

STABILIZATION OF BLACK COTTON SOIL USING COCONUT COIR

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ABSTRACT - Black cotton soil is the cohesive soil in which it having less supporting power hence it needs to face some of the hindrances during construction of the structure like a Building, Bridges, embankments and Roads. Problems are like settlement, permeability, and shear strength and we need to increase strength of soil. We have many methods but cost effective eco friendly easily available. We are advised to mix the coconut coir to the soil during construction of engineering projects. By various percentages, black cotton soil less bearing capacity compared to red soil, sandy soil etc. In highly metropolitan area consist of G+12, and G+15 building, instead of replacing the poor soil, mix the some amount of coir fiber to the soil material, hence it resist the load coming from existing structure. and stabilization consist of many methods chemical and mechanical methods in chemical stabilization various chemicals are use to stable the soil such as lime, silica, and aluminum powder etc. and mechanical stabilization consist of by using various mechanical devices such as compactors, roll rollers tampers, etc to improve the geotechnical properties of soil soil. Many tests are carried out on soil to check the behavior of soil during the elastic loading, variation in present of moisture content and also shape, size and texture, gradation of soil to engineering and HRB classification of soil. Least water content require to stay in plastic mode, such as liquid limit, plastic limit, vane shear tests, sieve analysis test, specific gravity test, standard proctor test, permeability test and unconfined compression test.

Keywords: Black Cotton Soil, coconut coir, geotechnical properties, stabilizers, sustain resist.

1. INTRODUCTION

Soil is the finer material obtained by chemical and mechanical disintegration of rocks. Its plays very important role in the various fields, such as agriculture and engineering field. In engineering field soil is need to sustain the load coming from the structure. If it is not resist, the structure goes on settled or collapsed. Hence its need to check the strength of soil, its helpful for designing of surface and subsurface structure like buildings, bridges, roads, pipelines etc. and soil properties are change when it intimate contact with water, if bearing capacity of soil is less its need to goes on deep foundation, hence cost is more than the other type of foundation. For all these kinds of problems during construction process the naturally obtained coconut coir material is added to the soil during excavation process by variation of percentages. By adding coconut coir to the soil few geotechnical properties of soil are changed such as increase the permeability and shear resistance between the adjacent soil particles and also reduced the settlement. During the construction of buildings, bridges, and any other engineering structure, soil decides the depth of foundation also during the construction of roads it decides the type and thickness of pavement. The main reason to uses of coir material is its easily available and no any adverse effect on ecosystem. when coir added to the soil, it improve the strength and stability of soil material more than 40-50 percent compared to normal soil. By adding suitable amount of coir the permeability of soil increases, if water retains at below the structure the strength and stability decreases by intimate contact with water.

II. OBJECTIVES

Main objective of the project is to achieve the following

- To increase the supporting power of soil
- To decrease the consolidation settlement
- To increase the shear resisting strength between the soil particles.
- To prevent the decay of foundation by increase the permeability.
- It provides good stability to the foundation for different types of structure.

III. METHODOLOGY

The methodology comprises with the following tests are carried out on the soil sample, by adding suitable percentages of coir fiber, such as 0.5%, 1%, 1.5%, 2%.

The following Tests are carried out by IS reference..

1. Specific gravity test.
2. Grain size distribution.
3. Liquid limit test.
4. Plastic limit.

5. Standard proctor test.
6. Unconfined compression test.
7. Permeability test.
8. Vane shear test.

V. TEST CARRIED OUT FOR SOIL SAMPLE

TABLE 1. The results of various tests on black cotton soil are as follows:

Sl.No	TEST	RESULT
1	Grain size distribution Cc	1.125
	Cu	4.4370
2	Specific gravity	2.46
3	Liquid limit	55%
4	Plastic limit	24%
5	Optimum moisture Content (OMC)	18%
6	Maximum dry Density (MDD)	1.69gm/cm ³

TABLE 2. VARIATION IN ATTERBERG LIMITS

COCONUT COIR %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX %
0	62	29	33
0.5	64	28	36
1.0	55	25	30
1.5	63	23	40
2.0	54	22	32

