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EXPERIMENTAL STUDY ON THE EFFECT OF PALMYRA FIBRE ON SHEAR STRENGTH OF BLACK COTTON SOIL

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Abstract - *Soil having the property to expand and shrink is known as cohesive soil. Cohesive soil is black cotton soil or fine soil. The major problem for geotechnical engineers is the black cotton soil is required to be treated before the construction of superstructures. There are several methods like Grouting, stabilization, etc for the treatment of black cotton soil. In this project, we investigated the properties of black cotton soil stabilized by palmyra fiber. The experiment covered the index property testes, vane shear test, Direct shear test and unconfined compression test. With the focus on improving the shear strength parameters, soil samples with different combination of palmyra fiber is prepared like 2%,4%,6%, and 8% palmyra fiber blended with natural soil, and the soil sample namely Pfbc-1, Pfbc-2, Pfbc-3, Pfbc-4 were tested under different shear tests. Results were discussed and an optimum proportion of palmyra fiber with black cotton soil is suggested based on the test results performed above.*

Key Words: Black Cotton Soil, Palmyra fiber, **PFBC, Compaction tests, Optimum Moisture Content, and shear strength parameter of the *Black Cotton Soil*.**

I. INTRODUCTION

1.1. General

A landfill site is also known as a tip dump, rubbish dump, garbage dump, or dumping ground is a site for the disposal of waste materials. A landfill is the oldest and most common form of waste disposal. As Landfills may contain a lot of chemical components it may affect the quality of the soil and also affects the vegetation in the area so by using palmyra fiber the usage of chemicals can be reduced and increase the vegetation in the particular area of landfills. At the same time stability of landfills must be taken into accuracy for future use. A natural fiber that derives from the treatment of the palmyra palm is known as palmyra fiber. A large quantity of palmyra fiber is produced in southern and eastern India. As Using chemicals for the stabilization of the soil results in damage to the quality of the soil and also affects the growth of crops in it. So by using palmyra fiber such conditions can be prevented and soil can be stabilized without affecting the quality of the soil. So were intend to discover the effect of palmyra fiber on the shear strength of black cotton soil.

II. OBJETIVES

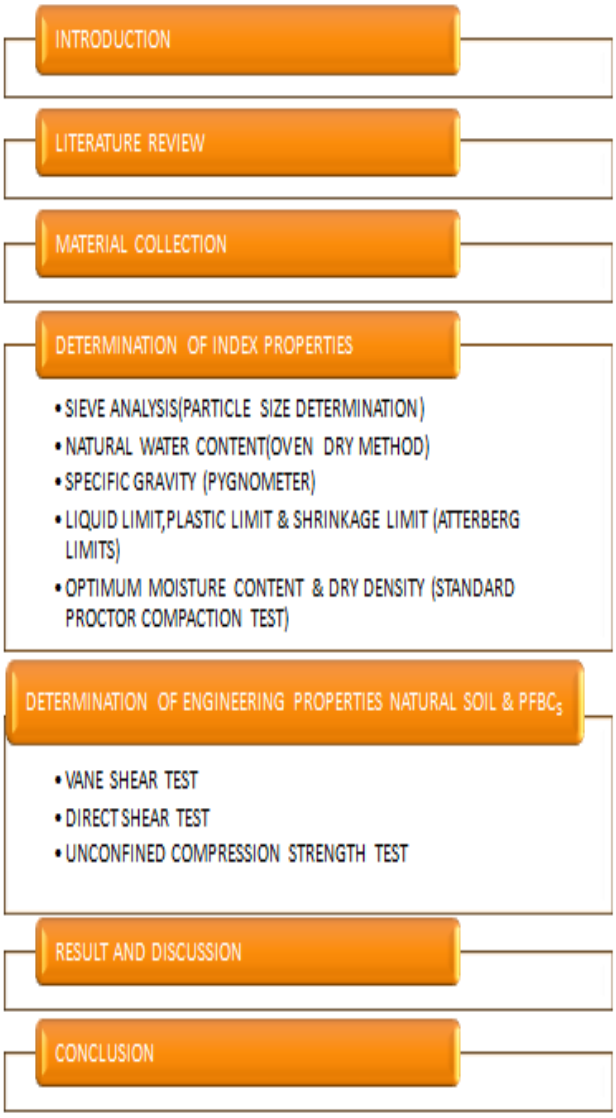
This paper is mainly aimed to get maximum information about the change in shear strength of black cotton soil available near Coimbatore and also observe the behavior while added with the palmyra fiber.

