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In-situ and ex-situ dissolution for carbon dioxide sequestration

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It is widely excepted [1] that CCS (Carbon Capture and Storage) could play a major role in mitigating climate change associated with CO2 emissions. Variety of industrial scale of CCS projects provide strong empirical support for the view that CO2 storage can be implemented safely. Nevertheless, many uncertainties remain regarding the security of underground storage. The major technical concern is the risks of leakage from the storage formation. Therefore, a critical issue for geological sequestration is to ensure that the stored CO2 does not escape from the underground formations. In conventional approach, after injection CO2 will slowly (scale of thousand years, [2]) dissolve in aquifer brine. During this time there is free CO2 available to leak.
To eliminate or reduce the risks of leakage we proposed new methods to dissolve CO2: in-situ dissolution [3] and ex-situ dissolution aiming CO2 to be dissolved before it is injected underground [4]. In ex-situ approach brine produced from target aquifer is mixed with previously captured and liquefied carbon dioxide. After that carbon dioxide-brine mixture enters a pipe where the process of dissolution of carbon dioxide in brine occurs. After the dissolution process is completed in the pipe, CO2 saturated brine is injected back to the aquifer.
During the dissolution process along the pipeline variety of dissolution regimes occur depending on CO2 droplet size and in our previous studies [4, 5] models for different regimes were developed.
In the study presented here an overview of both methods is presented. Development of methods and tools to mitigate the risks of leakage provide great benefits for widespread of CO2 storage technologies, facilitating regulatory and policy decisions.

References

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