Optimum Condition for the Application of Enzyme-Mediated Calcite Precipitation Technique as Soil Improvement Method

The optimum condition of enzyme-mediated calcite precipitation has been evaluated for its possible application as a soil improvement technique. Magnesium chloride (MgCl2) and magnesium sulfate (MgSO4) were substituted to the grouting solution composed of urease, urea, and calcium chloride (CaCl2), and its effects on the precipitation process, amount, and the mineralogical substances of the precipitated materials were investigated. The evolution of the strength of treated sand was also evaluated through unconfined compressive strength (UCS) tests. The substitution of magnesium compounds was found to be able to augment the precipitated amount and reduce the hydrolysis rate of urea. The mineralogical analysis indicated that the addition of magnesium to the grouting solution was a potential method for promoting the formation of aragonite. Furthermore, the formation of gypsum was also promoted when magnesium sulfate was substituted. The mechanical analysis showed that the producing of the high precipitated amount resulted in a significant improvement in the strength of the treated sand. The relation between the UCS of the treated soil and the precipitated mass indicated that the strength could be controlled by the precipitated mass within the soil.