Potential impact of CO_2 leakage on soil in the unsaturated zone: a pilot scale field experiment at the EIT site, Republic of Korea

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Anthropogenic release of carbon dioxide (CO_2) into the atmosphere strongly links to the global warming. The current studies have considered the techniques of CO_2 Capture and Sequestration (CCS) into the geological storage reservoirs to mitigate the global climate changes. However, little is known of the environmental implications of an accidential CO_2(g) leakage from the storage sites. If CO_2(g) unintentionally leaks upward to soil and groundwater from the storage sites, the leaked CO_2(g) might possibly cause the serious environmental concerns. Especially, soil and groundwater acidification due to CO_2(g) leakage may trigger some types of geochemical reactions increasing the mobility of contaminants such as ion exchange, sorption/desorption, and mineral dissolution/precipitation. The main purpose of this study is to examine the potential impacts of CO_2(g) leakage on soil environments.

The effects of CO_2(g) leakage on the soil environment in an unsaturated zone are currently under investigation through field and laboratory experiments. Pilot-scale field experiments are conducted at the Environmental Impact evaluation Test facility (EIT) site, located in Eumseong, Chungcheongbuk-do, Republic of Korea. The first field experiments were conducted by injecting CO_2(g) through gas-pipes buried at 2.5-m depth for artificial CO_2(g) leaking into the overlying unsaturated soil zone for 5 days from Oct. 26 – 30, 2015. Soil samples were collected from several locations at the EIT site before and after the injection of CO_2(g) to characterize the physico-chemical properties. In addition, laboratory batch experiments are conducted to examine the factors controlling the soil-water-CO_2(g) interactions under well-controlled systems using a specially designed glove box.