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STABIZATION OF BLACK COTTON SOIL BY USING TERRAZYME

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ABSTRACT

The goal of this project is to see if bio enzyme i.e., terrazyme can be used as a stabilizer for black cotton soil. This study investigates the consequences of treating a black cotton soil with a bio enzyme i.e., terrazyme. Liquid limit, plastic limit and unconfined compressive strength test was conducted on pure black cotton soil and black cotton soil mixed with terrazyme. To find the optimum dosage of terrazyme for black cotton soil in this experiment, terrazyme was utilized in normal black cotton soil at dosage of 0ml/kg, 0.8ml/kg, 1.2ml/kg and 1.6ml/kg by weight of soil. The purpose of this study is to compare and assess the performance of ordinary black cotton soil and black cotton soil with terrazyme. After 0, 7, 14 and 21 days of dry, the specimens were examined for Liquid limit, plastic limit and unconfined compressive strength test.

Keywords: *Black Cotton Soil, Bio-Enzymes, Terrazyme, Optimum Dosage, Liquid limit, Plastic limit, and unconfined compressive strength test.*

1. INTRODUCTION

In our India black cotton soil (BC soil) found in large area, almost 33% of Indian land. In Karnataka black cotton soil is found in North Karnataka region and where it comes to black cotton soil, it loses its bearing capacity when it gets damp. Because of its expanding and drying nature, it is extremely difficult to deal with the black cotton soil. By using soil stabilization process on black cotton soil, we can improve its engineering properties.

In history of civil engineering many types of soil stabilization techniques have been used for construction of building and roads. Common components utilized in stabilizing soil are lime, cement, fly ash, etc. These chemical components can improve the engineering property of soil but their impact on the environment is damaging.

In order to minimize these negative effects, recently bio-enzymes have emerged as a new hope for soil stabilization. To overcome this real problem, we can use bio enzyme i.e., terrazyme as a stabilizer. A variety of studies have been conducted to investigate the effects of terrazyme on soil and their applicability as stabilizer. As a result, terrazyme can be utilized as a stabilizer for black cotton soil while conserving the environment.

2. PRELIMINARY INVESTIGATION

Method and analysis which is performed in your research work should be written in this section. A simple strategy to follow is to use keywords from your title in first few sentences.

BLACK COTTON SOIL:

Ordinary black cotton soil from a single batch was used for the whole project, and it was maintained in airtight containers to avoid being influenced by atmospheric and monsoon moisture and humidity. The taken black cotton soil was tested for different tests i.e., specific gravity, liquid limit, maximum dry density, optimum moisture content, and unconfined compression test.

SL NO	PROPERTY	VALUE
1	Specific gravity	2.31
2	Consistency limits 1) Liquid limit % 2) Plastic limit % 3) Plasticity index %	 77.97 42.17 35.08
3	IS Soil Classification	CL
4	Engineering Properties I.S Light Compaction 1) Max dry density, γ dmax (gm/cc). 2) O.M.C %	 1.65 18
5	CBR Value I.S Light Compaction 1) OMC condition % 2) Soaked condition %	 39.0 6.0
6	Un confined compression test I.S Light Compaction (KN/m^2)	88.26

Table 1 – Properties of black cotton soil

BLACK COTTON SOIL WITH TERRAZYME:

Procedures for making terrazyme treated soil are:

1. We had taken 5kg sample of black cotton soil.
2. Then we mixed water with soil according to OMC which is 18% per kg of soil.
3. Then water and soil were mixed properly.
4. Then Terrazyme is mixed with wet soil at 0.8ml/kg and it is taken has sample no 1.
5. Then sample no 1 is gone through different tests i.e., liquid limit, plastic limit and unconfined compression test.
6. For the samples of 1.2ml/kg (sample no 2), 1.6ml/kg (sample no 3) and 2ml/kg (sample no 4) follow above procedure from 1 to 5 respectively.
7. Then we test samples After samples kept for 0, 7, 14 and 28 days respectively.

TESTS	**TERRAZYME DOSAGE(ML/KG)**				
	0	**0.8**	**1.2**	**1.6**	**2**
Liquid limits (%)	77.97	26.88	28.25	24.67	38.46
Plastic limit (%)	42.17	16.32	18.56	16.89	26.34
Plasticity index (%)	35.8	10.56	9.69	7.78	12.12
Unconfined compressive test (KN/m^2)	88.26	85.64	90.45	87.23	91.27

Table 2 – Test results of enzyme treated black cotton soil at day 0

Water:

The soil is mixed with fresh potable water that is devoid of organic debris and oil. Water was measured and added to the soil in the proper amounts using a graduated jar.

