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A Review on Stabilization of Black Cotton Soil using Bio enzymes for Pavement Construction

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Abstract: ***A soil needs to be stabilized when it lacks in properties which are required for the intended construction. Therefore, it is imperative to improve the engineering properties of such soil by selecting suitable materials and methods. Soils vary from place to place and also their properties. Selection of such materials and methods for soil stabilization requires sound engineering judgments; therefore, the best way to select suitable materials is testing of soil. The method and material selected for soil stabilization should be verified in laboratory before commencement of field construction.***
Keywords: ***Bio enzymes, Stabilization, Soil, Clayey Soil, Clay mineral***

I. INTRODUCTION

Clayey soils are so widespread that it becomes impossible to avoid them for any type of construction. Engineers face many problems while constructing facilities on such soils. Such clayey soils do not possess sufficient strength to support the loads coming on them during construction or service life of the structure. Clayey soils are spread over more than one third part of the country. Many parts of India are covered with such soils having poor strength and bearing capacity. Clay mineral montmorillonite is responsible for swelling properties of clayey soils. Such poor engineering performance of clayey soil has forced researchers to improve the properties of these soils, thus soil stabilization is an effective method of improving the properties of soil and performance of the facilities put on them. The aim of the soil stabilization is to increase the strength and stiffness of the soil. There are many methods are available to improve the properties and performance of the soil.

II. PROPERTIES OF CLAYEY SOIL

Clayey soils are expansive in nature and black in colour. These soils are spread over large part of country i.e. in Maharashtra, Madhya Pradesh, Uttar Pradesh, Tamil Nadu, Andhra Pradesh and Telangana.

The clayey soils are characterized by their properties of swelling and shrinkage. These soils contain clay mineral montmorillonite which is responsible for their large shrinkage and swelling.

These soils show the alternate swelling and shrinkage behaviour with seasonal change in moisture content. The liquid limit (LL) and plasticity index (PI) ranges from 40 to 100 and 20 to 60 respectively.

These soils show low shrinkage limit between 10 to 15 percentages. All the above properties of clayey soils are very sensitive to moisture change. Clayey soils have very low bearing capacity and strength of clayey soil is also extremely low.

Clayey soils have high selling pressure due to which these soils are not suitable for pavement construction. Seasonal variation of clayey soil causes excessive damage to the flexible pavements constructed on them. After every monsoon season signs of failure can be seen in the form of rut, unevenness and corrugations. So pavement on clayey soils requires frequent maintenance which results in heavy cost.

III.PROPERTIES OF BIO-ENZYMES

Enzymes are biological catalysts present in all living organisms. They are find from plants and animals, including microorganisms, by extraction with usuing suitable solvent. Kestler [4] recommended that enzymes are proprietary of their supplier; unless they provide the many composition, it is very difficult to determine the precise composition and stabilization mechanism.

He also recommended that some of commercial enzymes, for example, Biochemical Cat 300-1, EMC SQUARED, PermaZyme 11-X, TerraZyme, and UBIX No. 0010, should have contain protein molecules which react the soil molecules to add the soil particles together, thus decreasing the affection of soils for moisture.

Hitam et al. He noticed that the roads, which had many serious problems due to monsoons in last days, remained intact after two monsoon seasons.

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IV. LITERATURE SURVEY

Lacuoture and Gonzalez (1995) applied study on the affect of TerraZyme on sub-base and sub-grade. The reaction of the soil treated with Bio Enzyme was observed and compared with soil without Bio Enzyme. It was concluded that soil showed improvement in short duration of time but the cohesive soils showed improvement successively.

Bergmann (2000) observed from his study on bio enzyme that for improving strength to the soil, bio enzyme requires some clay content. He stated that for successful stabilization of soil minimum 2% clay content is required and 10 to 15 % of clay content gives good results. Compared to 28 % of untreated soil CBR after 1, 2, 3, 14 week was found as 37, 62, 66 and 100 respectively.

Manoj Shukla et al. (2003) carried out test on five different type of soil. The clay content in soil varies from low to high.. Little to high improvement is seen in the physical properties of soil with Bio Enzyme. The reason behind this little improvement is the chemical composition of soil which is less reactive with the Bio Enzyme. Sandy to silty type soil showed improvement in the CBR and UCS. It was observed that pavement thickness is reduced by 24 to 48 %. In places where the availability of granular material is less, Bio Enzyme treated soil with thin bituminous coating can satisfactorily fulfill the pavement requirement.

Shankar et al. (2009) conducted tests on lateritic soil of Dakshina Kannad (district of India). The initial liquid limit and plastic limit of soil were 25 % and 6% respectively. The lateritic soil of the district was not satisfying the sub base requirement .For satisfying the sub base course requirements sand is mixed with soil in different proportions until specified values were attained.. Study was done on the effect of enzyme, on soil properties like CBR, UCS and permeability for a period of 4 weeks. CBR value increased by 300% with about 10 % sand and 200ml/m3 of enzyme mixed with soil after 4 week of curing. An increase of 300% is seen the CBR value , increase of 450% in unconfined compressive strength value and decrease of 42 % in permeability of soil was seen with high dosage of enzyme of 200ml/2m3 after 4 weeks of curing . It was concluded from the CBR results of treated and untreated soil that addition of enzyme in non-cohesive soil has no effect on the cohesion less soil. It was also stated that the bio enzyme used shall be checked for its effect on type of soil in laboratory prior to the field application. In order to check the efficiency of Bio Enzyme in field, test were performed on National Highway which affirms that soil blended with enzyme shows high CBR value than ordinary soil.

