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Sensitivity Analysis of CO2 Mineralization Trapping during CO2 Sequestration

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One of the toxic greenhouse gases that significantly alters the climate is CO2, and it may be possible to lower its emission by sequestering it in an appropriate geological subsurface formation. For a secure and effective sequestration, it is necessary to answer questions relating to enhancing the reaction rates of rock minerals to speed up sequestration, understanding the critical reservoir parameters involved with geochemically induced changes and how they affect mineralization, and the affinity of rock minerals for dissolution or precipitation in the presence of CO2 and reservoir brine. Depleted oil and gas fields and deep saline aquifers are the most practical storage locations, while the latter is preferable because it is widespread and has a great storage capacity. However, inadequate rock mineral assessments, heterogeneities in the underlying characteristics, and insufficient knowledge of CO2 geochemical reactivity with in-situ minerals are some of the major obstacles to its development for CO2 storage. Hence, this study focuses on mineralization trapping mechanism of CO2 by simulating the sequestration of at least 48 million tons of CO2 over a five-year period in a saline aquifer. The effectiveness of CO2 mineralization trapping for the siliciclastic aquifer formation was characterized in relation to the impacts of injection period, pressure, temperature, and salinity. The ability of the aquifer to inject, mineralize, and store significant amounts of injected CO2 for a duration of 1000 years was studied using a numerical simulator. This study also analyzed the geochemical induced changes such as pH and porosity changes that occurred due to mineralization. Our results showed that while increasing the injection period appears to increase the efficiency of CO2 mineralization trapping, this is only the because there is more CO2 available in the formation, as a comparison with the volume of CO2 injected yields a contrary result. Additionally, the findings in this work can provide the appropriate mineralization temperatures at which each of the simulated minerals can either dissolve or precipitate. Calcite and dolomite mineralize more effectively at medium and lower temperatures, despite the fact that reaction of other minerals such as illite, kaolinite, k-feldspar and quartz will be more favored at high temperatures. Porosity and pH showed only slight variations, but they were sufficient to indicate the dynamics of mineral reactivity and mineralization trapping efficiency.

Participation

In-Person

References

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