International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 08 | Aug 2022 www.irjet.net p-ISSN: 2395-0072

Comparative Study on Soil Stabilization Using Terrazyme and Flyash

Brunda L[1], Ashwini Satyanarayana[2], Dr. Dushyanth V. Babu R[3]

[1]Brunda L, M. Tech Student, DSCE
[2]Ashwini Satyanarayana, Assistant Professor, Dept of CTM, DSCE, B 'lore / Research Scholar, Dept of Civil Eng., JAIN (Deemed to be University), B 'lore
[3]Dr. Dushyanth V. Babu R, School of Civil Eng., FET-JAIN (Deemed to be University), B 'lore

---***---

Abstract - *The qualities of the soil subgrade have a big impact on how well pavement works. In order to improve weak subgrade, the most effective stabilisation method should be used. Flyash and bioenzymes are compared for soil stabilisation since bioenzymes are more affordable and environmental friendly. Fly ash toxics can move across the environment via runoff, erosion, and fine dust in the atmosphere. The potential for the ash's pollutants to elude containment and spread throughout the environment The current work provides a bio-enzyme and Flyash-based approach for improving soil. Class F flyash and a bio-enzyme called Terrazyme are both employed in this investigation. Both sets of results are contrasted. An organic, non-toxic, liquid enzyme is called Terrazyme. Fruit extract, vegetable extract, and plant fermentation are used in its production. The finely separated byproduct of pulverised coal combustion is known as flyash. Terrazyme can be utilised as a soil stabiliser and can raise the CBR value in road construction, according to a comparison of the results of of flyash and terrazyme.*

Key Words: **Terrazyme, Flyash, Bio-enzyme, Class F flyash, Stabilization, Black cotton soil**

1. INTRODUCTION

The process of soil stabilisation involves changing a soil's physical characteristics to provide long-term, sustained strength benefits. The shear strength and overall bearing capacity of a soil are increased to achieve stabilisation. An enzyme is an organic catalyst that quickens a chemical reaction that would otherwise take considerably longer to complete without becoming a component of the final product. A relatively minimal quantity of bio-enzymes is needed for soil stabilization because they do not become a component of the finished product and are not consumed by the reaction. In order for an enzyme to function in soil, it needs to be mobile enough to go to the location of the reaction. Traditional additives like cement and lime are becoming more expensive, which has prompted the building industry to look for alternatives that are both less expensive and more readily accessible to address soil deficiencies and fulfil geotechnical engineering standards. Because of the harm they do to the environment and the dangers they pose to human health, the proper disposal of industrial and agricultural waste is a pressing issue that must be addressed as soon as possible at a reasonable cost.

1.1 Terrazyme

TerraZyme is a natural, non-toxic liquid that was created using vegetable extracts and is widely recognised as a sound and innovative road construction technique. It completely replaces the traditional granular base and granular sub base and places an emphasis on strength, performance, and higher resistance to deformation. TerraZyme was created specifically to alter the engineering characteristics of soil. Before use, they must be diluted in water.

The use of TerraZyme improves soil load bearing capacity and weather resistance. These characteristics are especially noticeable in fine-grained soils like clay where the formulation influences the behavior of swelling and contracting. This formulation has the power to alter the soil's molecular structure, preventing the soil from reabsorbing water after compaction and preserving the mechanical advantages of compaction even when water is reapplied to the compacted soil. The product is biodegradable and the transformation is permanent once the enzyme interacts with the soil.

Fig -1: TERRAZYME

1.2 Flyash

One of the four coal combustion products (CCPs) produced as a byproduct of burning coal are fly ash, which is divided into two main categories: Class C and Class F. Class C fly ash is created when lignite and subbituminous coal are burned.

Burning anthracite, also known as bituminous coal, however, results in Class F fly ash.

Fly ash particles typically consist of hollow spheres of silicon, aluminum, and iron oxides as well as unoxidized carbon, all of which combine to form both classes of fly ash pozzolans-siliceous or siliceous and aluminous materials-despite the fact that there can be multiple variations of the chemical additive. When utilizing the Unified Soil Classification System, it is commonly regarded as non-plastic fine silt (ML) (USCS). Class F fly ash is not used as frequently because it is not a self-cementing material and needs an activator, such as lime or cement, to create pozzolanic stabilized mixes (PSMs).

