CO_2-infused groudnwater injection and leakage test using shallow-depth groundwater and gas monitoring network

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Groundwater and gas monitoring networks considering hydrogeological characteristics were constructed to perform an artificial CO_2 injection and leakage test into a shallow aquifer system at EIT site, Eunseong, Korea. The main objective of CO_2 release test is to understand the behavior of CO_2 plume and inert gas tracers (Kr, Ar, He, and SF6) in a shallow aquifer system including saturated zone and unsaturated zone. Samll amout of CO_2-infused groundwater were (about 5,000 L) injected into a shallow aquifer. For the CO2-infused water injection, pre-pumped groundwater was mixed with CO_2 gas (through the gas dissolver) as well as multi-gas tracers (Kr, He, and SF_6). After injection period, about 2,500 L of chaser fluid, Ar-infused water, was immediately injected to push the CO_2 plume out of the injection well. The real-time monitoring for leakage test had been performed during 4 month. Spatial and temporal trends of measured values for soil gas CO_2 and SF_6 at unsaturated zone, hydraulic parameters (pH and EC), TIC (total inorganic carbon), carbon isotope ($\delta^{13}C$) and dissolved CO_2 and inert gas tracers at saturated zone were analyzed. Based on a time-concentration data of gas tracers obtained from preliminary inter-well tracer test, gas solubility was determined as a major factor governing the phase partitioning of tracers. Among partitioning tracers, Kr was firstly reached at around monitoring wells and maintained a detectable concentration which was longer detection time than other gas tracers. In the main test, the effect of injection was faintly represented on tracer concentration, water-level, temperature, EC, and TIC data obtained from monitoring wells adjacent to injection well due to a small amount of injection. The radius of influence by injection test was estimated as about 3 m. It was supposed that injected CO_2 plume did not migrate far away from injection well. Results from monitoring data can be utilized for site assessment and operation of monitoring network at EIT site for next long-term CO_2 injection experiment with increased injection volume.