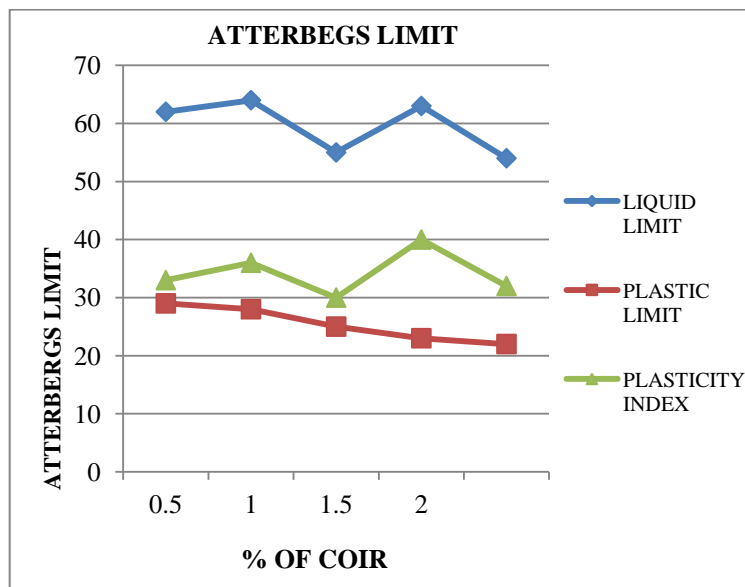


FIG 1 ATTERBEGS LIMIT

TABLE 3.VARITION IN STANDARD PROCTOR TEST

Sl no.	% OF COIR	OMC %	MDD KN/m ³
1	0	13.24	18.13
2	0.5	15.50	17.27
3	1	19	16.80
4	1.5	22.2	15.19
5	2	23.4	13.29

