Geological sequestration in saline carbonate formations: CO_2 -brine-rock interaction

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To reduce unequivocal global warming due to continuous emission of greenhouse gas CO_2 into atmosphere, geo-sequestration is one such emerging technology. For geologic sequestration, CO_2 is injected into suitable deep subsurface formations at supercritical temperature and pressure conditions. Saline carbonate formations are one such promising sink due to its wide spread availability and enormous storage potential. In this study, a series of experiments have been performed on carbonate cores for finding out the effect of injected supercritical CO_2 in subsurface formations. The laboratory study reported here investigated the cyclic injection of $scCO_2$ and brine on two types (Edward White and Edward Yellow) of core samples under reservoir conditions. Further, the pre and post flooded carbonate core samples are analysed for mineralogical changes of CO_2-brine-rock interaction using image analysis techniques such as FeSEM and EDX. The cyclic injection provides the differential pressure (DP) profile of the two samples with time, and is found to have increased with successive injection cycles. The FeSEM images showed that there was some dissolution and precipitation of minerals after the CO_2 flooding emphasizing on solubility trapping and EDX provides the quantitative information about mineral compositions. The results are also compared for both porosity and permeability changes which are found to have decreased post $scCO_2$ flooding. The results of this study provide vital information about mineralogical changes and thus will enhance the knowledge of implementing full scale CO_2 sequestration in subsurface carbonate formations.

Keywords: Global warming, geo-sequestration, image analysis, mineralogical changes

