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Pore Network Approach to Evaluate the Injection Characteristics of Biopolymer Solution into Soil

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ABSTRACT

Application of biopolymers to improve the mechanical properties of soils has been extensively reported. However, a comprehensive understanding of various engineering applications is necessary to enhance their effectiveness. While numerous experimental studies have investigated the use of biopolymers as injection materials, a detailed understanding of their injection behavior in soil through numerical analyses is not well understood. This study aimed to address this gap by employing pore network modeling techniques to analyze the injection characteristics of biopolymer solutions in soil. A pore network was constructed from computed tomography images of Ottawa 20-30 sand. Fluid flow simulations incorporated power-law parameters and governing equations to account for the viscosity characteristics of biopolymers. Agar gum was selected as the biopolymer for analysis, and its injection characteristics were evaluated in terms of concentration and pore-size distribution. Results indicate that the viscosity properties of biopolymer solutions significantly influence the injection characteristics, particularly concerning concentration and injection pressure. Furthermore, notable trends in injection characteristics were observed based on pore size and distribution. Importantly, in contrast to previous studies, meaningful correlations were established between the viscosity of the injected fluid, injection pressure, and injection distance. Therefore, this study introduces a novel methodology for integrating pore network construction and fluid flow characteristics into biopolymer injections, with potential applications in optimizing field injections such as permeation grouting.

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REFERENCES

Ryou, J. E., Jung, J. (2023), "Characteristics of thermo-gelation biopolymer solution injection into porous media", *Constr. Build. Mater.,* **384**, 131451.