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A Study On Stabilization Of Cohesive Soils By Using Sisal Fiber

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Abstract-Soil Properties which makes a significant effect on development exercises because of quick development of urbanization and industrialization. Particularly in broad soils are making overall hazardous soil these having enormous volumetric change conduct when it goes through an adjustment of the dampness content. Among those, dark cotton soil are one kind of extensive soils and they shows high enlarging and shrinkage conduct inferable from fluctuating water content. In India, dark cotton soil covers as high as 20% of the absolute land region and significantly in focal and south India. Assuming that it ought to be utilized as establishment material, Improvement of soil should be finished by embracing different strategies like soil adjustment, support and so forth Use of locally accessible admixtures is viable as far as simple versatility and economy.The principle objective of this study is to survey the chance of involving sisal fiber as settling specialist and to comprehend the adequacy of sisal strands in controlling a few properties of dark cotton soil under controlled lab conditions. To accomplish this objective a few exploratory investigations like ideal dampness content, compressive qualities tests (UCS), CBR, and so forth, were done with expansion of various rates of sisal in dark cotton soil test as experimentation process.In present review, the dirt examples arranged with expansion of sisal strands by 0.25%, 0.5%, 0.75%, and 1% the normal length of sisal fiber will use in this study is roughly 10-15mm. From the beginning, Optimum Moisture Content not entirely set in stone through delegate test. At those OMC, a few tests like CBR, UCS were led. CBR test was conveyed in both Unsoaked and splashed condition and most extreme qualities was acquired where 0.75% sisal fiber was added.

Keywords-CBR,UCR,OMC,Sisalfiber.

I. INTRODUCTION

Soil improvement is of major concern in the construction activities due to rapid growth of urbanization and industrialization. The term soil improvement is used for the techniques which improve the index properties and other engineering characteristic of expansive soils. Expansive soils are worldwide problematic soil which is associated with large volume change behavior when it undergoes a change in the water content. When expansive soils are exposed to high water content, the exhibit high selling characteristics. And when the presence of low water content, the shows low shear strength. These soils pose several problems to the structures due to their volume changes. Among those, black cotton soil are one type of expansive soils and they shows high swell shrinkage behavior owing to fluctuating water content. In India, black cotton soil covers as high as 20% of the total land area and majorly in central and south India. They are predominant in the states of Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka and Tamil Nadu. These soils have high swelling and shrinkage characteristics and extremely low CBR value and shear strength. If it should be used as foundation material, Improvement of soil need to be done by adopting various techniques like soil stabilization, reinforcement etc. One method of controlling volume changes is to stabilize the soils with admixtures that prevent volume changes are adequately modify the volume change characteristics of soft clayey soil (Kehew 1995).Soil Stabilization:The following are the different types of stabilization

i) Mechanical stabilization
ii) Chemical stabilization

Objective of the study:

- To determine the basic properties of the existed black cotton soil.
- To assess the possibility of using sisal fiber.

- Study the effect of Sisal Fiber on engineering properties of black cotton soil at different curing periods.
- To know the amount of Sisal Fiber required to stabilize the black cotton soil.
- To increase the stability and strength of the black cotton soil using these locally available materials.
- The analyze the variation of basic Engineering Properties like, OMC, MDD, CBR, UCS, with the addition of sisal fiber at different percentages.

II.MATERIALS AND METHODOLOGY

Black cotton soil was collected and it was subjected to air dried to carry the whole study. The whole study was carried in 3 phases.

a)Phase-I
b) Phase-II
c) Phase-III

III.LABORATORY EXPERIMENTAL STUDY

In this chapter, the list of experiments performed on different samples of black cotton soil along with the addition of lime and sisal fiber at different percentages were explained. The detailed procedures of sampling and testing methods of different tests were given in following sections.

The following experiments has done on the soil samples:

- Sieve Analysis
- Specific Gravity
- Liquid Limit
- Plastic Limit
- Plasticity Index
- Differential Free Swell
- Compaction Test
- California Bearing Ratio
- Unconfined Compressive Strength.

