Changes in groundwater composition in various geological materials due to CO_2 leakage

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When leakage of CO_2 occurs from a carbon capture and storage (CCS) site, it may result in deteriation of groundwater quality. As storage sites can locate in various geologic media, it is important to understand the interactions between the CO_2-impacted groundwater and geological materials. In this study, column experiments were conducted to evaluate geochemical changes in various geological materials in contact with CO_2-saturated groundwater. The experiments consisted of four columns, which were filled with the sediment collected from the Environmental Impact evaluation Test (EIT) facility in the Korea CO_2 Storage Environmental Management (K-COSEM) test site, clean sand, the mixture of sand and limestone (7:3 vol. %), and the Quaternary alluvium sediment collected from a western coastal area of Korea, respectively. Each column received the artificial groundwater simulating groundwater in the EIT facility after saturaiton with 100% CO_2. Temporal and spatial changes in groundwater composition, including pH, Eh, electrical conductivity (EC), alkalinity, and concentrations of anions and cations, have been monitored on a weekly basis for each column. The early experimental results show the decrease in pH and increases in EC and alkalinity for all columns, as suggested from previous stuides [1, 2]. However, there were also noticeable differences in geochemical composition between the different geologic media, such as high Na concentration in the EIT column and high Ca and alkalinity concentrations in the limestone column, which are due to the differences in mineralogical composition. The results from this study can be useful to monitor the potential CO_2 leakage in various geological settings and thus to manage undesirable impacts from the leakage. This research was supported by the "R&D Project on Environmental Management of Geologic CO_2 Storage" from the KEITI (Project Number: 2018001810002) and by the Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2016R1D1A1A02937479).

[1] Trautz *et al.* (2012) *Environ. Sci. Technol.* **47**, 298-305.
[2] Rillard *et al.* (2014) *Int. J. Greenh. Gas Con.* **21**, 23-32.