

Chemical Engineering Thesis Defense

Permeability loss in soil due to ferrous iron precipitation

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Abstract

In this project, the potential of ferrous iron precipitation as an alternative for ground improvement applications is investigated. This study analyzes the potential of naturally occurring iron oxidizers, which uses Fe^{2+} as an electron donor for growth to produce Fe^{3+} precipitate. The goal of this study is to stimulate or accelerate the naturally occurring processes, including ferruginous duricrusts or Ferricretes that strongly mineralize crusts in the subsurface. Iron precipitation can occur through aerobic or anaerobic iron oxidizers. Results showed that the optimum conditions that stimulates ferrous iron precipitation as a ground improvement method are a reliable source of soluble iron, electron acceptor and buffering control. Initial experimental tests run in falcon tubes along with literature review shows the oxidation of ferrous iron and the necessity of Buffer based on the precipitation of iron in the falcon tubes. Experimental studies in which aerobic and anaerobic iron precipitation is stimulated in sand columns under various boundary conditions also leads to an optimization of conditions for mineralization. Mineralized zones are evaluated via permeability loss tests, extent of iron oxidized and characterization tests which show that the crust has the most concentration of precipitated iron, which can be used in targeting pollution mitigation, erosion control, etc. The results show a significant loss of permeability- by a factor of two, in high concentration of iron with a balanced buffer control. In this study, the knowledge on ground stabilization by studying the naturally occurring mechanism of iron precipitation, leading to possible industrially relevant geotechnical applications are successfully investigated.



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Zoom Link: <https://asu.zoom.us/j/89078071989>