Contribution ID: **393** Type: **Poster Presentation**

Experimental investigation of hydrogen and cushion gas mixing during underground hydrogen storage in porous reservoirs

Monday, 19 May 2025 15:05 (1h 30m)

Hydrogen has gained interest in recent years as a clean energy source and form of energy storage to support renewables. Porous underground reservoirs (e.g., saline aquifers and depleted gas reservoirs) could accommodate the high volumes of safe, long-term storage that will be needed to support hydrogen economies but remain unproven for underground hydrogen storage (UHS). In particular, cushion gas must be present in such reservoirs to assure brine displacement and pressure maintenance during the hydrogen withdrawal stage. However, the mixing between hydrogen and the cushion gas in the porous media decreases the purity of the gas withdrawn. Understanding how this mixing occurs in porous media and which parameters can help control it is critical to assessing the viability of UHS in various porous geologic reservoirs. In this work, a miscible core flooding experiment of hydrogen displacing supercritical carbon dioxide (as cushion gas) is conducted to estimate the dispersion coefficient from the fitting of the convection-dispersion equation with the experimental breakthrough curve A Gray Berea sandstone core (2 in. diameter by 6 in . length) is initially saturated with supercritical carbon dioxide (CO_2) at 40℃ and 1500 psi of pore pressure, which is displaced by hydrogen gas at a fixed flow rate supplied by a syringe pump. The hydrogen concentration in the binary mixture gas is measured by a portable gas analyzer and is corroborated by the results of gas samples analyzed in a Gas Chromatographer Mass Spectrometer. This cycle of experiments is repeated for a range of flow rates that varies from 0.1 ml/min to 10 ml/min. The dispersion coefficients are calculated for each flow rate. Resultant data provides needed inputs for UHS field simulations as it represents relevant reservoir conditions and the complexity of supercritical CO_2 as cushion gas. Understanding mixing and displacement phenomena in porous media is necessary to evaluate feasibility and optimize operations of UHS in porous reservoirs of interest.

Country

United States

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

I would like to submit this presentation into the student poster award.

Water & Porous Media Focused Abstracts

References

Primary author: GOMEZ MENDEZ, Ianna (Pennsylvania State University)

Co-authors: MENEFEE, Anne H. (Pennsylvania State University); KARPYN, Zuleima (Pennsylvania State University)

Presenter: GOMEZ MENDEZ, Ianna (Pennsylvania State University)

Session Classification: Poster

Track Classification: (MS08) Mixing, dispersion and reaction processes across scales in heterogeneous and fractured media