2. COMPACTION

The IS 2720 compaction test was carried out. A 3.5 kilogramme sample of dried soil that had been sieved through a 475 micron sieve was poured in three equal layers in a mould and compacted using a 2.6 kg rammer that had a 30.5 cm drop height between each layer. Following the collection of soil samples from the mold's extremes and the intermediate region, the ideal moisture content and maximum dry density were determined. The link between moisture density and dry density was obtained by plotting a graph of dry density versus percentage of water content.

Table -1: Standard proctor test

Dosage	Optimum moisture content %	Maximum dry density (g/cm3)
Untreated	1.65	18
BCS+200ml/1m³	1.85	18
BCS+200ml/2m³	1.83	18
BCS+200ml/3m³	1.82	18
BCS+15% FA	1.76	18
BCS+20% FA	1.79	18
BCS+30% FA	1.82	18

The graph clearly demonstrates that adding Terrazyme increased the MDD values significantly, increasing them from 1.65g/cm3 to 1.85g/cm3 when added to 200ml/1m3, and from 1.65g/cm3 to 1.81g/cm3 when added to Flyash. As a result, the tests unequivocally demonstrate that terrazyme operates as a reinforcing agent in soil. According to the study, terrazyme performs 8.33 percent better in this condition than flyash.

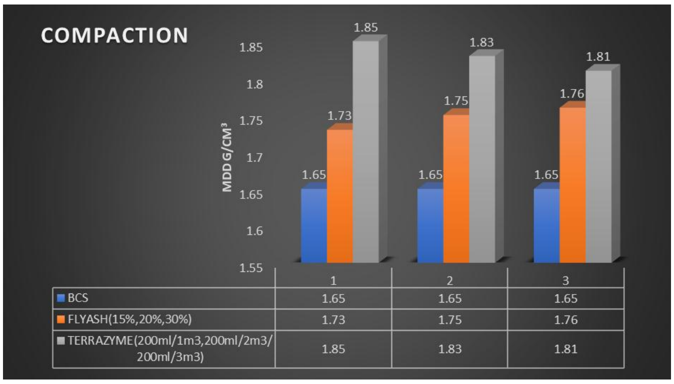

Chart -1: **Comparison of compaction values of Terrazyme and Flyash**

2. CBR

The 5kg air dried sample for the unsoaked California bearing test is weighed and sieved through a 475-micron sieve in accordance with IS 2720 specifications. The mould was compressed with 5 layers, each with 55 blows using a 4.89 kg rammer, with the collar put at the bottom of the mould. The CBR value at 2.5mm and 5mm is determined with the help of the graph after the mould was removed and placed in the CBR testing machine. The load in kg and the depth of penetration are documented, and a graph of the load versus penetration is plotted.

Table -2: CBR

Dosage	CBR(%)
Untreated	1.65
BCS+200ml/1m³	1.85
BCS+200ml/2m³	1.83
BCS+200ml/3m³	1.82
BCS+15% FA	1.76
BCS+20% FA	1.79
BCS+30% FA	1.82

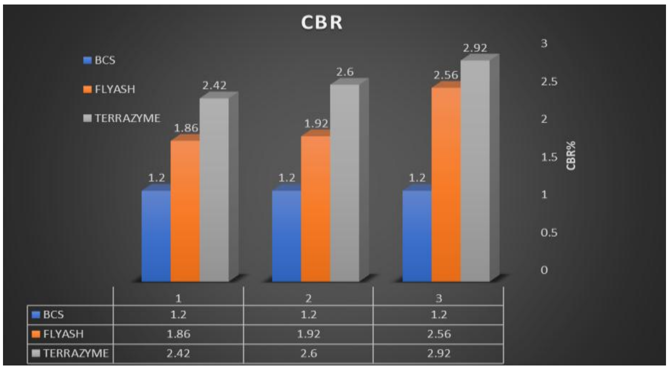

Chart -2: **Comparison of CBR values of Terrazyme and Flyash**

When terrazyme was added in doses of 200ml/1m3, 200ml/2m3, and 200ml/3m3, it was discovered that 200ml/1m3 had a higher CBR value than the other two doses. When flyash was added to soil in doses of 15, 20, and 30% and tested for CBR, it was found that flyash added in 30% was the optimal percentage. When flyash and terrazyme were compared, it was discovered that terrazyme added in 200ml/1m3 had a higher CBR value than flyash added in 30%. The CBR value increased with decreasing dosage, and for lower dosage, CBR value was more.

