Physics and Chemistry of the Earth 130 (2023) 103361

Contents lists available at ScienceDirect

Physics and Chemistry of the Earth

journal homepage: www.elsevier.com/locate/pce

Effectiveness of coffee husk ash and coconut fiber in improving peat properties

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ARTICLE INFO

Keywords:
Ground rehabilitation
Coffee husk ash
Coconut fibre
Strength properties of peat

ABSTRACT

Peat is a well-known problematic soil associated with poor engineering properties because its engineering with low shear strength, highly compressible, high moisture content. The characteristics make it unsuitable for construction in its natural stage. Thus, this study determines the soil properties of untreated peat soil and assesses the changes in strength of the treated peat soil using the admixture of Coffee Husk Ash (CHA) and Coconut Fibre (CF). The percentage of CF used is 0.50%, 0.75% and 1.0% meanwhile the percentage of CHA used was 5%, 6%, and 7% by the weight of the soil sample. The peat soil for this study were retrieved from Mardi Pontian in Johor. Soil properties such as moisture content, bulk density, and the Atterberg limit have been tested. The result of the Standard Proctor test in this study determined the Optimum Moisture Content and Maximum Dry Density of soil samples. The strength of these samples has been determined by using the Unconfined Compressive Strength (UCS). The physical properties for untreated peat soil with the moisture content of 250%, organic content about 77%, the specific gravity was in the range of 1.48–1.8. The Atterberg limit for liquid limit is 230. The compaction test results has shown decrement in maximum dry density (MDD) but an increase in strength with the addition of CHA and CF in peat soil. According to the findings, 0.5% of Coconut Fiber improves the engineering properties of peat soil (CF).

1. Introduction

Peat is a well-known problematic soil associated with poor engineering properties because its engineering with low shear strength, highly compressible, high moisture content (Talib et al., 2021). The characteristics make it unsuitable for construction in its natural stage. Peats are found to contain high organic matter and are generally associated with poor strength characteristics, large deformation, high compressibility, and high magnitude and rates of creep. As a result, peat is subjected to problems of instability such as local sinking and development of slip failure due to the characteristics with low shear strength, highly compressible, high moisture content (Wahab et al., 2020). It is also subjected to very large primary and long-term settlement under an even moderate increase in load (see Fig. 14).

Peat differs from mineral soils in many ways and therefore needs special attention. These unique features included high moisture content (up to 800%), compressibility and significant compression, low shear strength (typically 5–20 kPa), high spatial variability, and the potential for further degradation due to changes in environmental conditions. Instead, it might seem that the peat is fully organic, contain identifiable remains of plants, low density, and dark brown to black (Deboucha, 2008; Jarukas et al., 2021; Hewitt et al., 2021). Referring to Wahab et al. (2020), considered that peat soils were difficult to work with because it contained more than 75% organic matter, have a low shear strength

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https://doi.org/10.1016/j.pce.2023.103361
Received 11 August 2022; Received in revised form 21 December 2022; Accepted 10 January 2023
Available online 16 January 2023
1474-7065/