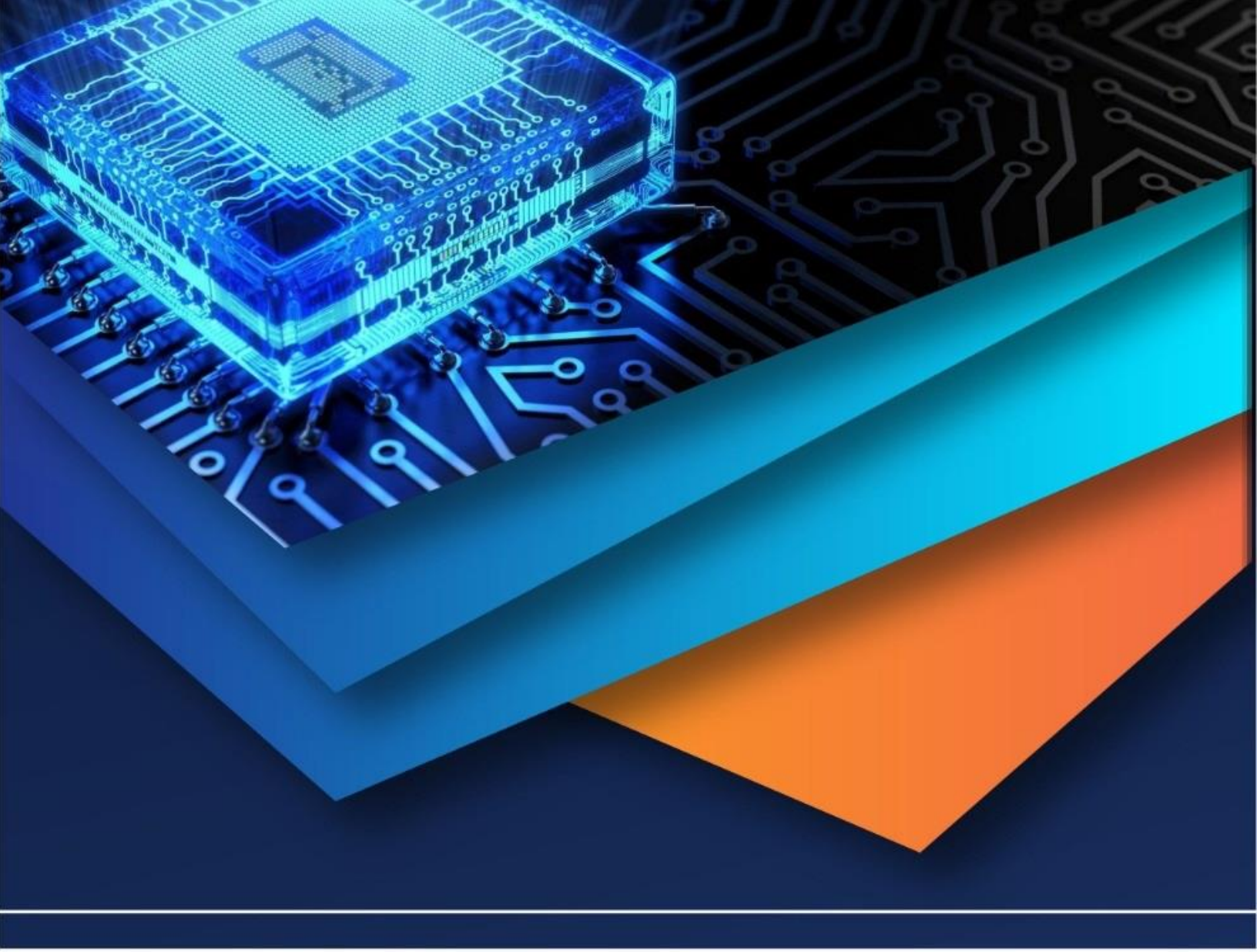
Venkatasubramanian & Dhinakaran (2011) performed test on 3 different soils with different properties. These soils were tested with different dosage of enzyme. The liquid limit and plasticity index of soil were reported as 28, 30, 46 % and 6, 5 and 6 % respectively. An increase of 157 to 673 % is seen in CBR after 4 weeks of curing and 152 to 200 % in UCS.Vijay Rajorial,

Suneet Kaur (2014) carried out a theoretical evaluation of enzyme. Reduction of about 18 to 26 % is seen in cost of construction of roads by using TerraZyme as a soil stabilizer, constructed by public work department in Maharashtra. Structures made of bio enzyme are economical and have greater strength.

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