Master's Thesis Engineering Technology 2021-2022

Desorption of CO_2 from concentrated mono-ethanolamine solutions

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Introduction

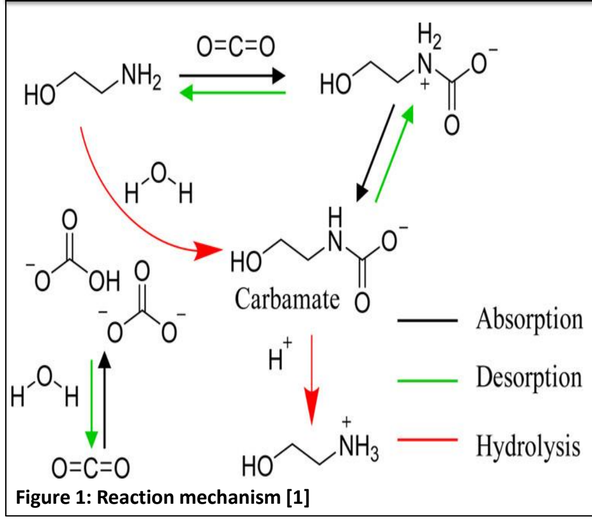

Figure 1: Reaction mechanism [1]

To counteract the greenhouse effect, amines can be used to capture CO_2. Mono- ethanolamine (MEA) reacts with CO_2 to form carbamate. The overall process consists of an absorption and desorption section.

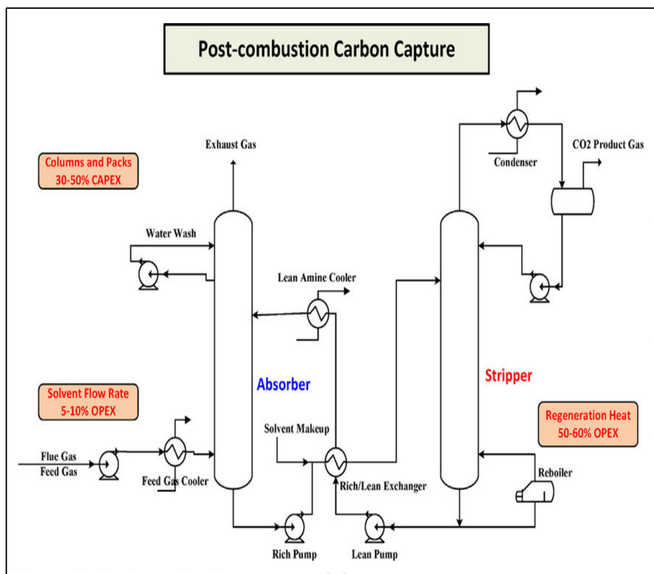

Figure 2: Post-combustion process [2]

In the **absorption** process, a molecule of CO_2 is absorbed into the structure of the MEA. During the **desorption** process, the carbamate undergoes thermolysis. The solvent is heated and releases CO_2.

Results and discussion

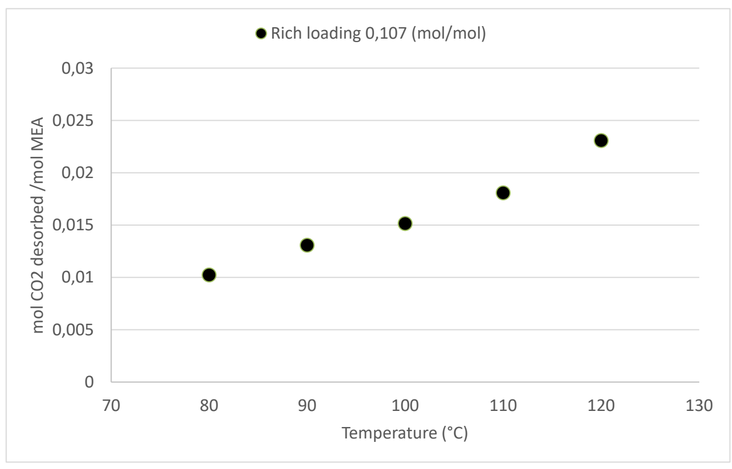

Figure 4: Effect of temperature on pure MEA

The higher the temperature, the more CO_2 is released from the MEA solution and the lower the lean load which remains in the solvent.

