Artificial injection of CO_2 infused groundwater and evaluation of its partitioning behavior using inert gas tracers

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Relatively small amount of CO_2 infused groundwater (5 m^3 of CO_2 infused groundwater and 2.5 m^3 of chaser fluid) was artificially injected at EIT (Environmental impact test) site in Eumseong, Korea and monitored for 4 months. The measured TIC (total inorganic carbon), alkalinity and pH for CO_2 leakage detection showed minor change after the CO_2 injection where anomalies of parameters were within natural variation except injection well. For a sensitive detection of the CO_2 leakage, 4 types of artificial tracers (SF_6, He, Ar, and Kr) were injected together with CO_2 infused groundwater. Artificial tracers were immediately distinguished from natural background concentration as soon as plume arrives at the detection point due to their low natural concentration. In this study, TIC, alkalinity and pH were evaluated combined with artificial tracers to understand the key process of concentration change during the CO_2 migration. From the obtained time-concentration graph, the phase-partitioning was dominant during plume migration resort to an excessive partial pressure of injected water. The partitioning behaviors of CO_2 and artificial tracers were fingerprinted on breakthrough curves as a retardation of the center of mass. It was consistently observed that the center of He mass showed the fastest arrival but Kr was firstly detected at monitoring point. This study informed that artificial tracer can be applied as a precursor in CO_2 leakage detection and a clue of phase-partitioning mechanism of CO_2.