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Geotechnical Properties of Lateritic Soil Stabilized with Ground-Nut Husk Ash

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Abstract

This study assesses the geotechnical properties of lateritic soil stabilized with Ground-nut Husk Ash. Preliminary tests were carried out on the natural soil sample for identification and classification purposes, while consistency limits tests were thereafter carried out as well. Engineering property tests such as California Bearing Ratio (CBR), Unconfined Compressive Strength (UCS) and compaction tests were performed on both the natural soil sample and the stabilized lateritic soil, which was stabilized by adding Ground-nut Husk Ash, GHA, in percentages of 2, 4, 6, 8 and 10 by weight of the soil. The results showed that the addition of GHA enhanced the strength of the soil sample. The Maximum Dry Density (MDD) reduced from 1960 kg/m^3 to 1760 kg/m^3 at 10% GHA by weight of soil. The Optimum Moisture Content (OMC) increased from 12.70% to 14.95%, also at 10% GHA by weight of soil. The unsoaked CBR values increased from 24.42% to 72.88% finally, the UCS values increased from 510.25 kN/m^2 to 1186.46 kN/m^2, for both CBR and UCS, the values were at 10% GHA by weight of soil. It was therefore concluded that GHA performs satisfactorily as a cheap stabilizing agent for stabilizing lateritic soil especially for subgrade and sub base purposes in road construction.

Keywords: Geotechnical Properties; Ground-nut husk Ash; Lateritic Soil; Stabilization; Strength Tests.

1. Introduction

Laterites are soil types rich in iron and aluminum that are formed in tropical areas. Most laterites are rusty-red because of the presence of iron oxides. They develop by intensive and long- lasting weathering of the underlying parent rock. Tropical weathering (laterization) is a prolonged process of chemical weathering which produces a wide variety in the thickness, grade, chemistry and ore mineralogy of the resulting soils. The initial products of weathering are essentially kaolinized rocks called saprolites [1]. Lateritic soils are products of tropical weathering with red, reddish- brown or dark brown colour, with or without nodules or concretions and generally (but not exclusively) found below hardened ferruginous crusts. Laterite formation factors include climate (precipitation, leaching, capillary rise and temperature), topography (drainage), vegetation, parent rock (iron rich rocks) and time of these primary factors. However, climate is considered to be the most important factor [2].

Soil stabilization aims at improving soil strength, controlling dust and increasing resistance to softening by water through bonding of the soil particles together thereby water proofing the particles or a combination of the two [3, 4]. The simplest stabilization processes are compaction and drainage (if water drains out of wet soil, it becomes stronger). The other process is by improving the gradation of particle size and further improvement can be achieved by adding binders to weak soils [5].

Soil stabilization can be accomplished by several methods, all these methods fall into two broad categories namely mechanical and chemical stabilization. Mechanical Stabilization is a physical process that involves altering the physical nature of native soil particles by either induced vibrations or compaction or by incorporating other physical properties such as barriers and nailing. Chemical Stabilization involves initiating chemical reactions between

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