

ABSTRAK

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PEMANFAATAN KALSIMUM PADA CANGKANG KERANG UNTUK BIOGROUTING TANAH EKSPANSIF MENGGUNAKAN BAKTERI *Bacillus subtilis*

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(xxi + 194 halaman; 118 gambar; 106 tabel; 4 lampiran)

Tanah ekspansif sangat mudah mengalami kembang susut akibat perubahan kadar air dalam tanah. Salah satu cara meningkatkan stabilitas tanah ekspansif adalah dengan metode *biogrouting* yang ramah lingkungan dengan memanfaatkan mikroorganisme seperti bakteri. Bakteri ditumbuhkan dalam medium kultur B4 dengan sumber ion kalsium non-konvensional yang berasal dari cangkang kerang simping. Bakteri yang digunakan pada penelitian ini adalah bakteri *Bacillus subtilis* yang sudah terbukti pada penelitian terdahulu dapat meningkatkan nilai kohesi tanah. Bakteri akan mempresipitasi kalsium karbonat yang menjadi *binding agents* untuk mengikat butiran tanah. Penelitian ini menggunakan pengujian *direct shear*, *triaxial unconsolidated undrained* (UU), *triaxial consolidated undrained* (CU), dan *unconfined compression test*. Berdasarkan pengujian pada masa pemeliharaan 90 hari, terdapat kenaikan nilai kohesi sebesar 300% untuk pengujian *direct shear*, 288,79% untuk pengujian *triaxial* UU, dan 250,94% untuk *unconfined compression test*. Berdasarkan pengujian *triaxial* CU pada masa pemeliharaan 105 hari, terdapat kenaikan nilai kohesi sebesar 117,39%. Potensi pengembangan bebas tanah juga turun sebesar 44,44% pada masa pemeliharaan 120 hari. Selain itu, dilakukan juga metode *mix* konvensional dengan mencampurkan bubuk cangkang kerang simping dengan konsentrasi 10% dan 15% pada suhu pembakaran bubuk cangkang kerang simping sebesar 100°C, 250°C, dan 500°C. Hasilnya, ditemukan peningkatan nilai kohesi tanah berdasarkan metode pengujian *unconfined compression test* pada pencampuran benda uji tanah dengan bubuk cangkang kerang simping konsentrasi 15% dengan suhu pembakaran 500°C sebesar 98,95%. Potensi pengembangan bebas tanah juga menurun sebesar 22,22%.

Kata Kunci: tanah ekspansif, *free swell index*, *biogrouting*, kerang, pengujian sifat mekanis tanah

Referensi: 30 (1960-2019)

ABSTRACT

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UTILIZATION OF CALCIUM IN SEA SHELLS FOR EXPANSIVE SOIL BIOGROUTING WITH *Bacillus subtilis*

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Expansive soil is very susceptible to swell shrink due to changes in water content. One of the methods to improve the stability of expansive soil is biogrouting, which is environmentally friendly because it uses microorganisms such as bacteria. The bacteria were grown in B4 medium with non-conventional calcium ions derived from sea shells. In this study, *Bacillus subtilis* was used because it has been reported for its ability to improve soil cohesion value in previous research. With the calcium ion in the medium, the bacteria could form calcium carbonate precipitation that becomes binding agents for soil grains. This research used direct shear test, triaxial unconsolidated undrained (UU) test, triaxial consolidated undrained (CU) test, and unconfined compression test. Based on curing period of 90 days, there was an increase in cohesion value of 300% for direct shear test, 288,79% for triaxial UU test, and 250,94% for unconfined compression test. Based on triaxial CU test during the curing period of 105 days, there was an increase in cohesion value of 117,39%. The free swell index also decreased by 44,44% during the curing period of 120 days. In addition, a conventional mix method was also carried out by mixing the seashell powder with a concentration of 10% and 15% at the seashell combustion temperature of 100°C, 250°C, and 500°C. As a result, there was an increase in cohesion value based on the unconfined compression test by mixing soil test specimens with seashell powder with a concentration of 15% at the seashell combustion temperature of 500°C at 98,95%. The free swell index also decreased by 22,22%.

Keywords: expansive soil, free swell index, biogrouting, seashell, soil mechanical properties test

References: 30 (1960 – 2019)