

The research on the movement of CO₂ solution in CO₂ microbubble storage.

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It is important to keep CO₂ underground from leaking out of the ground for Carbon dioxide Capture and Storage (CCS). Carbon dioxide Microbubble Storage, that injects CO₂ microbubble water instead of supercritical CO₂, is one of the ways of CCS and it does not require the existence of cap rock, because the higher density of CO₂ dissolved water enables CO₂ to go downward. Existing studies on CMS revealed an efficiency of CO₂ microbubble to make the CO₂ dissolved water CO₂ transport in the underground by numerical analysis. However, there are few researches to examine the movement of CO₂ solution by laboratory experiments, and then, we conducted experiments to know how CO₂ dissolved water moves after injection into a water tank filled with grass beads and BTB solution.

Experimental procedures are as follows. Water tank (height: 30 cm, width: 50cm, thickness: 3cm) made of acrylic boards was used for experiments. The tank was filled with grass beads (1mm in diameter) and BTB solution. Permeability was measured by controlling the difference of hydraulic head between the left and right end of the tank and found to be 1.32×10^{-2} m/s. We observed how CO₂ dissolved water moves after CO₂ microbubble water was injected. As a result, CO₂ solution moved downward as time passed and the shape of CO₂ solution showed fingering.

In the second experiment, we injected CO₂ solution by controlling the horizontal groundwater flow rate. As a result, it was observed that CO₂ moved downward while it moved leftward because of advection. In this experiment, whether fingering was observed or not was dependent on the rate of advection. In CCS, whether the fingering occurs or not possibly depends on the rate of groundwater flow and CO₂ concentration and it has crucial effect on solubility trapping and mineral trapping. However, there have been few researches of numerical analysis that consider the fingering because of computational load. However, the result of our experiment suggests the importance of simulation including possible fingering processes.

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