Reactive absorption of CO₂ in MEA: A scale-up study

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CO₂ removal by reactive absorption
- Post combustion CO₂ capture is one of the most important methods to combat global warming
- CO₂ removal by reactive absorption using amines is a very attractive option to achieve post combustion CO₂ capture
- CO₂ absorption by aqueous Mono Ethanol Amine (MEA) is one of the most widely studied reaction systems
- Most of these studies concentrate on reaction kinetics, laboratory scale absorption and finding alternative solvents for reactive absorption
- Hence, a scale-up study of absorption-desorption system using CO₂-MEA-H₂O is undertaken
- A rate-based model using Aspen Custom Modeler® (ACM) was modified for CO₂-MEA-H₂O system
- The model is currently being validated using the experimental results provided by TU Kaiserslautern

Reaction system
- Kinetically controlled reactions
  \[ \text{CO}_2 + \text{MEA} + \text{H}_2\text{O} \rightleftharpoons \text{MEA} \text{COO}^- + \text{H}_3\text{O}^+ \]
  \[ \text{CO}_2 + \text{OH}^- \rightleftharpoons \text{HCO}_3^- \]
- Equilibrium reactions
  \[ \text{HCO}_3^- + \text{H}_2\text{O} \rightleftharpoons \text{H}^+ + \text{CO}_3^{2-} \]
  \[ \text{MEA} \text{COO}^- + \text{H}_2\text{O} \rightleftharpoons \text{MEA} + \text{HCO}_3^- \]
  \[ 2\text{H}_2\text{O} \rightleftharpoons \text{OH}^- + \text{H}_3\text{O}^+ \]
  \[ \text{MEA} + \text{H}_2\text{O} \rightleftharpoons \text{MEA}^+ + \text{H}_2\text{O} \]

Results and Future Work

Results
- A good agreement was seen between the predicted values by the model and experimental results.

Future work
- Validation of the model for desorber
- Experiments on laboratory and pilot plant scale absorption-desorption system
- Scale-up studies using results from experiments and the model

Further important parameters
- Column diameter: 0.125 m
- Total packing height: 4.2 m
- Packing: Sulzer Mellapak 250Y
- Mass transfer correlations: Billet and Schultes (1999)
- Gas capacity factor: Experiment 1: 1.64 [Pa¹/²], Experiment 2: 2.15 [Pa¹/²]