1. Sieve analysis

A sieve analysis or gradation test, is a practice or procedure are commonly used to assess the particle size distribution or also called gradation. The size distribution is often of critical importance to the way the material performs in use. A sieve analysis also can be performed on any type of non-organic or organic granular materials including sands, crushed rocks, clays, etc.Take 1000gm of the soil sample after taking representative sample. Conduct sieve analysis using a set of standard sieves as given in the data sheet. The sieving may be done either by hand or by mechanical sieve shaker for 10 minutes. Weigh the material retained on each sieve. The percentage retained on each sieve is calculatedon the basis of the total weight of the soil sample taken. From these results the percentage passing through each of the sieves is calculated. Draw the grain size curvefor the soil in the semi-logarithmic graph provided.

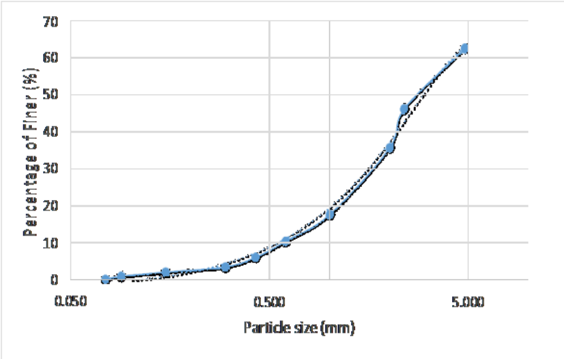

Fig-2 Liquid Limit Determination Graph

3. Test procedure for consolidation test

- Clean and dry the metal ring, Measure its diameter and height. Take the mass ofthe empty Ring.
- Press the ring into the soil sample contained in a large container at the desiredensity and water content. The ring is to be pressed with hands.
- Remove the soil around the ring. The soil specimen should project about 10mm on either side of the soil lightly.
- Trim the Specimen flush with the top and bottom of the ring.
- Remove any soil particles sticking to the outside of the ring. Weigh the ring with specimen.
- Take a small quantity of the soil removed during trimming for the water content determination
- Assemble the consolidometer. Place the bottom porous stone, bottom filter paper, specimen, top filter paper and the top porous stone, one by one.
- Position the Loading block centrally on the top porous stone. Mount the mould assembly on the loading frame. Centre it such that the load applied is axial. In the case of the lever-loading system, counter balance the system.
- Set the dial gauge in position. Allow sufficient margin for the swelling of the soil.
- Connect the mould assembly to the water reservoir having the water lever at about the same level as the soil specimen. Allow the water flow to the specimen till it is fully saturated.
- Take the initial reading of the dial gauge. Apply the first load increment to apply pressure of 0.1 kg/cm2, and start the stop watch. Record the dial gauge readings at 0, 0.25, 1.0, 2.25, 4.0, 6.25, 9.00, 12.25, 16.00, 20.25, 25.00, 36, 49, 64, 81,etc. min.
- Increase the load to apply a pressure of 0.2kg/cm2, and repeat the above steps. Likewise increase the load to apply a pressure of 0.4, 0.8, 1.6kg/cm2 or upto the desired pressure.
- Dismantle the assembly. Take out the ring with the specimen. Wipe out the excess surface water using a blotting paper. Take the mass of the ring with specimen.

- Dry the Specimen in the oven for 24 hrs, and determine the dry mass of specimen.
- Plot a Curve between Pressure and final void ratio for determination of av and mv.
- Plot a graph between log $\bar{\sigma}$ and final void ratio for determination of Cc.
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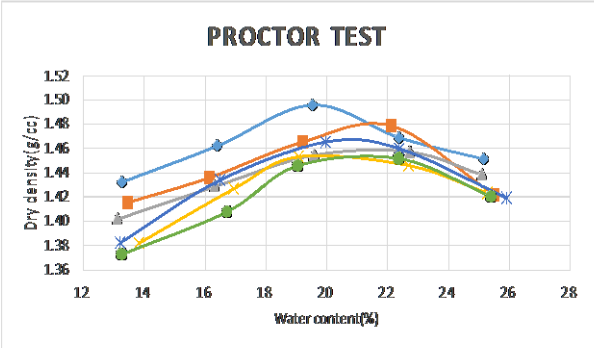

Fig-3:Compaction Curves For Soil Samples With At Different Percentages Of Sisal Fiber.