2. COST ANALYSIS

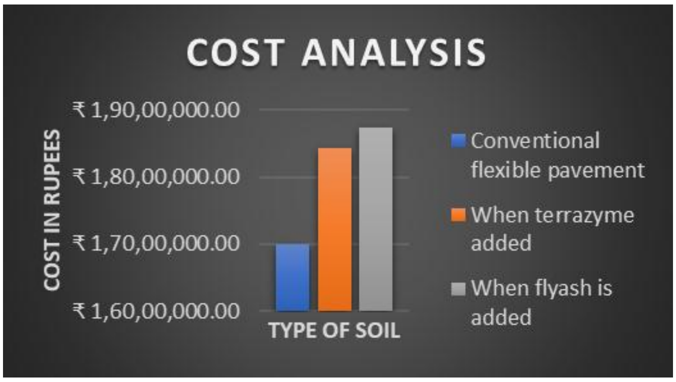

Chart -3: COST ANALYSIS

According to the cost study above, the price to build a conventional flexible pavement is Rs. 1,69,97,800, while the price to build a flexible pavement using soil that has been treated with terrazyme is Rs. 1,84,37,800, which is 8.29 percent more expensive.

When there is little traffic, Terrazyme eliminates the need for granular sub-base, base course, and surface course. Utilizing Terrazyme has the advantage of having essentially no maintenance costs, making this strategy economically sensible.

3. CONCLUSIONS

Fly ash and Terrazyme results on the geotechnical properties of expansive soils with regard to their application as pavement subgrade were compared experimentally in this study. The key conclusions from this research are as follows:

- According to the current study's findings, terrazyme may be an efficient way to reinforce soil when soil stabilisation is done with the help of flyash and terrazyme. Terrazyme, which has a low cost but high strength, strengthens and stabilises the structure. Black cotton soils were used for the check. Any foundation can be built within the soil due to the soil's increased bearing capacity as a result of soil stabilisation.
- With the addition of Flyash and Terrazyme, the CBR values of the soaked and unsoaked CBR increased, reaching their highest when 200ml/1m3 of Terrazyme was added.
- The soil was mixed with flyash and terrazyme at various dosages, and the results of the standard Proctor test revealed that the maximum MDD of 1.85g/cm3 with OMC of 18% was seen when terrazyme was introduced to the soil at 200ml/1m3.
- From the results, it is evident that expansive soils treated with 200ml/1m3 of terrazyme had a significant increase in strength. Therefore, 200ml/1m3 of terrazyme can be used cost-effectively to stabilise expansive soils for use as road pavement.
- According to the cost study above, the price to build a conventional flexible pavement is Rs. 1,69,97,800, while the price to build a flexible pavement using soil that has been treated with terrazyme is Rs. 1,84,37,800, which is 8.29 percent more expensive. Since it has been demonstrated that adding terrazyme to soil prior to construction will boost the soil's strength, extending the life of the pavement and enabling low-cost maintenance of the pavement.

REFERENCES

[1] Rajoria, V. and Kaur, S. (n.d.). A REVIEW ON STABILIZATION OF SOIL USING BIO-ENZYME. [online] IJRET: International Journal of Research in Engineering and Technology, pp.2321–7308.

[2] Sahoo, S. and Sridevi, G. (2018). SOIL STABILIZATION USING BIO ENZYME. International Journal of Pure and Applied Mathematics, [online] 118(24).

[3] Safana, B. and Sabu, K. (n.d.). Soil Stabilization using Terrazyme for Road Construction. IJRET: International Journal of Research in Engineering and Technology

[4] Abdulkareem, A., Eyada, S.O. and Mahmood, N. (2021). Improvement of a subgrade soil by using EarthZyme and cement kiln dust waste. [online] www.semanticscholar.org.

[5] AbouKhadra, A., Zidan, A.F. and Gaber, Y. (2018). Experimental evaluation of strength characteristics of different Egyptian soils using enzymatic stabilizers. Cogent Engineering, 5(1), p.1517577. doi:10.1080/23311916.2018.1517577.

[6] Singh, S. (2021). Experimental investigation on black cotton soil altered thru cement kiln dust and terrazyme. Materials Today: Proceedings, 37, pp.3661–3664. doi:10.1016/j.matpr.2020.10.147.

BIOGRAPHIES

Brunda L, M.Tech Student, Department of Construction technology & Management, Dayananda Sagar College of Engineering,

Bengaluru, Karnataka, India.

Ashwini Satyanarayana,

Assistant Professor, dept of CTM, DSCE, B 'lore / Research Scholar, Dept of Civil Eng., JAIN (Deemed to be University), Bengaluru.

Dr. Dushyanth V. Babu R, School of Civil Eng., FET-JAIN (Deemed to be University), Bengaluru.