Bioremediation Potential of NanoGeopolymer Pervious Concrete

Hwang, Vincent

Nanogeopolymer pervious concrete was tested for remediation of fecal coliforms (FC)-containing water. First, mix design of liquid-to-binder (L/B), fly ash-to-binder (FA/B), nanoSiO2-to-binder (NS/B) and NaOH concentration (NH) of fly ash-nanoSiO2-cement nanogeopolymer pastes were optimized for the spread percentage and the compressive strength simultaneously. Optimum mix design was found at 50% L/B, 60% FA/B, 0.04% NS/B and 1.71 M NH with the maximum achievable compressive strength at 22.2 MPa after a 7-day curing at ambient temperature (25±5oC) and the desired spread percentage at 110%. The addition of NS/B reduced the spread percentage of the fresh paste and had the least effect on the compressive strength of the hardened paste. Then, in the bioremediation study, pervious nanogeopolymer concrete made with the optimum nanogeopolymer paste mix was able to reduce FC by 54-100%, depending on the contact time (0.5-8 hrs). A greater FC removal was achieved for the pervious nanogeopolymer concrete containing a greater amount of nanoSiO2. Future studies include nanogeopolymerization with a longer curing period as FA substitution for cement reduces the rate of the strength development and nanoSiO2 could have played an important role in the formation of microstructure of cement and concrete at later curing age.

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