Applicability of Natural Zeolite for NH-Forms Removal in Enzyme-Mediated Calcite Precipitation Technique

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This study evaluated the applicability of natural zeolite for the removal of the NH-forms in the enzyme-mediated calcite precipitation technique. The natural zeolite of mordenite was added to prepared grouting solutions composed of urea and urease and mixed thoroughly using a rotation table for the mixing times of 0.5, 1.0, and 2.0 h. Then, the concentrations of evolving NH-forms in the solutions were measured. The effects of the presence of zeolite on the amount and the mineralogical substance of the precipitated minerals were also evaluated by X-ray powder diffraction and scanning electron microscopy analyses. Sand samples were treated with the grouting solutions containing zeolite, and the improvement in strength was assessed. It was found that utilizing zeolite in grouting solutions can reduce the concentration of NH-forms. A significant reduction in the concentration of NH-forms was obtained. The addition of 10 g natural zeolite/L solution, combined with the 2-h mixing time, resulted in removal efficiencies of 75% and 45% in reagent concentrations of 0.5 and 1.0 mol/L, respectively. Mechanical test results showed that the grouting solutions also brought about a significant improvement in the soil strength. A precipitated material, comprising 9% of the sand mass, was produced by three pore volume (PV) injections of the grouting materials, which showed an unconfined compressive strength of 300 kPa.

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