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Enhancing Biocementation Using Hydrogels

Enzyme-induced carbonate precipitation (EICP) is a technique used for soil stabilization. EICP cements soil particles together using urease enzymes to precipitate calcium carbonate in a water-based solution. EICP may be used as a means of improving the bearing capacity of soils, preventing erosion, and mitigating the potential for earthquakeinduced soil liquefaction through mass stabilization. However, in order to work properly, EICP requires an aqueous environment. In arid and semi-arid climates, water evaporation limits the effectiveness and efficiency of the EICP process. Therefore, there is a need for an innovative approach to prevent evaporation and maintain hydration for the EICP soil stabilization process.

Researchers at Arizona State University have invented a process to use water-laden hydrogels to enhance and facilitate enzyme-induced carbonate precipitation (EICP) for soil stabilization. The use of hydrogels creates a viscous water-laden solution that enhances the water retention capacity of the EICP solution, while also reducing its migration. This leads to extended reaction times that increase the efficiency and effectiveness of EICP for soil stabilization. Hydrogelassisted EICP enhances the performance of EICP, particularly in semiarid and arid climates susceptible to rapid desiccation. Hydrogelassisted EICP may also improve mass soil stabilization by limiting the spatial distribution of the EICP solution. Additionally, certain formulations of hydrogel can sequester or remove the undesirable ammonium byproduct of EICP by chemical binding with the hydrogel.

Potential Applications

- Soil Stabilization
- Liquefaction Prevention
- Civil Infrastructure Engineering
- Foundation Grouting
- Erosion & Groundwater Control

Benefits and Advantages

- Increased Range of Application – The use of hydrogels enhances the EICP process for arid and semi-arid climates.
- Increased Efficiency - Extends the reaction time associated with EICP by reducing the evaporation rate of the EICP solution, thereby increasing EICP efficiency.
- Environmentally Friendly - Provides a pathway for ammonium byproduct sequestration and/or removal.
- Versatility – Can be used for foundation support, slope stabilization, road subgrade improvement, tunneling, erosion control, groundwater control, and earthquake hazard mitigation. A non-disruptive alternative to chemical

grouting, micro-fine cement grouting, compaction grouting, and deep soil mixing.

For more information about the inventor(s) and their research, please see

Dr. Ximin He's directory webpage

Dr. Edward Kavazanjian's directory webpage