International Journal of Advanced Technology in Engineering and Science
Vol. No. 14, Issue No. 03, March 2026
www.ijates.com
ijates
ISSN 2348 - 7550

USES OF TERRAZYME IN ROAD CONSTRUCTION

Mona Khosla[1],

[1]*Asst Proff, Dept. Of Civil Engineering , IIMT College of Engineering Greater Noida*

Aman kumar Rai[2], Tanu Yadav[3], Shivani Bharti[4], Yash Saxena[5], Zuber Alam[6],

[2,3,4,5,6]*Student, Dept. Of Civil Engineering , IIMT College of Engineering Greater Noida*

Abstract

Soil stabilization is an important aspect of road construction, especially in areas where the natural soil has poor strength or high clay content such as black cotton soil. Weak soil can lead to pavement failure, cracks, and uneven road surfaces. Traditionally, materials such as cement and lime are used to improve soil strength, but these materials increase construction cost and also have environmental impacts.

In recent years, bio-enzymes have been introduced as an alternative method for soil stabilization. Terrazyme is a natural liquid enzyme derived from organic materials such as molasses and fruit extracts. It improves soil strength by changing the interaction between soil particles and water.

This review paper discusses the use of Terrazyme in road construction and summarizes previous studies on its performance in improving soil properties. Research findings indicate that Terrazyme can significantly reduce the plasticity of clay soils and increase their bearing capacity. Experimental results from previous studies show that the plasticity index of soil can decrease by about 44%, while the soaked California Bearing Ratio (CBR) may increase by up to 165% after proper curing. These improvements help in reducing pavement thickness and construction cost, making Terrazyme a sustainable solution for road infrastructure development.

Keywords: *Terrazyme, Soil Stabilization, Bio-Enzyme, Road Construction, Subgrade Improvement, CBR Improvement*

1. Introduction

Roads play a very important role in the development of a country's transportation network and economy. The durability and performance of roads largely depend on the quality of the

subgrade soil. The subgrade forms the foundation of the pavement structure, and any weakness in this layer can lead to failure of the entire pavement system.

In many regions, road construction faces problems due to the presence of expansive clay soils. These soils have low shear strength and high compressibility. They tend to expand when they absorb water and shrink during dry conditions. Because of this behavior, roads constructed on such soils often experience cracks, rutting, and surface deformation.

To improve soil properties, engineers commonly use stabilization techniques such as mechanical compaction or chemical stabilization using cement, lime, or fly ash. Although these methods improve soil strength, they also increase construction costs and have negative environmental impacts. Cement production, for example, contributes significantly to global carbon emissions.

Due to these concerns, researchers have been exploring environmentally friendly alternatives. Bio-enzymes such as Terrazyme have emerged as a promising solution for soil stabilization. Terrazyme works by improving the bonding between soil particles and reducing the moisture sensitivity of clay soils.

This review paper discusses the role of Terrazyme in soil stabilization and its potential benefits in road construction.

2. Literature Review

Several researchers have studied the effectiveness of Terrazyme and other bio-enzymes in soil stabilization.

Studies conducted on clay soils have shown that Terrazyme significantly improves soil strength and reduces plasticity. Shankar et al. reported that the use of bio-enzymes increased the California Bearing Ratio (CBR) value of soil and reduced permeability. Similarly, other researchers observed that Terrazyme performs particularly well in soils with intermediate and high plasticity.

The stabilization mechanism of Terrazyme is different from traditional chemical stabilizers. Clay particles normally carry negative charges, which attract water molecules and form a thin water layer around them. This layer causes swelling and reduces soil strength.

Terrazyme helps reduce the surface tension of water and allows better penetration of the enzyme solution into soil pores. It also promotes cation exchange reactions that neutralize the

charges on clay particles. As a result, the water layer surrounding the particles is removed and the particles pack more closely together.

Another important factor affecting the performance of Terrazyme is curing time. Unlike cement stabilization, which produces quick reactions, bio-enzymes require time to react with soil particles. Research has shown that soil treated with Terrazyme continues to gain strength over time and often reaches maximum performance after around 28 days of curing.

The dosage of Terrazyme also plays a critical role. Studies suggest that the optimum dosage generally lies between 0.05 ml/kg and 0.15 ml/kg of soil. Beyond this range, additional improvement in soil strength may not occur.

