LATERITE SOIL STABILISATION BY USING TERRAZYME FOR ROAD CONSTRUCTION

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Abstract - As the main problem in developing countries like India, is to have maximum road length at minimum cost. This problem can be solved by adopting construction of low cost roads and by stage construction of roads. Therefore best utilization of locally available and the cheapest materials have to be made in road construction. During construction work soil stability is one of the major problems. Due to lack of strength possessed by soil, it fails to bear the loads imposed on it during or after the construction. The process involved in soil stabilization must be eco- friendly, cost effective and efficient. Terrazyme proves to be the best solution for this problem.

It is natural, non-toxic, biodegradable liquid which significantly improves the strength of soil by reducing the voids. It increases the compaction of soil with minimal compactive efforts and its effect is permanent. This paper deals with all the information about terrazyme including its working mechanism and effects on different properties of soil.

Key Words: Terrazyme, Soil Stabilization, Enzyme, Biodegradable.

1. INTRODUCTION

The oldest mode of travel was started on the foot- paths. The extensive use of animal drawn vehicles as a mode of transportation brought up the necessity of providing a hard surface for those vehicles to move on. It is during the period of Roman Empire, roads were constructed on large scale. Romans are considered to be the pioneers in road construction.

In developing countries like India the biggest handicap to provide a complete network of road system is the limited finances available to build road by the conventional methods. There is a need for suitable methods for low cost road construction, followed by stage development of roads for growing traffic needs.

The construction cost can be considerably reduced by using local materials including local soils for the lower layers of pavement like sub-base course. As the main problem in developing countries like India, is to have maximum road length at minimum cost. This problem can be solved by adopting construction of low cost roads and by stage construction of roads. Therefore best utilization of locally available and the cheapest materials have to be made in road construction. With the increased depletion of granular materials or granite rocks and with the increased cost of the aggregate materials alternate sources should be found out that can be used in the pavement construction. Here lies the scope for the use of soil stabilization and other low cost pavement materials. There are several techniques of soil stabilization and the choice of method of stabilization depends on several factors such as the soil type, availability of stabilizers, climatic conditions, the component of pavement which is being constructed and the traffic.

All pavements derive their ultimate support from the underlying sub-grade; therefore, knowledge of basic soil mechanics is essential. Therefore, highway engineers are faced with the problems of providing very suitable materials for the highway construction. Continuous researches have been and still being carried out by various agencies to improve the engineering properties of soils. If the stability of the local soil is not adequate for supporting wheel loads, the properties are improved by soil stabilization techniques and the soil stabilized road construction involves the effective utilization of local soils and suitable stabilizing agents. The treated soil is stable, if it is able to withstand the traffic under all weather conditions without excessive deformations. The term soil stabilization means the improvement of the stability or bearing power of the soil by the use of controlled compaction; proportioning and/or the addition of suitable admixtures or stabilizers.

1.1 Literature Survey

Venika Saini and Priyanka Vaishnava deals with soil stabilization using terrazyme. The bio enzyme has emerged as a material which drastically improves the properties of soil, is ecofriendly and is economical in long run. In the present study ,the virgin soil (Dehradun) was mixed with various dosages of Terrazyme with different durations and had shown significant improvement in index properties of soil

e.g. Specific gravity, Optimum Moisture Content and Maximum Dry Density and California Bearing Ratio (unsoaked and soaked).Based on the studies optimum dosage was found out. Bio enzyme reduces the voids between the particles of soil and minimizes the amount of absorbed water in the soil so that compaction caused by enzymes can be maximum. Bio enzymes are non poisonous, organic and biodegradable in nature. The product formed after the application of Terrazyme is biodegradable in nature and the effect is permanent. Terrazyme eliminates the use of granular sub base and sub grade course. Initial cost of Terrazyme is higher but the maintenance cost is zero.

Vijaya Rajoria and Suneet Kumar deals with the stabilization of soil using bioenzyme. Recently there are many bio-enzymes available for soil stabilization such as Renolith,Perrazyme, Terrazyme, Fujibeton etc. These enzymes have been proven to be very effective and economical.The efficiency depends upon the amount of dose, type of soil available and field conditions. The properties, mechanism of stabilization, experimental studies, and advantages of each of the above mentioned enzyme was done. It was found that use of bio-enymes has lot of advantages. They improve various properties of soil enhacing its strength, thus can result in aggregate free pavement construction. Bio-enzyme can also be used as dust control agent, as 75% reduction in dust on unsurfaced roads is reported in many construction work where bio-enzyme have been used.

