Study On The Influence Of Terrazyme As Stregthening Agent For Black Cotton Soil

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Abstract **- Stabilization of Black Cotton Soil is studied by using terrazyme. Black Cotton soils are highly clayey soils nature (montmorillonite clay mineral). The moisture changes in Black Cotton Soils, compressibility and last- plasticity nature can be greatly improved with the addition of terrazyme. This paper includes the evaluation of soil properties like optimum moisture content, dry density and strength parameter (California bearing ratio valve). Different quantities of terrazyme (% weight) are added to the BC soil and the experiments conducted on these soil mixes. The results show that the use of terrazyme has increased the CBR values i.e., the strength of soil to a great extent.**

keywords **- Black Cotton Soil, California Bearing Ratio(CBR), Compaction Factor, Soil Stabilization, Terrazyme**

I. INTRODUCTION

For every Civil Engineering Structure, the load from super structure is to be transferred to the soil. In case of Expansive soils, which are generally problematic by nature. It possesses swelling and shrinkage properties which results in bruises for the structure in the form of cracking, undulations and differences in settlements etc., These are generally experienced by roads, canal, buildings etc. Therefore, our attempt is to improve the strength and stabilize the soil by using the terrazyme. Therefore, these soils should be properly treated to avoid such practical serious problems.

Therefore, one of the most popular techniques is Soil Stabilization. In simple words, Soil Stabilization could be defined as, "The process which involves the enhancement of the Soil's physical properties like shear strength, durability etc., and minimizing the pessimistic properties like shrinkage, swelling and water absorption by addition of few additives, and thus helping for the improvement of the Load Bearing capacity of the sub-grade of the soil, which helps for the construction of pavements, structures etc.,"

Black cotton soil is one of the most commonly occurring soils in India covering an area of about 3 lakhs sq.kms spreading over 6 states. It is an inorganic clay with a standard of medium to high compressibility. It possesses a high percentage of clay which is predominately Montmorillonite in structure. And occurs in black or blackish grey in color. Having high swelling and shrinkage characteristics, Black Cotton soil has always been a major face-off for Constructions. This soil holds a very peculiar property of becoming very hard when dry conditions, also losing its strength completely in wet condition. And the Black Cotton Soil used for our study is been collected from Basuregadi village in Northern Telangana.

The additive used to strengthen and stabilize this Black Cotton Soil for our study is Terrazyme. It is a liquid enzyme which is organic in nature and it is formulated from vegetative and fruits extract. it improves the deficit properties of soil like its quality, California Bearing Ratio, Durability and decreases the abundant and pessimistic properties like Optimum Moisture Content and Plasticity Index of soil.

II. OBJECTIVES OF THE STUDY

The main objectives for this study are as follows:

1. To determine the essential Geotechnical properties of Black cotton soil.
2. To evaluate the effect of Terrazyme on the basic Properties of soil.
3. To determine the effects of addition of this enzyme to BC Soil on its crucial properties like consistency limit, CBR, swell test, and unconfined compressive strength.
4. To observe whether the soil is good in compressive strength and possesses essential tensile strength.
5. To analyze that up to what extent the unsolicited properties of BC Soil are surpassed using Terrazyme.

III. MATERIALS USED

1. Black Cotton Soil:

Black Cotton Soil is one of the major soil deposits in India. This soil is also popularly termed as Regur Soil. It exhibits high scale of Swelling and shrinkage because of high percentage of montmorillonite content and is capable of holding more content of water. This is the reason that favors the growth of only Cotton. For our study, we have selected BC Soil from an agricultural land in Basuregadi Village as shown in **Figure:1** and the soil is collected after a depth of 2 feet from Ground Level and is properly sealed and transported to our laboratory and proceeded for the experimentations.

Fig: 1 Black Cotton Soil Sample Collected From Basuregadi Village

2. Terrazyme:

Terrazyme is a chemical which can be used as stabilizing agent for soil process, as specified in **Figure:2**. It is capable of increasing the durability of pavement also reducing the unwanted swelling properties of soil. Terrazyme is found to enhance the weather resistance and improves load bearing capacity of soils.

