STABILIZATION OF BLACK COTTON SOIL USING CHICKEN FUR AS AN ADMIXTURE

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Abstract — Soil is one of the major key element of the environment, Black Cotton Soil get high potential in swelling as well as shrinkage while change in moisture content. Thus, it is necessary to stabilize or strengthen the BC Soil by use of controlled compaction or adding admixtures. So, in this present work the BC Soil is stabilized by using admixture which is easily available and waste material. The admixture used is Chicken Fur this is the waste of poultry farming. In this work tests are carried out such as, Compaction Test and UCS Test for the Soil and also for the soil replaced with CF in Percentage variation (1%, 2%, 3%). From the results, we observed that the strength of the soil increased by the addition of the admixture up to the certain limit.

***Index Terms*— BC Soil, Chicken Fur, OMC, MDD, UCS**

I. INTRODUCTION

Foundation is the main factor in any construction activities and it should be strong enough to hold the loads (i.e. superstructure loads etc,) coming on it. So, for the strong foundation, the soil which is present below the foundation should be strong. As we all know, BC Soil is a problematic soil with dramatic nature because of its physical properties i.e. it undergo changes in its behavior (i.e. volume changes) during every seasonal variation due to increase and decrease of moisture content. Because of this nature it is also called as expansive soil. These soils undergo excessive swelling and shrinkage due to the presence of clay mineral Montmorillonite. So, any structures constructed on these soils are more susceptible to damage. Thus, these soils need to be stabilized before start of any construction works. Stabilization means enhancing the properties of soil by compaction or by adding external agents (admixtures or additives) to the soil. Various additives are used for stabilization purpose, the additives which are to be used should be economical, environmental friendly and it should be easily available.

Here we used an additive as stabilizing material which is easily available and mainly this is a waste product. The additive which is used here is, Chicken Fur or Chicken Feather (CF).

Chicken feathers are excogitated as an unwanted product from the poultry production. Massive amount of waste feathers generated and disposed every year by the poultry processing plants and from butcher's shop results in awful solid waste unease. The usage of CF in any field is very less and they become litter to overcome this problem which is used for stabilization of soft soils which are very weak in nature.

II. MATERIALS AND METHODOLOGY

2.1. Black Cotton Soil (BC Soil):

Table 2.1 Physical Properties of BC Soil

Sl No	Properties	Black cotton soil
1	Specific Gravity	2.63
2	Liquid Limit (%)	51.53
3	Plastic Limit (%)	45.50
4	Shrinkage Limit (%)	19.39
5	Plasticity Index	6.03
6	I S Soil Classification	MH
7	Maximum Dry Density (g/cc)	1.602
8	Optimum Moisture Content (%)	20.18
9	Free Swell Index (%)	40
10	Wet Sieve Analysis (%)	78 (clay+silt)
11	Color	Dark Black in Color
12	Odour	Odorless
13	Category	Silt with High Plasticity
15	Unconfined Compressive Strength (Kpa)	139.25
16	Direct Shear	C=9.81 Kpa and Φ=64.54
17	California Bearing Ratio (CBR)	2.5mm=1.63 5.0mm=1.32

The soil which is to be stabilized is collected from the ground near the sadguru school, Bhalki. The soil is collected from the depth of 2.5m to 3m from the ground level. Below table shows the Properties of BC soil which is taken for test.

2.2. Chicken Fur (CF):

Chicken Feathers are collected from the waste dumping yards in Bhalki. After the collection of CF washed them with clean water to remove other wastes attached to them and then allowed them for drying for 2 to 3 days until the CF dried completely, after that the CF's are cut into small pieces and make them as possible as small pieces by using mechanical mixers

Fig 2.2: Chicken Fur

2.3 METHODOLOGY

The tests which were conducted here are,

1. Compaction Test
2. Unconfined Compressive Strength Test (UCS)

Firstly, the above tests are conducted for normal soil (BC) without additives and the results are taken.

Then the same tests which we are conducted for soil (BC) are conducted for the soil (BC) with the addition of CF by the percentage replacement of CF i.e. 1%, 2% and 3% by the weight of soil mass taken. The results which are obtained by these tests are noted down and the results are compared with the results of Normal Soil (BC).

III. RESULTS AND DISCUSSIONS

3.1 OMC and MDD:

OMC and MDD are main parameters of Compaction; here we conducted Standard Proctor Test for determination of OMC and MDD