The broad Ares includes:

- Study the effect of palmyra fiber on black cotton soil with various proportion
- To produce the proper surface layer for backfills without affecting the environment.

III.METHODOLOGY

Following process was done for investigate the Effect of palmyar fiber on Black cotton soil.



3.1 Mix Proposition

We collected Black cotton soil from the Coimbatore district. In Coimbatore district, the Black cotton soil is around 2687 sq. km. it contributes 57.62%. To create the proper bonding between palmyar fiber with Black cotton soil. Fibers were cut into a length of 2.5 cm. and mixed with Black cotton soil on different combinations like PFBC-1, PFBC-2, PFBC-3 and PFBC-4 (Palmyar fiber with black cotton soil- PFBC)

Table-1: Mix Proportion

Mix	Natural soil	PFBC-1	PFBC-2	PFBC-3	PFBC-4
Weight of soil (g)	5000	4900	4800	4700	4600
Palmyar fiber (g)	0	100	200	300	400

IV. RESULT AND DISCUSSION

Properties of materials

4.1 BLACK COTTON SOIL:

Index Properties of Black cotton soil were determined as per IS code and tabulated below

Table 3: Properties of Soil

S.No	Property	Specification
1.	Natural Water Content	15.42%
2.	Specific Gravity	2.274
3.	Soil Classification	CH
4.	**Consistency Limits**	
	Liquid Limit (W_L)	34.5 %
	Plastic Limit (W_p)	33.34%
	Plasticity Index (I_p)	1.16 %
5.	**Standard Proctor Test**	
	Optimum Moisture Content	11 %
	Maximum Dry Density	1978 kg/m^3
6.	**Vane Shear Test**	
	Torque (T)	0.140 N/mm^2
	Cohesion (C_t)	0.035 N/mm^2
7.	**Direct Shear Test**	
	Angle of Internal Friction (ϕ)	13^0
	Cohesion (C_d)	7.72 kN/m^2
8.	**Unconfined Compressive Test**	
	Unconfined Compressive Strength (q_u)	0.069 N/mm^2
	Cohesion (C_u)	0.0345 N/mm^2

4.3 Studies on PFBC Samples

A detailed experimental study is done on palmyra fiber blended with natural soil on a different combination of palmyra fiber prepared like 2%, 4%, 6%, and 8% by weight. Experimental study aimed at getting the detailed shear strength parameters of PFBC samples and the results

of experimental study were given below samples is as follows.

4.4 Direct Shear Test

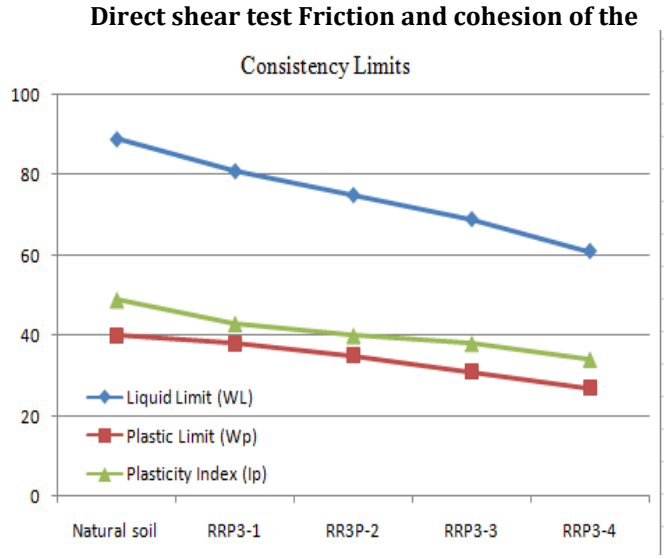


Fig. 1 Atterberg's limits Test on natural soil & RRP3 samples

4.5 Compaction Properties

Proctor compaction tests were carried out on natural soil as well as prepared RRP3 samples. Variations in Optimum moisture content and maximum dry density of RRP3 samples and Natural Soil shown in the figure 2