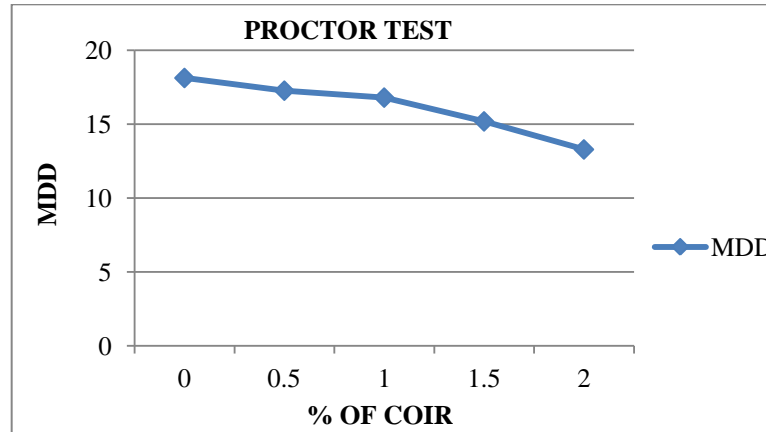


FIG 2 PROCTOR TEST

TABLE 4.VARITION IN VANESHEAR TEST

Sl No.	% OF COIR	VANE ANGLE(ϕ)	SHEAR STRENGTH (τ)
1	0	63	0.537
2	0.5	73	0.670
3	1	89	0.758
4	1.5	110	0.937
5	2	142	1.21

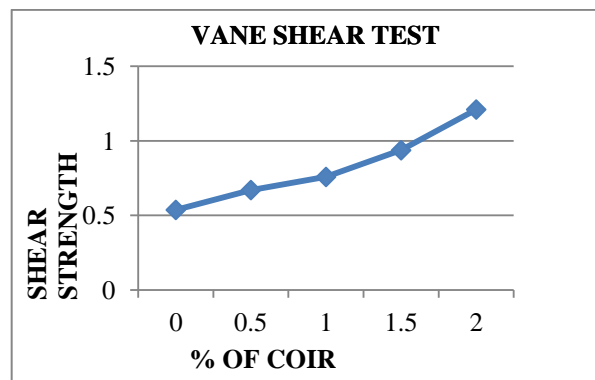


FIG 3 VANE SHEAR TEST

TABLE 5.UNCONFINED COMPRESSION STRENGTH TEST

%OF COIR	UCS (q_u) N/m ²
0	3.25
0.5	4.20
1.0	14.97
1.5	17.58
2.0	19.92

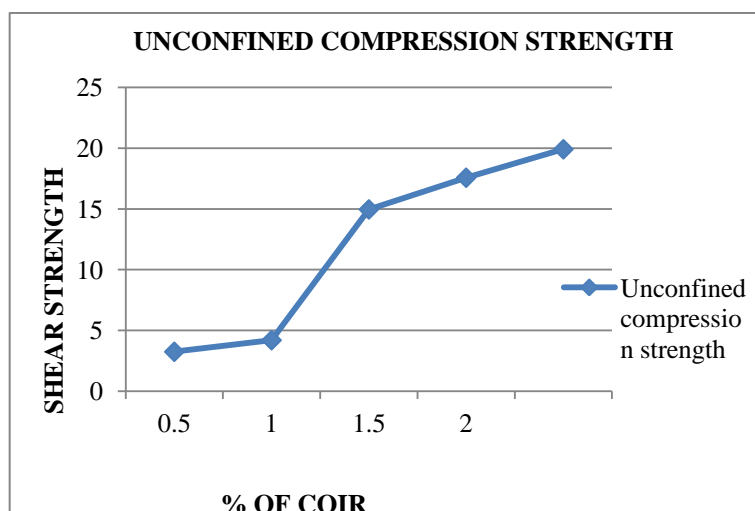


FIG 4 UNCONFINED COMPRESSION STRENGTH

TABLE 6.VARITION PERMEABILITY OF TEST

% OF COIR	AVERAGE PERMEABILITY (cm/sec)
0	0.0001296
0.5	0.0003
1	0.00038
1.5	0.0004
2	0.000423

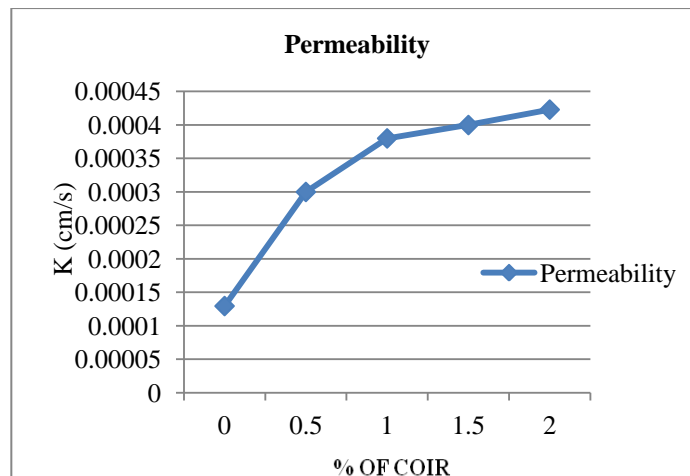


FIG 5 COEFFICIENT OF PERMEABILITY

VI. CONCLUSION

From above experiments we have concluded that, the strength of soil goes on increasing by increasing in the rate of coir fiber, in permeability test, rate of water flowing through soil mass increase, when the percent of coir increase. And also shear strength increase by increase in percentage of coir fiber. This is the best method of soil stabilization compared to all other method, because easily available, chief in cost, no any adverse effect on ecosystem.

- in standard proctor test percentage of coir added 0,0.5,1.0,1.5,2.0% the MDD is 18.13,17.27,16.80,15.19,13.29 respectively.
- In vane shear test, the % of coir added is 0,0.5,1.0,1.5, 2.0 the maximum shear strength is 0.537,0.67,0.758,0.937,1.21 respectively.
- In unconfined compression test for the various % of coir 0,0.5,1,1.5,2 the compression strength is 3.25,4.20,14.97,17.58,19.92 respectively.

VII. REFERENCE

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