Microscopy Research and Technique

Understanding the mechanism of interaction of candidate soil stabilizing prototypes by using microscopy and spectroscopy techniques

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Abstract

Globally, there is a high demand for bio-based soil stabilizers required for improving the strength properties of weak in situ soil. Microbes and microbial components such as Bacillus spp. have gained interest as soil stabilizers due to their production of spores, bio-enzymes, and bio-polymers. However, the current approach for any microlevel assessment of bio-additives and in situ soil improvement is limited. This paper provides data for microstructural evaluation of stabilized soil material for the postulation of the mode of action. In this study, the microbonding effect (i.e., bio-based cementation, bio-clogging, and soil particle bio-coating) is successfully observed within the various stabilizing prototypes, obtained from a novel Bacillus spp. using advanced methods, namely field emission gun-scanning electron microscopy and Fourier transform-infrared spectroscopy. The results show that treated soil versus untreated soil properties are altered by the bio-additive/s stabilizing effect. These indicator tests provide data for further bio-stabilizer product prototype development and processes (i.e., improved products in terms of strength and moisture susceptibility). The use of microscopy and spectroscopy was sufficient for the preliminary selection of suitable candidates for soil stabilization.