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Preliminary Strength Characterization of Peat Soil Stabilized with Mg-Rich Gypsum Waste

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Abstract. The global demand for soil stabilization techniques using chemical additions has indeed increased, and the utilization of problematic soils such as organic, peat, and expanding clay has become necessary due to the rapid growth of industrial enterprises. Peat soil, in particular, is considered geotechnically problematic due to its weak properties, which can limit its use in load-bearing applications. Therefore, the use of soil stabilization techniques to improve the properties of peat soil has become crucial. In recent years, the use of waste materials for soil stabilization has become increasingly popular, as it aligns with the sustainability goals of reducing waste and promoting environmental protection. This study focused on the use of magnesium-rich gypsum (MRSG), an industrial waste by-product, for improving the compressive strength of peat soil in Kuantan, Pahang, Malaysia. The study utilized various analytical approaches, including mechanical and physicochemical parameters, to determine the optimal combination of additives in the soil. Unconfined Compressive Strength (UCS), pH, scanning electron microscopy (SEM-EDX), and Fourier infrared spectroscopy (FTIR) were used to examine the untreated and treated soil with MRSG. The results showed that the use of MRSG was effective in improving the peat soil properties, as evidenced by the increase in peat strength and the improvement in peat microstructure. Furthermore, the study highlights the potential application of industrial waste by-products as sustainable substances for soil improvement and stabilization, which is significant in achieving sustainable development goals. By utilizing waste materials for soil stabilization, reduction of waste is promisable and promote environmental protection while improving the properties of problematic soils and increasing its potential use in various applications.

Keywords: *Chemical Soil Stabilization; Peat Soil; Mg-Rich Gypsum; Sustainable Soil Stabilization; Chemical Additives.*

INTRODUCTION

Ground improvement is becoming an increasingly important method due to the scarcity of construction areas and the growth of population and economy [1]. Malaysia is one of the countries that has a substantial amount of land covered by peat. Around 2.7 million hectares of total land area in Malaysia are covered with tropical peat soil [2]. However, potential construction on tropical peat soil is often hindered by their weak geotechnical properties, including high natural moisture content, high compressibility, and low bearing capacity [3]. Peat soil, in particular, is considered problematic due to these weak properties, which can result in settlement and compressibility issues. To address these challenges, soil stabilization techniques are utilized to increase the stability of peat soil by decreasing settlement and compressibility while improving bearing capacity. Traditional chemical additives such as fly ash, lime, and cement have been used in soil stabilization, but sustainable approaches using secondary raw materials are increasingly being recommended [4]. The stabilization of a chemical admixture can be accomplished by combining additives to promote flocculation and aggregation with the formation of chemical bonds between particles [5].

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