Nandini D N and Vinoda Amate deals with the compaction and strength characteristics of terrazyme stabilized red soil. It was found that terrazyme stabilized red soil shows significant increase in strength and the amount of dosage depends on dry density of compacted soil and has significant effect on strength of red soil. Though increase in curing period causes reduction in strength of terrazyme treated soil, the strength is found to be significantly larger than that for untreated red soil, as the dosage increase for all three conditions. It was found that increase in UCS and hence the strength of soil occurs at all dosage levels of terrazyme compared to untreated soil. Maximum increase in strength occurs at 7 days of curing period at all dosage levels of terrazyme. However marginal reduction in UCS occurs with increase in curing period.

1.2 Objectives

The main objective of this study is to determine the geotechnical properties of laterite soil and to determine the effects of adding enzyme to the laterite soil. Also, the change in geotechnical properties associated with the sub grade strength with different dosages and curing time of enzyme (Terrazyme) was studied. Optimum enzyme dosage was determined and strength characteristics of laterite soil were studied for different curing periods say, 0, 7, 14, and

28 days. The compaction tests were conducted to determine the optimum moisture content and maximum dry density of natural as well as enzyme treated soil. Other major tests carried out were the determination of consistency limits, CBR and unconfined compressive strength.

1.3 Scope Of TheStudy

Laterite soil was collected and treated with optimum dosage of terrazyme. The strength properties was compared with untreated soil. Soil can be tested with various other bioenzymes and the results can be compared with terrazyme stabilization. Further test can be performed for dynamic behavior of soil to improve soil property. Results of conventional stabilization methods can be compared with terrazyme stabilization. Economical stabilization method can thus be adopted.

1.4 Methodology

1. Collection of Laterite soil.
2. Collected soil was tightly packed in an air tight container.
3. The following basic tests were conducted on the soil samples to determine its physical and engineering properties:

- Liquid limit and Plastic limit
- Specific Gravity Test

- Grain size distribution
- Standard Proctor Test
- Unconfined compressive strength
- California bearing ratio

4. The suitability of soil sample was checked from the results obtained.

5. The soil sample was mixed with varying dosages of Terrazyme and unconfined compressive strength

test was performed to determine the optimum dosage.

6. The soil was then mixed with optimum percentage of Terrazyme. It was cured for 0, 7, 14 and 28 days.

7. Unconfined compressive test, Proctor test, California bearing ratio test were conducted for respective curing periods.

8. Analysis and interpretation of result.

2. EXPERIMENTAL INVESTIGATION

2.1 Raw materials

1. Laterite soil from chengamanad, Aluva
2. Terrazyme from Avijeet agencies, Gujarat

2.2 Terrazyme - Soil stabiliser

Terrazyme is a brown clear liquid which is organic in nature and is formulated using fruit and vegetable extract. The effect of terrazyme is due to the enzymatic reaction on the soil taking place between clay and organic cat-ion and forming a protective coating around clay particles and making clay particle water repellent. Since cationic interexchange take place, it reduces the thickening of absorbed layer. It helps in reducing the void in the soil and thereby achieving maximum compaction. It improves the load bearing capacity of soil as well as reduces the pavement thickness and maintenance cost. The terrazyme is obtained from Avijeet agencies, Gujarat.

Fig.1: Terrazyme

2.3 Test for untreated and treated soil

Fig. 2: Preparation of mould for proctor 2.California Bearing Ratio Test(CBR)

The California bearing ratio (CBR) is a penetration test for evaluation of the mechanical strength of natural ground, subgrades and base courses beneath new carriageway construction. Test conduct after 7,14 and 28 days.

Fig.3: CBR mould 3.Unconfined Compressive Test

The unconfined compressive strength qu is defined as the load per unit area at the time of failure of the soil sample.Test conduct after 7, 14 and 28 days.

1.Standard proctor test

Compaction is process of densification of soil mass by reducing air voids in the soil by applying compactive energy. The optimum moisture content of the soil is the water content corresponding to maximum dry density.And it is tested for treated and untreated soil for a curing period at 7,14 and 28

Fig.4:UCC mould

3.TEST RESULTS

3.1 Test Results Of Untreated S0il and TreatedSoilAfter7Days,14DaysAnd28 DaysOfCuring

Table-1: Standard Proctor test conducted after 7 days, 14 days and 28 days of curing

Sample	Curing period(days)	OMC (%)
Untreated	0	11.1
Treated	0	9.1
	7	8
	14	7.8
	28	7.5

