

## Effects of Water Flux and Bubble Characteristics on Nano-Bubbles Transport in Porous Media

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Potential applications of nano-bubbles (NBs) have drawn more attention, especially in environmental engineering fields such as soil/groundwater remediation. Understanding a transport mechanism of NBs in soils is essential to effectively pursue remediation techniques using NBs. In this study, one-dimensional column transport experiments using glass beads were conducted, where NBs water created by either air or oxygen were injected to the column with different water fluxes. The turbidity, pH, EC, DO, and bubble size distribution in the effluent were measured. Effects of water fluxes and bubble characteristics such as (gas species, bubble concentration, and bubble size distribution) on the NBs transport were investigated based on the column experiments. The results showed that relative turbidities (measured turbidity in the effluents / turbidity in the initial NBs water) during the NBs water injection were lower at lower water flux condition. Higher relative turbidities in the effluents were observed for O<sub>2</sub>-NBs at the same water flux condition that those for Air-NBs, suggesting higher mobility of O<sub>2</sub>-NBs in porous media. Column experiment with NBs with lower average bubble size and higher bubble concentration showed more gradual increase of relative turbidity in the effluents with time.

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