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Nurul Zainuddin[a], Nor Zurairahetty Mohd Yunus[a], Mohammed Ali Mohammed Al-Bared[b*], Aminaton Marto[c,d], Indra Sati Hamonangan Harahap[b] , Ahmad Safuan A Rashid[a]

[a]Department of Geotechnics and Transportation, Faculty of Civil Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

[b]Department of Civil and Environmental Engineering, Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak, MALAYSIA.

[c]Malaysia-Japan International Institute of Technology,Universiti Teknologi Malaysia, 54100 Kulala Lumpur, Malaysia

[d]Centre of Tropical Geoengineering, Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor, Malaysia

*Corresponding Author: albared2009@yahoo.com

ABSTRACT

Granite tile dust is a waste material produced in large amounts during the cutting and grinding processes of granite tiles at manufacturing factories and construction sites. Generally, it is dumped as a slurry containing a fine powder, which is non-biodegradable. Employing this waste in treating marine clay would be an environmentally friendly, cost effective, and green solution. However, dredged marine clay is a problematic soil because of its weak engineering properties. This study aims to identify the possibility of employing the granite dust obtained from a demolished tile material (DTM) to improve the geotechnical properties of the marine clay. Experimental techniques have been used to investigate the effect of percentages of DTM on the physical and mechanical properties of marine clay, which included the Atterberg limits, particle-size distribution, compaction, unconfined compressive strength (UCS), and pH. In addition, microstructural analysis tests such as scanning electron microscopy (SEM) and X-ray diffraction were conducted to examine the compositions of the granite and marine clays and of their combination at different mixing proportions of 5, 10, 15, and 20% of the dry weight of the soil. The results showed that the DTM was able to improve the plasticity and pH of the marine clay. The addition of DTM decreases the water holding capacity that resulted in reducing the plasticity of the soil (from 33 to 29%). The maximum dry density was increased (from 1.34 to 1.48 Mg/m^3) along with a reduction in the optimum water content (from 32 to 22%). Moreover, the UCS of the marine clay treated with the DTM decreased after an immediate treatment. However, for a DTM of 5%, the strength increased with an increase in the curing time, and a further increase in the strength was observed at a curing period of 28 days. The results of the microstructural analysis confirmed that the DTM largely acts as a filler as low rate of cementation or bonding minerals were observed. The outcome of this study will allow the usage of DTM as a low carbon and green soil additive. It is recommended to investigate the effect of different sizes of DTM to stabilize soft soils.

Keywords: Granite Tile Waste, Marine Clay, Engineering properties, microstructure analysis, pH

1. Introduction

Construction projects are being implemented worldwide for urban development, which require natural resources such as land and materials. The shortage of land forces developers