Contribution ID: **146** Type: **Oral Presentation**

Characteristics of CO2 Dissolution in Fractured Saline Aquifers

Monday, 13 May 2024 17:15 (15 minutes)

Dissolution of CO2 in brine, one of the key mechanisms for securely storing CO2 in the subsurface, involves diffusion of CO2 into the brine and subsequent buoyancy-driven convective migration. The stable stratification along the CO2-brine interface, predominated by diffusion, stimulates the density-driven convection, resulting in an enhanced dissolution rate. In fractured porous media, the complex geometry increases the uncertainty of CO2-plume migration. Predicting the characteristics of CO2 dissolution into the resident brine in fractured saline aquifers is important to understand the potential for long-term storage. In this work, a discrete fracture-matrix model (DFM), where fractures are explicitly characterized in the model with individual grid cells, is adopted to describe the geometry of the fractured saline aquifer. We first carry out a sensitivity study to obtain a reasonable resolution of grid discretization which can capture both the fast convective flow and converged dissolution rate with fractures. Based on the selected resolution, the properties of fractures, e.g., the permeability and aperture of fractures, are investigated to confirm their impacts on density-driven convection within an individual-fracture model. In addition, an aquifer containing a complicated fracture network that includes highly intersected/dead-end fractures is used to highlight the effects of fractures on the interactions between gravity currents and convective dissolution. Our simulation results demonstrate that due to a low porosity/permeability matrix, CO2 dissolution is driven by diffusive/convection transport along the CO2-brine interface, while the density-driven convection is very weak, i.e., relatively long onset time with a small Rayleigh number. The directions of fractures play a critical role in the convective behavior of CO2-enriched brine. The fracture network enhances CO2 dissolution compared to the case of an aquifer containing isolated fractures, i.e., no connections among fractures. These estimates of the dissolution rate with fractures show that the geometry of fractures plays an important role in enhancing storage security.

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

Country

China

Porous Media & Biology Focused Abstracts

References

Conference Proceedings

I am interested in having my paper published in the proceedings.

Primary author: Dr LYU, Xiaocong (China University of Petroleum (Beijing))

Co-authors: Ms XIAO, Junxi (China University of Petroleum (Beijing)); Prof. LIU, Huiqing (China University of Petroleum (Beijing)); Prof. WANG, Jing (China University of Petroleum (Beijing))

Presenter: Dr LYU, Xiaocong (China University of Petroleum (Beijing))

Session Classification: MS03

Track Classification: (MS03) Flow, transport and mechanics in fractured porous media