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Pandey, Jyoti Shanker; Daas, Yousef Jouljamal; von Solms, Nicolas

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CO_2 Storage in Sediments by Hydrate Formation and Self-Preservation in the Presence of Environment-Friendly Promoters

Jyoti Shanker Pandey, Yousef Jouljamal Daas, and Nicolas von Solms,*

Center for Energy Resource Engineering (CERE), Department of Chemical Engineering, Technical University of Denmark, Lyngby 2800, Denmark

Correspondence: nvs@kt.dtu.dk; Tel.: +45-45252867

Carbon storage in the geological setting is seen as a useful technique to mitigate the impact of climate change. When CO_2 is injected into sediments, at a specific pressure and temperature range, CO_2 hydrate can be formed as a by-product, which could act as a seal against the possible leaking of CO_2 over an extended period. CO_2 hydrate formation can be accelerated in the presence of certain chemicals known as hydrate promoters. Effect of these promoters on hydrate self-preservation tendency is also important to study for storage in the permafrost region.

This study investigate the formation behavior of CO_2 hydrate in sediments with different particle sizes and quantifies the kinetics of hydrate formation, and self-preservation using the high-pressure cell. Hydrate promoter selected in this study includes surfactant sodium dodecyl sulfate (SDS) and amino acids, L-valine, L-methionine, L-histidine. Amino acids are seen as a potential replacement for toxic surfactant such as SDS for CO_2 capture & storage application due to their environment-friendly nature.

Results demonstrate that presence of promoters enhance CO_2 hydrate formation kinetics and self-preservation effect in different sediments. Amino Acids with higher hydropathy Index are better hydrate promoters for CO2 capture. Obtained results are expected to provide an enhanced understanding of industrial-scale CO_2 capture and storage in geological formation in the presence of hydrate promoter.