Master thesis proposal

Master’s Thesis project proposal:

Life cycle assessment of phase-change solvents for post combustion CO₂ capture

Background

With the CO₂ concentration hitting the 400ppm record and continuing to grow, the battle against global warming seems to be lost. The need for climate change mitigation technologies has never been so urgent. According to IPPC Carbon Capture and Storage (CSS) is one of the essential technologies to mitigate climate change. However, among all the abatement techniques CO₂ capture might be the most debatable one. The necessity of its usage seems to be inevitable while the high cost creates a significant barrier to acceptance and industrial application.

Post-combustion capture of CO₂ by chemical absorption is the most mature of CO₂ capture technologies. The main obstacle for optimization of the technology is the high energy demand for solvent regeneration. Careful selection of solvents can significantly improve the performance of the system in terms of energy requirement and cost. A new class, the phase-change solvents, seem to be a promising alternative to conventional solvents because they can be partly recovered before the thermal regeneration stripping process, which is the main driver of the cost. Processes utilizing phase-changed solvents were reported to be able to operate with energy demands as low as 2.1 GJ/ton of CO₂ [1].

While a significant amount of research focuses on physical and operational properties of phase-change solvents, there is very little work done on sustainability aspects of the new chemicals. Due to the novelty of the molecules there is no information on the impact of the manufacturing stage of the molecules. Potentially high losses of the solvents during the CO₂ capture process lead to constant input of the new solvent to the system, what might result in significant environmental impact. Therefore, life cycle assessment of phase-change solvent production is required to determine if the molecules’ manufacturing poses a threat to environment and human health.

Task description

- Extensive literature screening to model the process of the solvent manufacturing
- Modelling the solvent manufacturing process
- Cradle-to gate life cycle assessment of the solvent
**Group size and schedule**

The Master’s Thesis should preferably be carried out in a group of two students working together, however, if there is an interest in doing it alone it also possible. The suggested start is at the beginning of the spring semester in January of 2019 with a timeframe of 20 calendar weeks. However, if you are interested in starting your master thesis work earlier any time during the autumn semester it is also possible.

**Prerequisites**

The applicants should have a background in chemistry or chemical engineering and be able to perform life cycle assessment.

It is also a prerequisite to have taken the course “Industrial Energy Systems”, and preferably the course “Preliminary plant design”, or have similar experience from other universities. The student should be familiar with process simulators such as Aspen Plus etc.

**Contact information to supervisor**

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