3. Materials and Methods

3.1 Soil Characteristics

The soil used in previous studies for Terrazyme stabilization was generally clayey soil collected from different locations. Laboratory tests were conducted to determine the basic engineering properties of the soil.

Typical results showed that the soil had a liquid limit of around 42% and a plastic limit of about 17%, giving a plasticity index of approximately 25%. Standard Proctor tests indicated an optimum moisture content of around 18.5% and a maximum dry density of about 1.65 g/cc.

3.2 Terrazyme Additive

Terrazyme is a concentrated liquid bio-enzyme that is usually diluted with water before mixing with soil. The dosage of Terrazyme is calculated based on the weight of dry soil.

In most experimental studies, three different dosages were used:

- 0.05 ml/kg
- 0.10 ml/kg
- 0.15 ml/kg

The enzyme solution is mixed with water and then blended with soil during compaction to ensure uniform distribution.

3.3 Laboratory Tests

To evaluate the effect of Terrazyme on soil properties, several laboratory tests are conducted. These tests include:

- Atterberg Limits Test
- Standard Proctor Compaction Test
- California Bearing Ratio (CBR) Test
- Unconfined Compressive Strength (UCS) Test

Both untreated and treated soil samples are tested to compare the results.

4. Results and Discussion

4.1 Compaction Characteristics

Studies show that Terrazyme improves the compaction characteristics of soil. The addition of the enzyme allows soil particles to rearrange more efficiently during compaction.

As a result, the maximum dry density increases while the optimum moisture content decreases. For example, soil treated with Terrazyme at a dosage of 0.10 ml/kg achieved a dry density of about 1.78 g/cc compared to 1.65 g/cc for untreated soil.

4.2 Reduction in Plasticity

Terrazyme treatment significantly reduces the plasticity of clay soils. Experimental results show that the plasticity index of soil can decrease from about 25% to approximately 14%.

This reduction indicates that the soil becomes less sensitive to water and is less likely to expand or shrink with changes in moisture.

4.3 Improvement in CBR Value

The California Bearing Ratio is an important parameter used for pavement design.

Untreated soil generally shows low CBR values, which indicates weak subgrade conditions. However, after stabilization with Terrazyme and curing for about 28 days, the soaked CBR value can increase significantly.

In some studies, the soaked CBR value increased from about 3.2% to around 8.5%, representing an improvement of approximately 165%. This increase in strength improves the load-bearing capacity of the soil and enhances pavement performance.

5. Pavement Design Implications

Improvement in subgrade strength directly affects pavement design. When the CBR value increases, the required thickness of pavement layers decreases.

With Terrazyme stabilization, the thickness of base and sub-base layers can be reduced by up to 20%. This reduction lowers the amount of construction materials required and reduces transportation costs. Additionally, the use of locally available soil becomes possible, which further reduces construction expenses and environmental impact.

6. Conclusion

The use of Terrazyme for soil stabilization offers several advantages in road construction. Based on the studies reviewed, the following conclusions can be drawn:

1. Terrazyme improves the engineering properties of clay soils by modifying the interaction between soil particles and water.
2. The optimum dosage of Terrazyme is generally around 0.10 ml/kg of soil.
3. The plasticity index of soil can be reduced significantly after treatment.
4. The soaked CBR value increases considerably after curing for about 28 days.
5. Improved soil strength allows reduction in pavement thickness and overall construction cost.

Therefore, Terrazyme can be considered a sustainable and environmentally friendly alternative to traditional soil stabilizers for road construction projects.

References

1. IRC Guidelines for Soil Stabilization
2. Khanna, S. K., Justo, C. E. G. – *Highway Engineering*
3. Kadiyali, L. R. – *Highway Engineering*
4. Research studies on bio-enzyme soil stabilization
5. Civil Engineering Department Guidance -Mona Khosla
6. IOP Conference Series: Earth and Environmental Science, A Review on Terrazyme as Pavement Enhancement Approach.
7. International Journal of Engineering and Technology (IJAET), Soil Stabilization by using Terrazyme.
8. Journal of Engineering Research and Technology (IJERT), Soil Stabilization using Terrazyme for Road Construction.
9. ResearchGate/Springer, Stabilization of Soil Using Terrazyme for Road Construction.
10. International Journal of Innovative Research in Technology (IRJET), Impact of Terrazyme on Expansive Soil