3. METHODOLOGY

In this study, the black cotton soil is collected from the Yadgiri District of Karnataka state, India. It was ensured that the selected soil was air dried, pulverized using a wooden mallet to break the clods and sieved through 4.75 mm sieve. The selected soil was characterized by its physical properties namely, liquid limit, plastic limit, maximum dry density, optimum moisture content and unconfined compression characteristics using the standard procedures as specified by Bureau of Indian Standards and the results are summarized in above tables.

The methodology we followed in different tests are given below

1. We collect the pure black cotton soil from the north Karnataka region
2. Then we will use that untreated black cotton soil for testing in laboratory to find the liquid limit, plastic limit and unconfined compressive strength.
3. Then note down the all-tests results of untreated or pure black cotton soil
4. The untreated black cotton soil is mixed with terrazyme with optimum dosage i.e., 0.8ml/kg, 1.2ml/kg, 1.6ml/kg, 2ml/kg.
5. Then tests will be conducted on mixed black soil to find liquid limit, plastic limit and unconfined compressive strength.
6. Then we will compare the results of tests with treated and untreated black cotton soil.

4. RESULTS AND DISCUSSION

The results obtained from the experimental analysis are as follows.

1) LIQUID LIMIT

Variation in 7 days, 14 days, and 28 days liquid limit is shown in Table 3, Fig 1

TERRAZYME DOSAGES (ML/KG)	After 7 days	After 14 days	After 28 days
0%	77.97	77.97	77.97
0.8	24.55	29.6	25.77
1.2	23.30	40.45	26.82
1.6	24.65	29.58	26.82
2	32.62	29.31	32.66

Table 3 Liquid limit of black cotton soil with different dosages of terrazyme

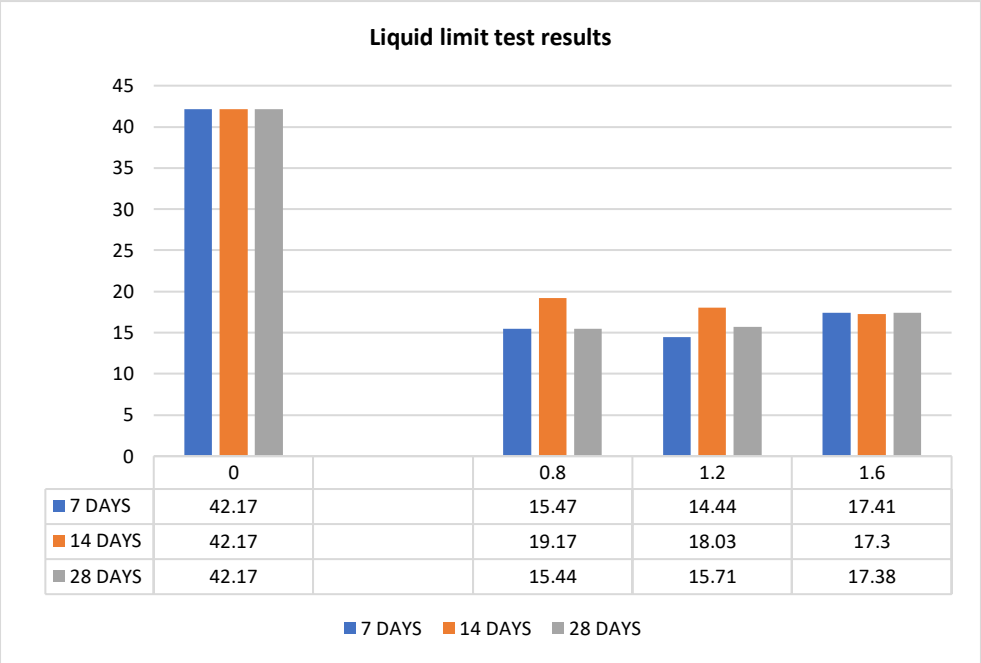


Fig 1: - Liquid limit of black cotton soil with different dosages of terrazyme

1) PLASTICITY INDEX

Variation in 7 days, 14 days, and 28 days plasticity index is shown in Table 4, and fig 2