Table 1. OMC and MDD values of BC + Lime% + Sisal%

S.No	Sample	OMC (%)	MDD (g/cc)
1	Black Cotton Soil	20	1.5
2	BC + 0.25% Sisal	21.5	1.46
3	BC + 0.50% Sisal	21.5	1.45
4	BC + 0.75% Sisal	22	1.47
5	BC + 1.00% Sisal	22.5	1.45

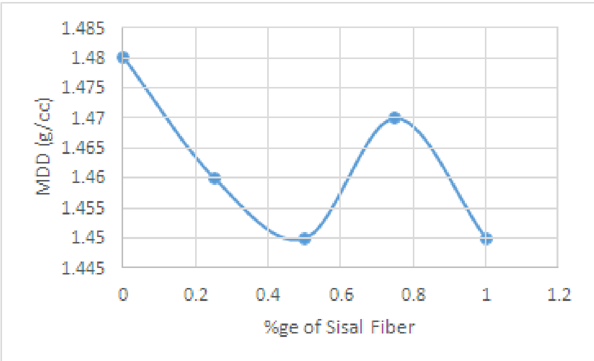

Fig.4 Variation of OMC with different %ge of Sisal Fiber at 4% Lime.

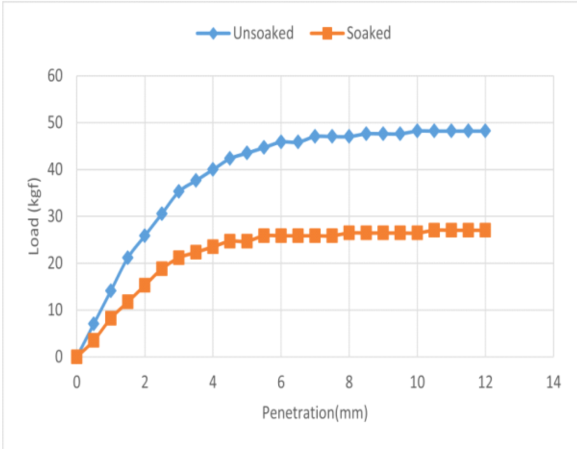

Fig-6Load Vs Penetration Graph For Black Cotton Soil (Unsoaked & Soaked).

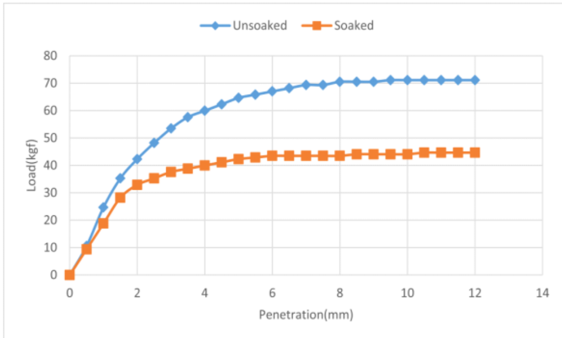

Fig-7Load Vs Penetration Graph For Black Cotton Soil + 0.25% Sisal Fiber.