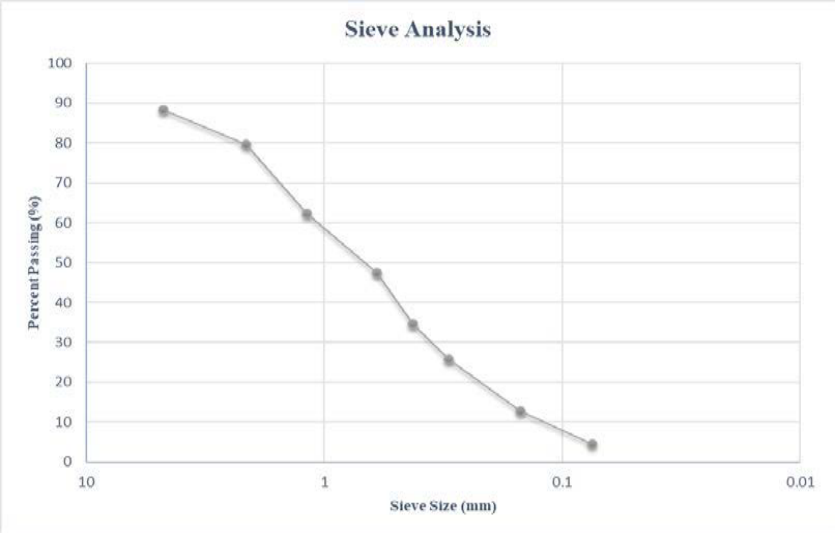
Fig: 2 Terrazyme Chemical

IV. METHODOLOGY

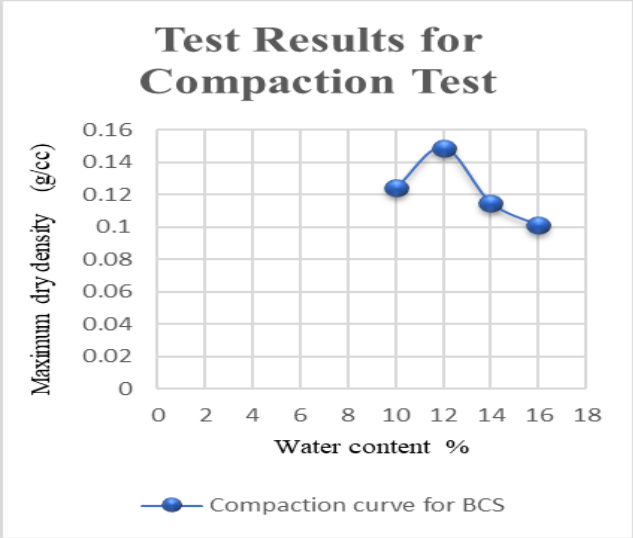
Initially, the few important laboratory tests were carried, as mentioned below, on the samples of black cotton soil without terrazyme later other major tests are been carried out after its addition to the soil samples. Those test results are presented in Table:1 and Graphs and 2 respectively.

Table 1 Test Results For Index Properties of Soil Sample

S. No	Parameters	Results
1	Specific gravity (G_s)	2.6
2	Atterberg's limits (%)	
	Liquid limit	0.7275
	Plastic limit	18.269
	Plasticity index	17.5
3	Sieve analysis%	
	Sand	30.5
	Silt	44.3
	Clay	24.5
	Effective particle size *(D10) mm*	0.275
	(D30) mm	0.69
	(D60) mm	61.8
	Coefficient of uniformity (*Cu)*	11.45
	Coefficient of curvature *(Cc)*	0.88
4	Optimum moisture content	14
5	Maximum dry density KN/m^3	15.901
6	IS classification	CH & MH



