Optimal design of a CO$_2$ absorption unit and assessment of solvent degradation

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1. Introduction

Post-combustion capture
2. Objectives

Objectives:

• Simulation and optimal conception of the CO$_2$ capture process

• Comparative degradation study for amine solvents

=> Final objective is to propose optimal operating conditions for CO$_2$ capture
3. Model description

Simulation tool: Aspen Plus
### 3. Model description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Best-case value</th>
<th>Reduction of the thermal energy consumption</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEA inlet flow</td>
<td>11,725 m³/h</td>
<td>- 3%</td>
<td>not experimentally confirmed yet</td>
</tr>
<tr>
<td>MEA inlet concentration</td>
<td>40 wt-%</td>
<td>- 12.5%</td>
<td>Corrosive behavior</td>
</tr>
<tr>
<td>MEA inlet temperature</td>
<td>30 °C</td>
<td>-2.5%</td>
<td>Increase of the cooling water requirement</td>
</tr>
<tr>
<td>Stripper pressure</td>
<td>2.2 bar</td>
<td>- 16%</td>
<td>Possibility of solvent degradation</td>
</tr>
<tr>
<td>Temp. approach at the L-R heat exchanger</td>
<td>5 °K</td>
<td>- 5%</td>
<td>Increase of the equipment costs</td>
</tr>
</tbody>
</table>
3. Model description

Process modifications:
- Lean vapor compression
- Absorber intercooling
- ...

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4. Solvent degradation

Degradation study:

- Study of classical solvents
- Study of newly developed solvents and of degradation inhibitors
- Liquid and gaz phases analysis
- Optimal conditions in order to avoid degradation
4. Solvent degradation

Degradation test rig
5. Conclusion

- Advanced technical challenge
- Fast-developing technology
- Research objective: multi-parameter optimisation
Thank you for your attention!