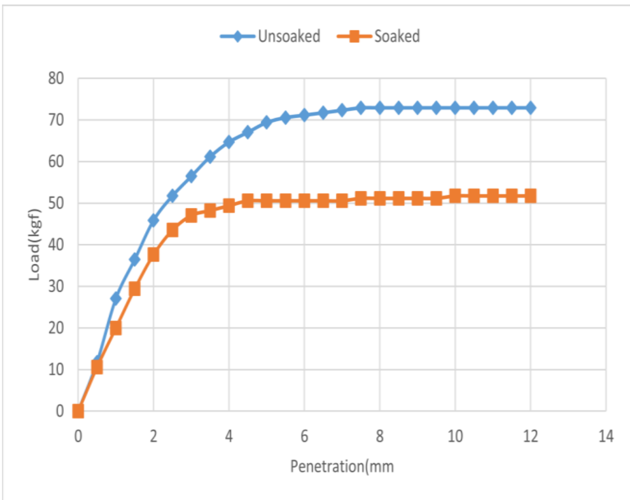

Fig-8 Load Vs Penetration Graph For Black Cotton Soil + 0.5% Sisal Fiber.

DD (g/cc)

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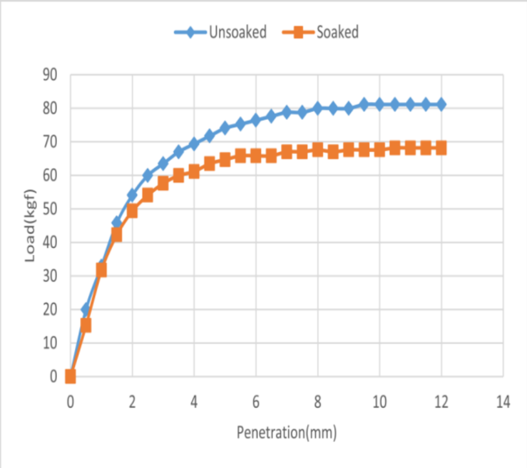

Fig-9 Load Vs Penetration Graph For Black Cotton Soil + 0.75% Sisal Fiber.

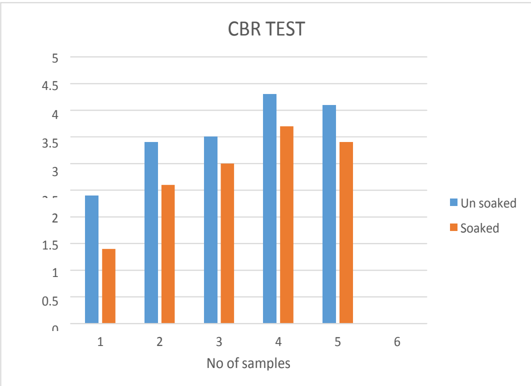

Fig-10 Unsoaked And Soaked Cbr Values At Different Percentages Of Sisal Fiber.

IV.CONCLUSIONS

In this study, the major properties studied are OMC, MDD, CBR, UCS, and Consolidation. Based on the all investigations on all samples and when compared with normal soil, following conclusions were made.

- Optimum Moisture Content: (OMC)
- Optimum moisture content (OMC) was increase with the addition of sisal fiber.
- For normal soil, OMC observed at 20% and it is increased to 21.5, 21.5, 22, and 22.5% with the addition of 0.25%, 0.5%, 0.75% and 1% sisal fiber respectively
- Maximum Dry Density: (MDD)
- Maximum dry density was decreased with the addition of sisal fiber
- When Sisal fiber added, MDD value were decreased. But, at 0.75% sisal fiber addition was increased when compared to other sisal fiber additions.
- California Bearing ratio: (CBR)
- Both the Unsoaked and soaked condition of CBR were studied and Peak value was obtained at 0.75% sisal fiber addition in both conditions.
- From 0 to 0.75% addition of sisal fiber, CBR value was gradually increased in both unsoaked and soaked condition.
- But, CBR value was decreased after 0.75% of sisal fiber addition (i.e., at 1%)
- Unconfined Compressive Strength: (UCS)
- In UCS, Due to increase in Sisal percentage the UCS value having increasing trend with respect to the parent soil.
- In UCS, Due to increase in Sisal percentage the UCS value has been observed increasing trend up to 0.75% after that having decreasing trend with Further increase of sisal content.
- With overall observations of UCS, 0.5% and 0.75% addition was good, and more than that was not good.

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