

Chemical Engineering 4M3, Fall 2013

Separation Processes: Course Project

1 Objective

The course project is an opportunity to show your insight into the daily operation of a separation unit.

There are 4 project topics to choose from, and you may complete the project on your own, or with one other person in the class. You can pick any topic below that you prefer - there is no need to email your decision to me.

The topics are chosen because they are of current interest not only to chemical engineers (and the companies that employ them), but because they are topics that appear in the general media and scientific media.

1. Treatment of wastewater from fracking operations, focussing particularly on removing the dissolved solids content.
2. Removal of carbon dioxide from a gas phase stream of mixed hydrocarbons (e.g. natural gas).
3. Removing non-valuable particulate solids, from about $0.1 \mu\text{m}$ to about $10 \mu\text{m}$ (i.e. dust), from a gas-phase stream.

You may choose to alternatively attempt the *Challenge Project*: design and operation of a device or method to create drinking-quality water in a region of hardship:

- water source is not easily accessible, and what water is available is contaminated
- electricity is not readily available (it doesn't mean it is non-existent, just that you cannot plug a device into an outlet)
- consumers of the water would have little/low money to pay for your water
- the device/method must not require technical sophistication to operate

2 Final project report

The project report will be a professional 10 page business report, written in Google Docs. These 10 pages include **all** content, including table of contents, references and any optional appendices (I strongly recommend against the use of an appendix; the report should contain the details inline where they can be read and studied by the reader). Do not use a cover page, just ensure your name(s) and student number(s) appear somewhere on the first page.

Paper documents will not be accepted. If you choose to use Microsoft Word or some other software for your report, please save it as a PDF, and share your PDF in Google Drive. We will grade the project electronically.

The report must include the following components:

1. An executive summary (150 words) to your manager.
2. An-in depth description of the unit that can meet the objectives of the separation required (~2 pages). Describe the principle of separation and how the unit is operated on a day-to-day basis. Describe what the mass and/or energy separating agents are.
3. A literature review of an alternate unit operation to the one you selected (1 page). Describe how the alternative works, whether it is regularly used by your competitors, and what the advantages and disadvantages of this unit operation are (especially when compared to the unit you have selected). [Not required for the challenge project; focus instead on the prior point]
4. The main part of the report will describe the equations that are used to model the separation unit. Do not just write out pages of equations, but focus on the meaning and actual use of the equations. You must assume the level of reader would be another engineering colleague in your company, not necessarily a chemical engineer though.

You will find it better to consult the “everyday” chemical engineering literature (monthly trade media) instead of journal articles and textbooks.

- The equations must emphasize how the **performance** of the unit is typically measured in industry.
 - Then show how we can predict the performance of the separator when operating at 50% of regular throughput, and at 150% throughput.
 - How would the mass/energy separating agent usage change under low or high throughput.
5. A conclusion and list of supporting references must be provided (no more than a page in total). Internet links as references, especially as authoritative references, are discouraged, unless there is absolutely no other alternative supporting reference.

3 Due dates

- Written project report due by 12 November 2013.
- The work must be done by yourself, or in a group of 2 (you and one other person).