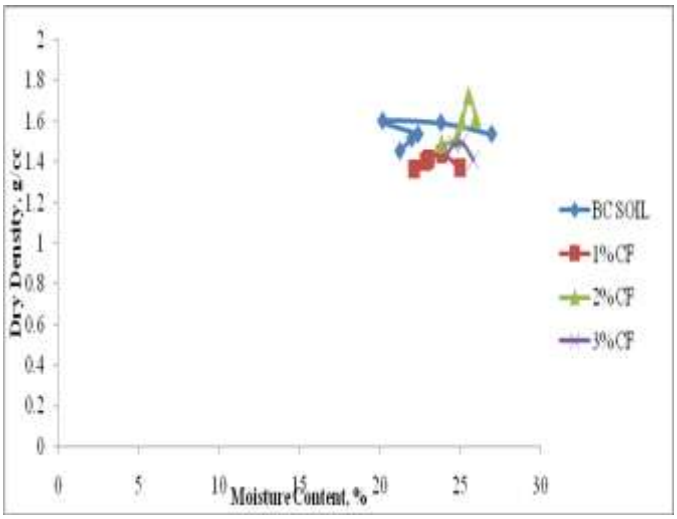

Fig 3.1 Compaction Test Curve of Soil and Soil with CF of varying percentage

The **Table 3.1 and the Fig 3.1** shows the overall results of Compaction Test conducted for Soil, Soil replaced with CF by the weight of soil mass. The results which we obtained are, for the **replacement of 2% CF with the soil** we get the result that the **MDD value is 1.726g/cc and OMC value is 25.53**%. Here, the MDD value of SOIL + 2% CF is more than that of the Soil. From the overall results we concluded that the MDD value increases after the addition of admixture thus, the admixture is suitable for stabilization.

Table 3.1: OMC and MDD Values of Soil replaced with various percentages of CF

Sl.No	Description	MDD (g/cc)	OMC, (%)
1	Only Soil	1.602	20.18
2	Soil + 1% CF	1.439	23.83
3	Soil + 2% CF	1.726	25.53
4	Soil + 3% CF	1.493	25.15

3.2 Unconfined Compressive Strength (UCS):

The test will be conducted for the soil and for the soil replaced with various percentages of CF (1%, 2%, and 3%).

Table 3.2: Compressive Strength Values of Soil replaced with various percentages of ESP and CF and their combinations

Sl.No	Description	Compressive Strength (Kpa)
1	Only Soil	139.25
2	Soil + 1% CF	1214.06
3	Soil + 2% CF	1332.72
4	Soil + 3% CF	1306.24

The **Table 3.2 and the Fig 3.2** shows the overall results of UCS tests conducted for Soil and the Soil replaced with CF by the weight of soil mass. The results which we obtained are, for the **replacement of 2% CF with the soil** we get the value of compressive strength as **1332.72Kpa** and it is the maximum value among the replacement of various percentage of CF with Soil and it is more than that of **compressive strength of Soil (139.25Kpa).** Thus, this percentage **(SOIL + 2% CF)** replacement is better for Stabilization purpose.

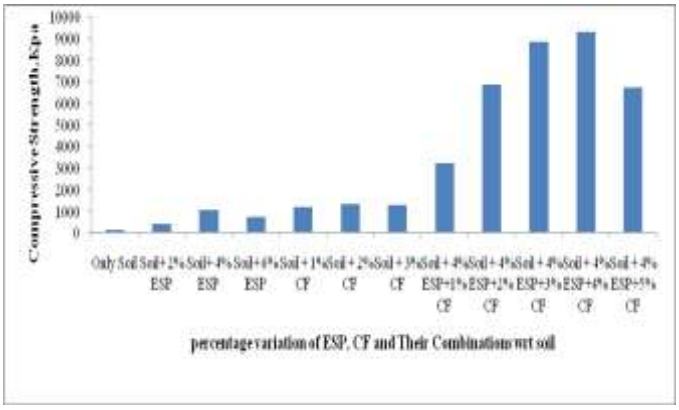

Fig 3.2: Bar graph showing variation of UCS values wrt the percentage variation of CF wrt Soil

IV. CONCLUSIONS

The Experimental study will be done on the soil by replacing it with admixture by weight of soil mass to stabilize the soil i.e. to increase the strength of the soil with less cost, without effecting an environment and in an effective way by using admixture like CF which is the waste product of poultry farming, we utilizing this waste product as stabilizing material and the results we obtained shows that this serve as a better stabilizing material for BC Soil by increasing the strength of a soil. Thus, what are all the results we obtained in the present experimental study are summarized in following conclusions;

The **MDD value increased by 7.74% and also the OMC value increased by 26.51%** when compared with the Original Soil sample and **the Soil replaced with 2% CF** by the weight of soil mass. Thus, by knowing above result it can be concluded that the CF should be used as admixture up to certain limit to increase the Density of BC Soil by decreasing its moisture content.

The Compressive strength value **increased by 857.07%** when compared with the original Soil sample and the **Soil replaced with 2% CF** by the weight of soil mass.Thus, by knowing above result it can be concluded that, the addition of admixture cause various changes in the soil strength, there is more increment in the value of Compressive Strength after the addition of admixture the CF gives abundant strength to the soil thus, This admixture is very much suitable for the increment of Compressive strength of the BC Soil while using in Stabilization process.

REFERENCES

[1] Dr. B. C. Punmia et. al.. "Soil Mechanics and Foundations" 16th Edition, Laxmi Publications (P) Ltd.

[2] Gagan Bansal et. al., "Application and Properties of Chicken Feather Fiber a Livestock Waste in Composite Material Development" Journal of Graphic Era University, Vol: 5, Issue:1, pp. 16-24, 2017

[3] Gopal Ranjan and A S Rao "Basic and Applied Soil Mechanics" 3rd Edition, New Age International Publishers