ABSTRACT

With the current outcry about the global climate and how it keeps worsening every year the construction industry is really now trying to look for greener and sustainable alternatives. This project mainly focuses on highway construction in particular. Biochar is produced from organic materials such as agricultural waste, forestry residues, and other biomass through pyrolysis, a process that heats organic matter in the absence of oxygen.

This makes it a renewable resource as it utilizes waste products that would otherwise contribute to landfill and pollution. During pyrolysis, a significant portion of the carbon in the biomass is converted into a stable form that is resistant to decomposition. When added to soil, biochar acts as a long-term carbon sink, helping to reduce the overall carbon dioxide levels in the atmosphere and mitigate climate change.

The stabilization of clay subgrades in highway construction is crucial for ensuring pavement durability and performance. This study investigates the potential of biochar as an additive for enhancing the properties of clay used in subgrade layers. Comprehensive laboratory tests, including Atterberg limits and California Bearing Ratio (CBR) tests, were conducted to evaluate the effects of varying biochar content (0%, 5%, 10%, 20%, and 30%) on the engineering properties of clay. The results indicated that the addition of biochar up to 10% significantly improved the clay's performance. Key findings include a reduction in the liquid limit (LL) and plasticity index (PI), indicating decreased moisture sensitivity and plasticity.

The linear shrinkage (LS) also decreased, demonstrating reduced shrinkage potential upon drying. Notably, the CBR values peaked at 10% biochar addition, suggesting enhanced load-bearing capacity and optimal soil strength. However, higher biochar contents (20% and 30%) led to diminishing returns, with a decrease in CBR values and potential over-stabilization issues. The study concludes that a 10% biochar mix is optimal for improving the mechanical properties of clay subgrades, offering a sustainable and effective solution for highway construction. Further site-specific testing and implementation guidelines are recommended to maximize the benefits of biochar in subgrade stabilization.

Keywords: Biochar, Clay Subgrade, Highway Construction, Atterberg Limits, California Bearing Ratio (CBR), Soil Stabilization.