Graph 1 Sieve Analysis of Soil Sample



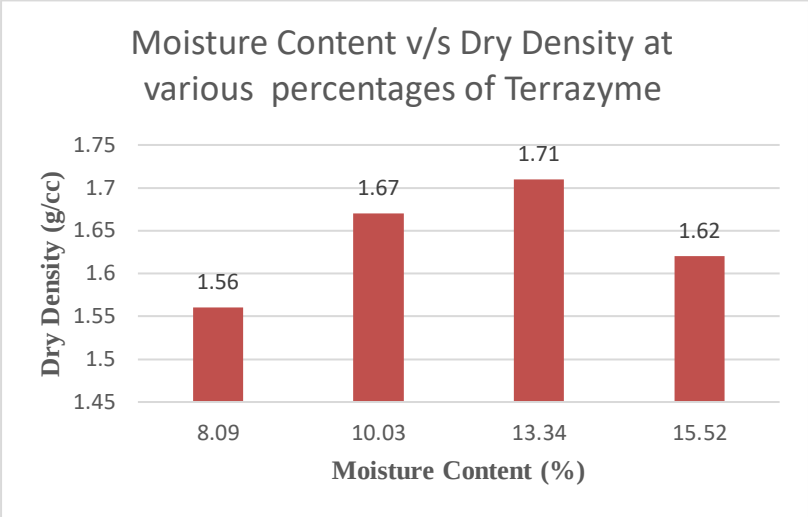
Graph 2 : Compaction Test of Soil Sample

V. RESULTS AND DISCUSSIONS

To analyze the influence of Terrazyme admixture on the strength of BC Soil, Compaction Test and CBR Test are carried. The results are displayed in Tables 2, 3, 4 and 5 and in Graph:3, 4 and 5 respectively.

Table 2: Test Results for Compaction Test At Various Percentages Of Terrazyme

S. No	Description	Percentage of adding of Terrazyme in BC Soil			
		0%	*7%*	*10%*	*13%*
1	Weight of Empty Moulds (W1) (in kg)	2.26	2.26	2.26	2.26
2	Weight of moulds+ compacted soil (W2) (in kg)	4.046	4.218	4.266	4.256
3	Weight of compacted soil(W3) (in kg)	1.756	1.928	1.976	1.966
4	Empty bin number	1	2	3	4
5	Weight of empty bin (W4) (in grams)	0.030	0.032	0.032	0.030
6	Weight of bin + wet soil (W5) (in grams)	0.034	0.044	0.042	0.044
7	Weight of bin+ dry soil (W6) (in grams)	0.032	0.042	0.040	0.042
8	Weight of dry soil (W6-W4) (in grams)	18.78	22.71	31.54	19.78
9	Weight of water (W6-W7) (in grams)	0.002	0.002	0.002	0.002
10	Water content =(W9*100/W8) %	8.09	10.03	13.34	15.52
11	Wet density =2/v (in g/cc)	1.69	1.84	1.94	1.88
12	Dry density=10/(1+w/100) (in kg/m^3)	1.56	1.67	1.71	1.62



Graph: 3: Moisture Content V/S Dry Density At Various Percentages Of Terrazyme

Result:

Optimum moisture content = 13.34%

Maximum dry density = 1.71 g/cc.

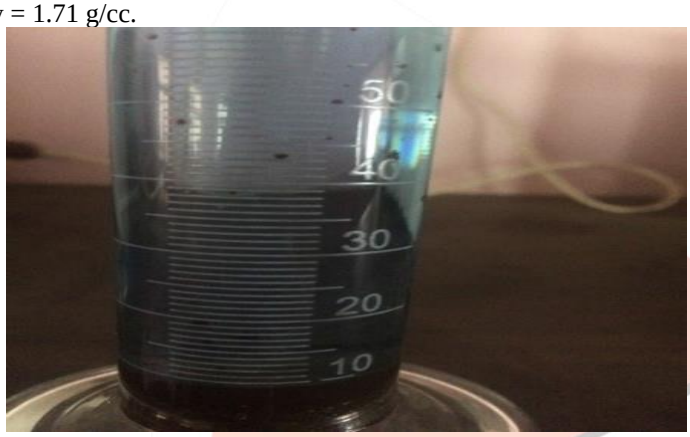


Fig: 3 Black Cotton Soil with Terrazyme

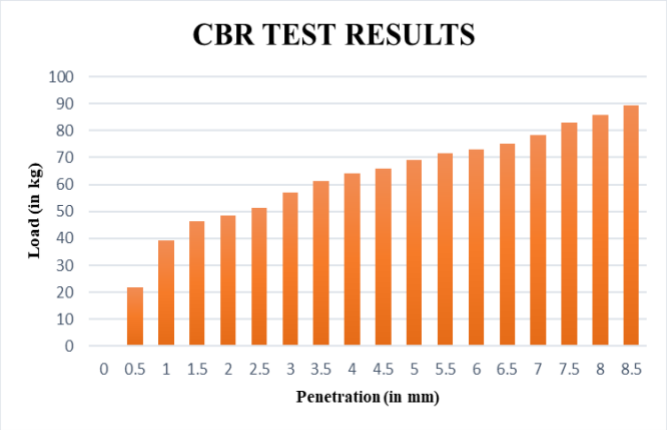
Table 3 CBR Test Results On BC Soil Sample

