CO2 Storage in Sediments by Hydrate Formation and Self-Preservation in the Presence of Environment-Friendly Promoters

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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.