TERRAZYME DOSAGES (ML/KG)	7 DAYS	14 DAYS	28 DAYS
0	35.8	35.8	35.8
.8	9.08	10.43	10.06
1.2	10.86	22.42	11.38
1.6	7.24	12.28	9.44
2	12.81	11.59	19.79

Table 4 – Variation in 7 days, 14 days, and 28 days plasticity index

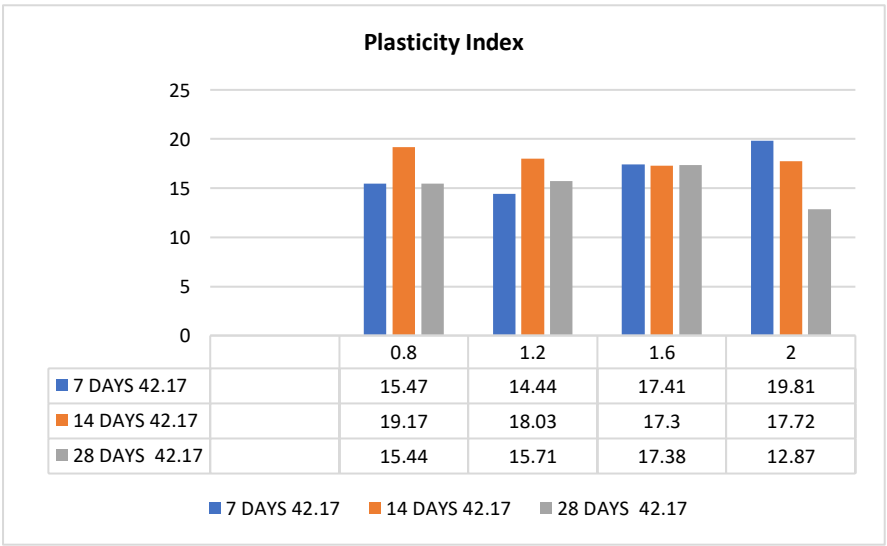


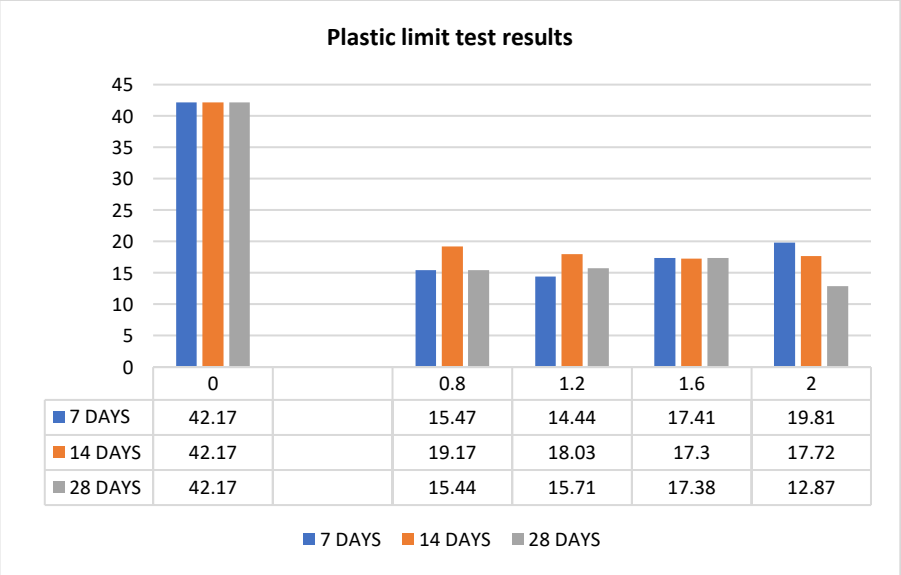
Fig2: - Variation in 7 days, 14 days, and 28 days plasticity index

2) PLASTIC LIMIT

Variation in 7 days, 14 days, and 21 days PLASTIC LIMIT is shown in Table

TERRAZYME DOSAGES (ML/KG)	7 DAYS	14 DAYS	28 DAYS
0	42.17	42.17	42.17
0.8	15.47	19.17	15.44
1.2	14.44	18.03	15.71
1.6	17.41	17.30	17.38
2	19.81	17.72	12.87

