UNIVERSITI TEKNOLOGI MARA

BIOENGINEERING PROPERTIES AND REINFORCING MECHANISM OF VEGETATION ROOT-SOIL MATRIX IN SOIL SLOPE

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The green vegetation for cut soil slope stability is widely used despite not many studies on its bioengineering benefit, thus there is still frequent soil slope failure with this vegetation. This research has recently studied the bioengineering properties of soil-root matrix toward the stability of shallow soil slope with depth from 1 to 1.2 m. The vast scope of work from in-situ pull out test on Bermuda grass and Vetiver grass at 11 selected sites, i.e Karak, Lancang, Maran, Gambang, Dengkil, Batang Kali, Kuala Pilah, Ulu Yam, Temerloh, Kuantan, Gombak, and Sabak Bernam. Soil-root samples from the sites were examined for their physical properties, microorganism, root texture and physicochemical content. The bioengineering properties of the roots were determined from uniaxial tensile strength, direct shear strength and triaxial tests. The respective results, data analysis and comparative study were done by converging on the significance and influence of the roots system as the mechanism of root reinforcement in soil slope stability. The Bermuda and Vetiver grass roots have fibrous root type. Both grass roots have higher pull-out resistance in dry sandy soil. In wet sandy soil, the fibrous root of Bermuda grass easily to fracture. In dry and wet clay soil, the fibrous root of Bermuda grass has higher pull out resistance compared to Vetiver grass. The fibrous root of Vetiver grass not able to survive well in dry clay soil. From root uniaxial tensile strength test results, the single root for both grasses has a higher tensile strength in sandy soil compared to clay soil. While for the group root system, the tensile strength increases as the no of root system increases especially dry primary root. Under the view of the Scanning Electron Microscope test, the root shrinks and enlarge as the day increases due to the process of evapotranspiration occurred thus release moisture from the root micropores. From direct shear tests results, the soil obtained greater cohesion and friction angle with the appearance of the root. Similar to triaxial strength test results, the root appearance increases the shear strength of the soil. The appearance of Plant Growth Promoting Rhizobacteria (PGPR) and Plant Growth Promoting Fungi (PGPF) colonize in root thus enhance the root strength in soil. Based on the physicochemical test results, the nutrient concentration and pH not much affects the growth of both grasses. Factor of Safety (FOS) obtained values above 1 with the presence of root in soil compared to soil only itself. The ultimate pull out bond strength resulting in the effectiveness of interaction between root and soil similar to the grip between steel and concrete. The root system of vegetation plays important roles by enhancing the shear strength of soil thus prevent shallow soil slope failure.

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