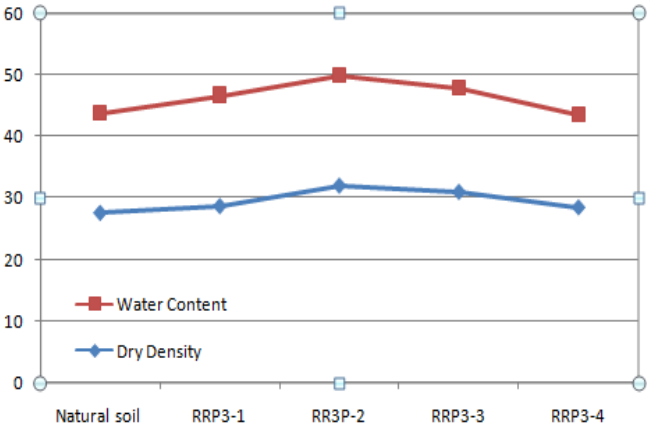


Fig. 2 Proctor compaction Test on natural soil & RRP3 samples

4.6 Unconfined Compression Strength

To find the unconfined compression strength and cohesive force developed on the soil with different proportions of powered Recorn - 3s. the UCC tests were conducted on natural soil and RRP3 samples, results of UCC tests were shown in the figure 3

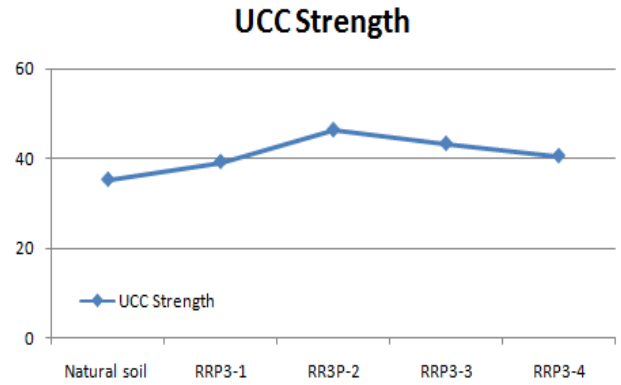


Fig. 3 Unconfined Compression Test on natural soil & RRP3 samples

4.7 California Bearing Ratio

In order to calculate the California Bearing Ratio for natural natural soil and RRP3 samples, CBR tests were conducted and results were shown in the figure 4

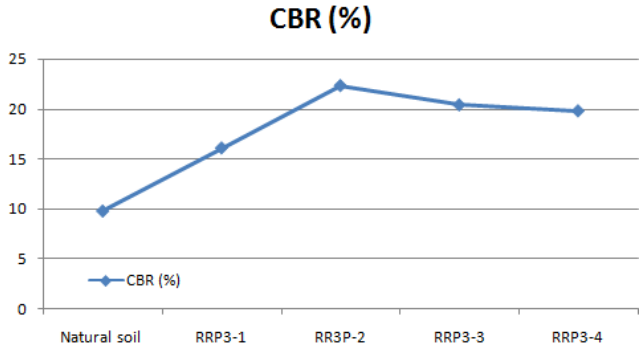


Fig. 4 California Bearing Ratio Test on natural soil & RRP3 samples

From all of the test results, it is observed that the Liquid Limit, Plastic Limit, and Plasticity Index values get decrease with the addition of PR3. It also shows the increase in Dry Density, Optimum Moisture Content, Unconfined compression strength, cohesion, and California Bearing Ratio while adding the PR3.

(I) Soil with PR3 shows a gradual reduction in the Liquid Limit, Plastic Limit, and Plasticity Index.

(2) The soil having 2% PR3 may increase the Dry Density by 15.36% and the Optimum Moisture Content by 12.5%

(3) The soil having 2% PR3 may increase the unconfined compression strength by 31.23% and Cohesion by 15.56%

(4) Soil with 2% PR3 may increase the California Bearing Ratio by 127%

V. CONCLUSION

In this experimental work, we did several tests on natural and RRP3 samples to get a clear idea of the effect of PR3 in red clay around the Coimbatore region. From the result, we conclude that the maximum percentage of RP3 mixed with red clay is in the range of 1% to 2%.

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