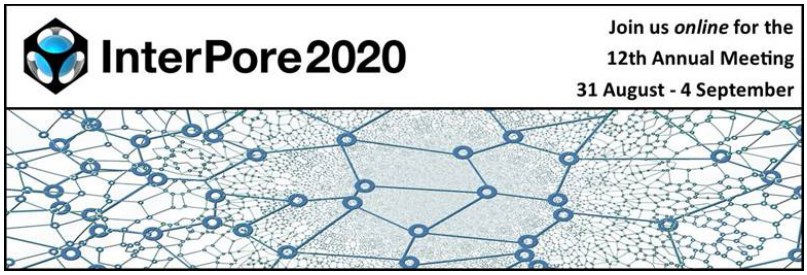

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Flue Gas Hydrate Storage, Self-Preservation and Dissociation in Unconsolidated Porous Medium in the Presence of Environment-Friendly Promoters

Gas storage, such as carbon storage in the geological setting, is seen as a useful technique to mitigate the impact of climate change. When Flue gas containing different CO2 mole % is injected into sediments, at a specific pressure and temperature range, CO2 hydrate can be formed as a by-product, which could act as a seal against the possible leaking of CO2 over an extended period. CO2 hydrate formation can be accelerated in the presence of certain chemicals known as hydrate promoters. Effect of these promoters on hydrate self-preservation tendency and dissociation behavior is also important to quantify the effect of promoters.
This study investigates the kinetics of flue gas hydrate in unconsolidated sediments with different particle sizes and quantifies the kinetics of formation, dissociation, and self-preservation using the rocking cell apparatus. Hydrate promoter selected in this study includes three amino acids L-valine, L-methionine, L-histidine amino acids are seen as a potential replacement for toxic surfactants such as sodium dodecyl sulfate (SDS) for gas capture and storage including CH4 and CO2 capture & storage application due to their environment-friendly nature.
Results demonstrate that the presence of hydrophobic amino acids (L valine, L methionine) enhances flue gas hydrate formation and self-preservation effect in different unconsolidated sediments, while hydrophilic amino acids (L-histidine) act as an inhibitor. The difference in behavior is attributed to water perturbation caused by the charge present on the side chain. Smaller particle size enhanced the gas uptake while large particle size lowers the induction time. The presence of porous medium introduces the stochastic nature opposite to bulk water case in the presence of hydrate promoters. Obtained results are expected to provide an enhanced understanding of industrial-scale flue gas capture/storage via hydrate formation in geological formation in the presence of hydrate promoter.

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