Materials and methods

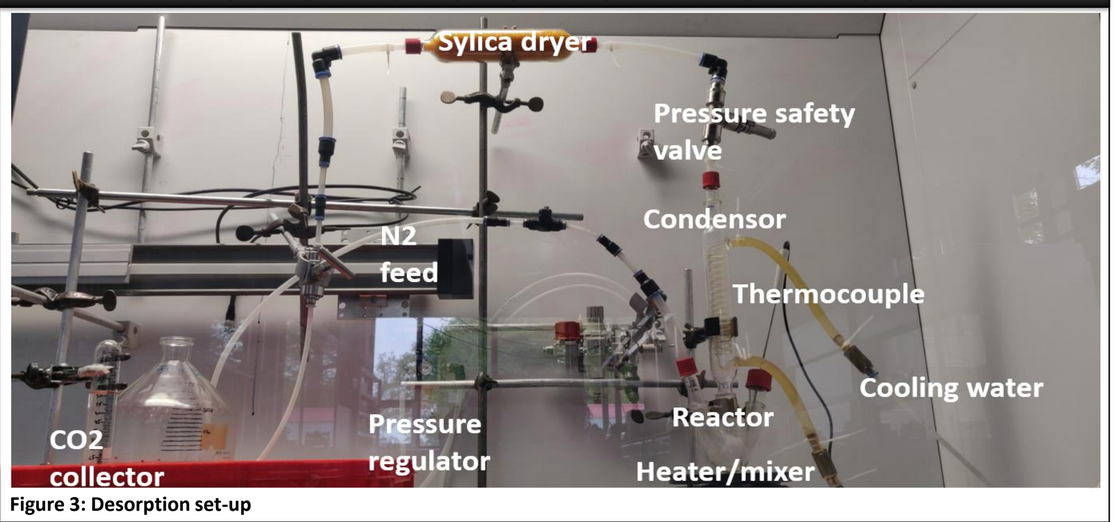

Figure 3: Desorption set-up

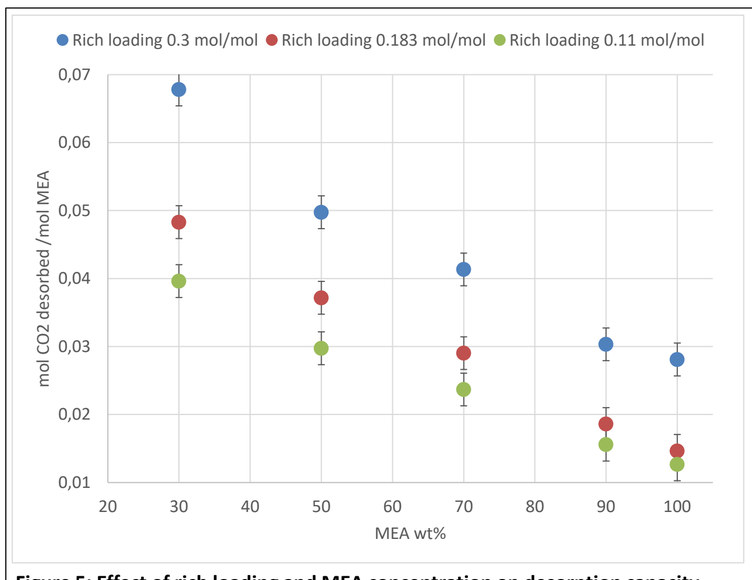

Figure 5: Effect of rich loading and MEA concentration on desorption capacity

With a higher water content and rich loading, more CO_2 is released because there are more carbamates and H^+ ions present that enchant thermolysis.

Conclusion

The use of high concentrations of MEA is disadvantaged by the fact that there are fewer H^+ ions in the solution. This limits the desorption of CO_2 and a solution of 30wt.% appears to be the most efficient.

References

[1] B. Lv, B. Guo, Z. Zhou, and G. Jing, "Mechanisms of CO 2 Capture into Monoethanolamine Solution with Different CO 2 Loading during the Absorption/Desorption Processes," Environmental Science & Technology, vol. 49, no. 17, pp. 10728–10735, Sep. 2015, doi: 10.1021/acs.est.5b02356.

[2]Z. (Henry) Liang *et al.*, "Recent progress and new developments in post-combustion carbon-capture technology with amine based solvents," *International Journal of Greenhouse Gas Control*, vol. 40, pp. 26–54, Sep. 2015, doi: 10.1016/j.ijggc.2015.06.017.

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