Table-2: CBR test conducted after 7 days, 14 days and 28 days of curing

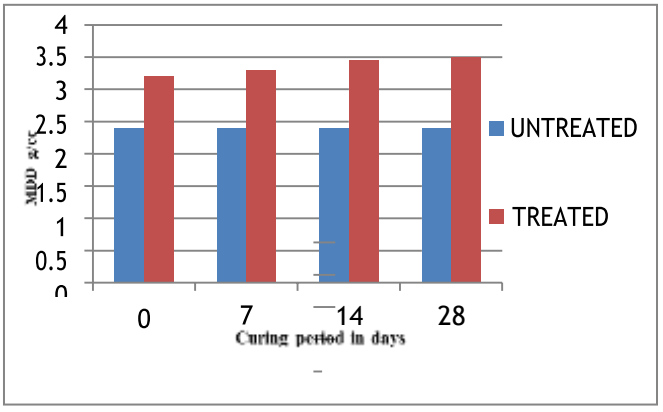
Sample	Curing period (days)	CBR VALUE (%)
Untreated	0	36.5
Treated	0	37.66
	7	38.12
	14	38.81
	28	40.91

Table-3: Unconfined Compressivw Strength Conduct after 7days,14 days and 28 days

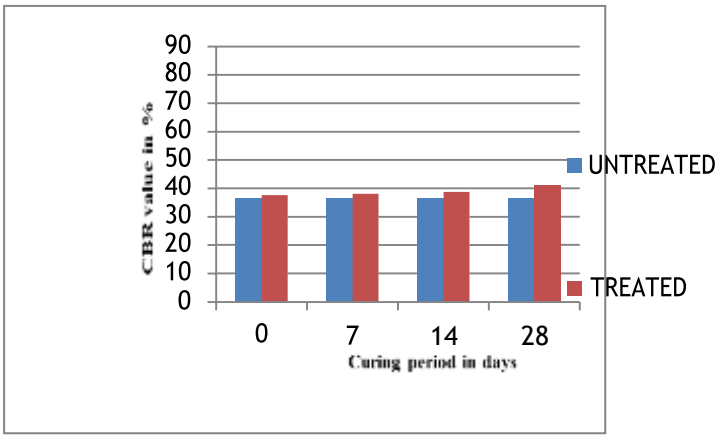
Sample	Curing period (days)	Compressive strength (KN/m²)	Cohesion value (KN/m²)
Untreated	0	7.84	3.92
	7	9.36	4.68
	14	10.98	5.49
	28	11.2	5.6
Treated	0	11.76	5.88
	7	13.5	6.75
	14	14.3	7.15
	28	15.48	7.74

3.2 Comparison Of Untreated soil And Treated soil After 7 Days, 14 Days And 28 Days

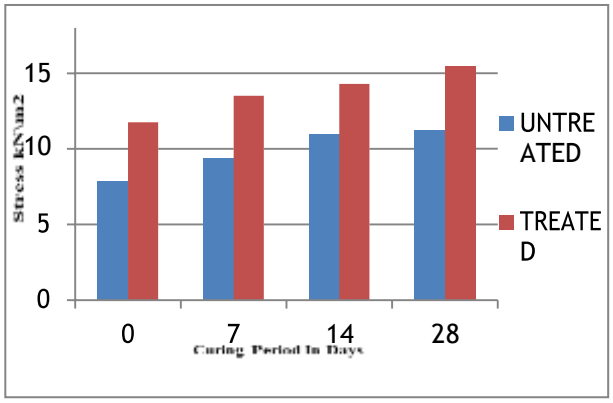
a. Standard proctor test



b.CBR Test



C.UCC Test



4. CONCLUSIONS

1. Laterite soil is the typical soil of tropics which are the end product of decomposition when heavy rainfall leaches away calcium and silica leaving behind iron with silica. In the majority of cases, these soil doesn't satisfy conventional specifications for road construction materials especially road bases.

2. It undergoes property changes during construction, gradation being considered to be the most sensitive. The poor performance of the soil has forced engineers to attempt to improve the engineering properties of the soil.

3. By adding Terrazyme, the maximum dry density has increased to 2.4 g/cc to 3.5 g/cc and a decrease in the optimum moisture content from 11.1 % to 7.5 % after a curing period of 28days.

4. The decrease is due to effective cation exchange process which generally takes longer period in the absence of such stabilizers. Also an increase in the CBR value was observed from 36.5% to 40.91% for unsoaked CBR after curing for 28days.

5. This increase is because soil treated with enzyme renders improved density values by reducing the void ratios.

6. An increase in the unconfined compressive strength was also observed which 7.84KN\m2 was initially on 0th day to 15.48 KN\m2 after curing with enzyme for 28days which is due to the reaction of enzyme with clay which results in cementation effect.

7. Bio-Enzyme stabilization results in the improvement of physical and strength characteristics of Laterite soil.

8. The CBR value has shown 12.1% increase in the strength when treated with the bio-enzyme. There is significant improve in the strength characteristics of Laterite soil when treated with enzyme.

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