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Carbon Neutral CH_4 production during CO_2 Storage in Permafrost and Marine Environment

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Abstract Text:
CO_2-rich gas injection into natural gas hydrate reservoirs is proposed as a carbon-neutral, novel technique to store CO_2 while simultaneously producing CH_4 gas from methane hydrate deposits without disturbing geological settings. Geological sequestration of CO_2-rich gas in natural gas hydrate reservoirs for CO_2 capture and storage technique has a lower technical and cost barrier compared to other industrial alternate. This novel technique has ability to contribute to global warming mitigation strategies, including carbon capture, utilization, and storage (CCUS) and methane release prevention into the atmosphere hydrate melting caused by global warming. CO_2 storage and simultaneous CH_4 production is known as hydrate swapping. In this study, we have studied hydrate swapping in sands in the presence of low dosage chemicals including alcohols, surfactant and amino acids.

Through this study, we have demonstrated the novel application of anti-agglomerate and hydrate inhibitor additives when used in low concentration to enhance CH_4-CO_2 hydrate exchange. This research opens the possibility of CO_2 storage in methane hydrate without disturbing the geological formation using the CH_4-CO_2 hydrate exchange processes in the presence of anti-agglomeration additives. Presence of these chemicals in water would delay hydrate formation at the gas-liquid interface during CO_2 injection into methane hydrate and would create dispersed hydrate morphology. Delay in hydrate film formation and its dispersed nature would allow additional CO_2 gas molecule availability for CH_4-CO_2 swapping, thus improving both CH_4 recovery and CO_2 storage.

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