An experimental investigation of CO_2 leakage pathways in soils

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CO_2 capture and storage (CCS) is one of options for reducing CO_2 emission to the atmosphere. CO_2 geological storage is the most prospective natural storage methodology because huge amount of CO_2 can be stored in appropriate geological formations. Stored CO_2 can be leaked through various pathways and thus leakage monitoring is necessary to assess the CO_2 leakage. The objective of this study is to evaluate visually the CO_2 leakage pathways in soils at various conditions.

An acrylic reactor (25 x 25 x 5 cm) was used to mimic subsurface environment in a small scale. The reactor was filled with glass bead or soils and DI water or salt solutions. CO_2 gas was injected using a plastic pipe at 5 cm above the bottom of the reactor and the CO_2 concentration was measured at top of the reactor using a . An universal pH indicator was used to observe pH changes visually in pore water. The changes in color of the pore water was monitored using cam shots. CO_2 leakage flux was determined using CO_2 concentration measured at the top of the reactor.

Pathways of CO_2 bubbles and dissolved CO_2 when passed through the glass bead or soils were clearly observed. The test conditions such as porosity, water content, and heterogeneity of soils affects the characteristics of CO_2 leakage pathways. Results of this study also imply that the universal pH indicator can be useful for evaluating CO_2 leakage pathways in small scale laboratory experiments.