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Effect of $CaCO_3$ microbiological precipitation on dune sand

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Abstract

Microbial induced calcite precipitation (MICP) is a novel ground improvement method to increase strength and reducing the hydraulic conductivity of sand using natural biogeochemical processes. This paper aims to study the effectiveness of MICP in improving the shear strength and hydraulic conductivity of dune sand. A species of *Sprosarcina* group, *S. urea* was used to trigger the calcite precipitation. Sand specimens were treated using of bacterial cell and urea–calcium chloride solutions. Measured strength and stiffness values from unconfined compression tests ranged for treated samples were 527.7 kPa and 69.43 MPa, respectively, while strength and stiffness values of control specimen (untreated sand) in triaxial condition (confining pressure 50 kPa) were measured 255.7 kPa and 25.5 MPa, respectively. Permeability coefficient value of treated sample was reduced 50.5% to treated sample by falling head test.

Key words: MICP, soil improvement, shear strength, hydraulic conductivity, *S. urea*

1. Introduction

Over the last century, various methods of treating soil with a solution/grout have been developed, and today they are used widely in geotechnical projects. All of these methods have benefits and drawbacks, and there continues to be a need to explore new possibilities of soil improvement, particularly as suitable land for development becomes more scarce.

Factors determined critical to the success of the microbial treatment include pH, oxygen supply, metabolic status, and concentrations of microbes, and ionic calcium in the biological and nutrient treatment flushes, as well as the timed sequence of injections [1]. Higher cementation solution concentrations over the range 0.1–1.0 M examined were found to produce more rapid and greater permeability coefficient reductions [2]. This process has been explored for the improvement of the strength and stability of soft and poorly consolidated