrease in optimum moisture content is probably a consequence of additional water held within the flocculated soil structure resulting from fiber and soil interaction

4. It is observed from the result of California bearing ratio value of soil reinforced with same fiber content and increases with increase in the length of fiber. This may be attributed to the fact that for shorter jute fibers the area of contact with the soil is less and hence there is less improvement in strength and stiffness of soil.

5. By the addition fiber to soil the stiffness of soil increases and may be due to thus reason there is improvement in the strength of expansive soil. The optimum fiber content corresponding to maximum strength is found to be 1.5% of jute for 40mm length.

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