Geophysical Research Abstracts
Vol. 19, EGU2017-6148, 2017
EGU General Assembly 2017

Impacts of CO_2 Leakage on a Shallow Aquifer System: Laboratory Column Experiments and Reactive Transport Modeling

Jong Heon Ha and Sung-Wook Jeen
Chonbuk National University, Earth and Environmental Sciences, Korea, Republic Of (sjeen@jbnu.ac.kr)

Groundwater quality change due to the leakage of CO_2 in a shallow aquifer system is an important aspect of environmental impact assessment in a carbon dioxide capture and storage (CCS) site. This study evaluated geochemical changes in a shallow aquifer system resulting from leakage of CO_2 through laboratory column experiments and reactive transport modeling. In the column experiments, two columns were set up and filled with the sediment from the Environmental Impact Test (EIT) facility of the Korea CO_2 Storage Environmental Management (K-COSEM) Research Center. Groundwater, also collected form the EIT site, was purged with CO_2 or Ar gases, and was pumped into the columns with the pumping rates of 200-1000 mL day^{-1} (0.124-0.62 m day^{-1}). Profile and time-series effluent samplings were conducted to evaluate the spatial and temporal geochemical changes in the aquifer materials upon contact with CO_2. The experimental results showed that after injecting CO_2-purged groundwater, the pH was decreased, and alkalinity, electrical conductivity (EC) and concentrations of major cations were increased. The spatial and temporal geochemical changes from the column experiments indicate that dissolution of aquifer materials in contact with dissolved CO_2 is the major contributor to the changes in groundwater geochemistry. The reactive transport modeling has been conducted to reproduce these geochemical changes in the aquifer system by incorporating dissolution of the dominant aluminosilicate minerals in the aquifer such as microcline, anorthite, albite, and biotite. This study suggests that pH, alkalinity, EC and concentrations of major cations are important monitoring parameters for detecting CO_2 leakage in a shallow groundwater aquifer system.