S. No	Penetration (in mm)	Load (in kg)
1	0	0
2	0.5	21.80
3	1	39.32
4	1.5	46.16
5	2	48.30
6	2.5	51.29
7	3	56.89
8	3.5	61.20
9	4	64.22
10	4.5	65.94
11	5	69.25
12	5.5	71.39
13	6	73.10
14	6.5	75.23
15	7	78.23
16	7.5	82.93
17	8	85.92
18	8.5	89.34

Result:

1. CBR value of soil at 2.50 mm penetration = (× 100) = 3.74
2. CBR value of soil at 5 mm penetration = (× 100) = 3.36

∴ CBR value of the BC soil is 3.74.



Graph 4 CBR Test Results On BC Soil Sample

Fig 4: CBR TEST

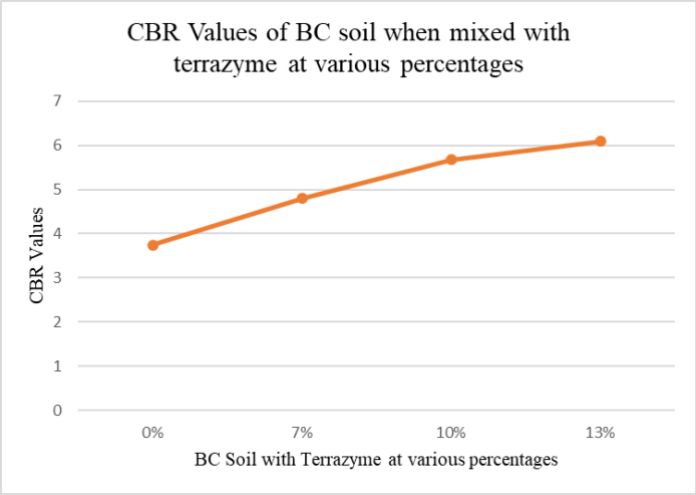
Later all the above tests were conducted on BC Soil with various percentages of Terrazyme. Here are the results of them.

Table 4 Properties of BC Soil Mixed With Terrazyme

S. No	Property	Percentage of addition of terrazyme			
		0 %	*7%*	*10%*	*13%*
1	Liquid limit	0.2857	0.086	0.11	0.104
2	Plastic limit	0.001	0.09	0.096	0.096
3	Plasticity index	29	15	15	7
4	OMC (%)	1	3.25	14	12
5	MDD (KN/m^3)	1.5901	1.82	1.95	2.14

Table 5: CBR Properties of BC Soil When Mixed With Terrazyme At Various Percentages

S. No	CBR values when BC soil added with Terrazyme (%)			
	Black cotton soil with No Terrazyme	***BC soil +7% terrazyme***	***BC soil + 10%of terrazyme***	***BC soil+13% of terrazyme***
1	3.74	4.80	5.67	6.09



Graph 5 : Variations In CBR Value By Adding Terrazyme At Various Percentages To BC Soil

VI. CONCLUSIONS

- From the above results, it is evident that, the BC soil has CBR Value of just 3.74% and Max. Dry Density and Optimum Moisture Contents as 15.901 and 14 respectively, which are not satisfactory.
- Upon the increase of the amount of Terrazyme, there has been gradual increase in CBR Value of Soil.
- But at 10% addition of Terrazyme, it was found that we have got highest and satisfactory optimum moisture content and max. dry density for the BC Soil as 14% and 1.95KN/m^3
- At this percentage we have got the CBR Value as 5.67% which is reasonable.
- In simple words, Terrazyme material is capable of stabilizing the BC Soil up to good extent. Because it is a natural product, this process is eco-friendly.
- Soil Stabilization using Terrazyme could be achieved economically and with good viability.

VII. REFERENCES

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