Table 5 Variation in 7 days, 14 days, and 28 days PLASTIC LIMIT



Variation in 7 days, 14 days, and 28 days PLASTIC LIMIT

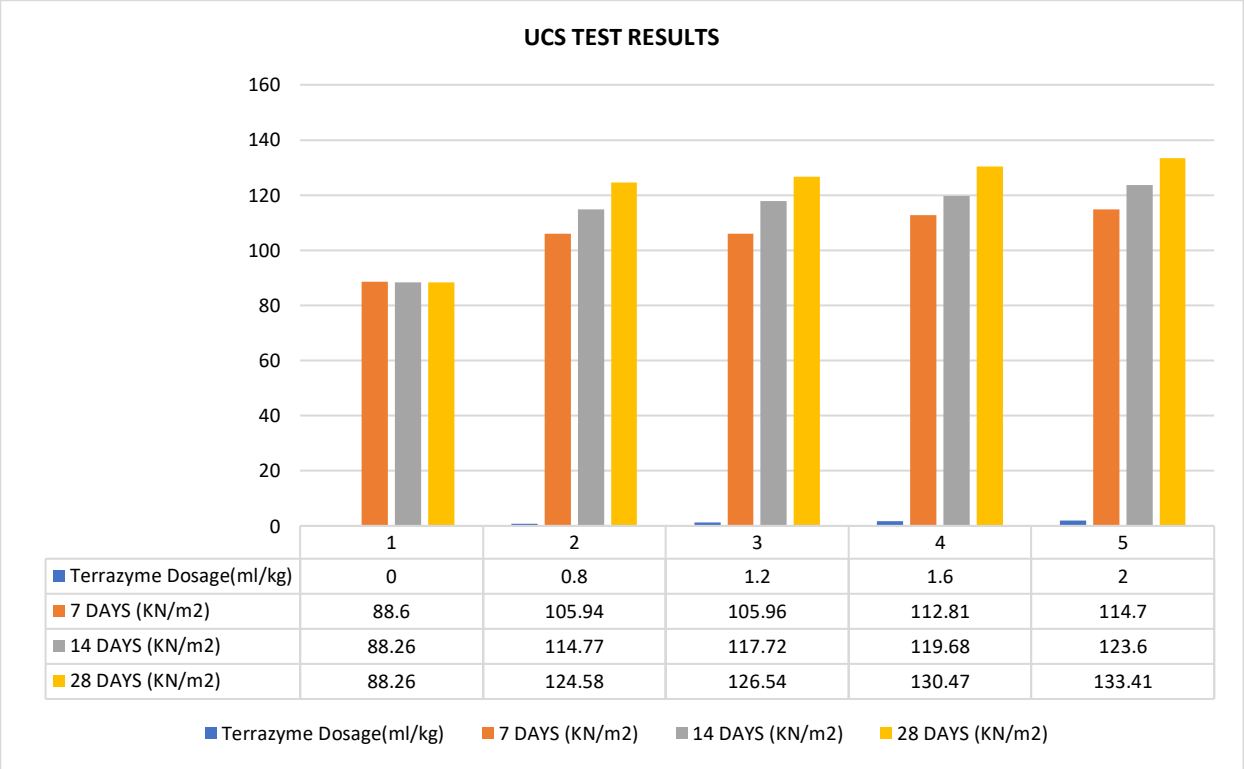
3) UCS TEST

Variation in 7 days, 14 days, and 28 days Unconfined test results is shown in Table

TERRAZYME DOSAGES (ml/Kg)	7 DAYS (KN/m2)	14 DAYS (KN/m2)	28 DAYS (KN/m2)
0	88.6	88.26	88.26
0.8	105.94	114.77	124.58
1.2	105.96	117.72	126.54

1.6	112.81	119.68	130.47
2	114.7	123.60	133.41

Table 6 UCS test results of enzyme treated black cotton soil with different dosages



5. CONCLUSION

Based on the experimental investigation the following conclusions have been arrived at:

1. Terrazyme is found to be effective in modifying the mechanical properties black cotton soil. However, curing is vital in the process of biological stabilization.

2. Terrazyme is found to be capable of preventing the moisture entry into the voids after enzyme blended compaction. This effect is pronounced from the considerable reduction in optimum moisture content in black cotton soil (up to 8%).

3. Improvement in compressive strength of treated black cotton soil is observed and hence the enzyme is productive in improving weaker soils.

4. The variation in mechanical properties of blended soils at lower enzyme dosage allows for economical and conservative infrastructural development activities such as pavement construction and maintenance, waste containment, mitigation of erosion etc.

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