

CHEG 3128 – Chemical Engineering Junior Laboratory
Spring 2017 – CSTR I Assignment

At the end of the laboratory period, each team will have a plot of the pH of the CSTR outlet as a function of time. However, what is needed in order to move forward to the second part of the experiment is:

1. A quantitative deconstruction of the experimental data. This has two parts. First, the raw pH data must be transformed to yield the concentration of acetic acid in the CSTR with time. Second, the team needs to compare the experimental data to theory and try to understand how hydrodynamics have influenced their result.
2. Analyze the existing impeller and describe qualitatively the flow pattern and why it leads to vortexing and non-instantaneous, non-homogeneous. Next, read the literature and design a new impeller using Solidworks® that overcomes these limitations. Your proposed impeller will be 3-D printed prior to the second part of this lab (CSTR II) and tested as a critical component to the CSTR II lab.
3. Investigate the influence of baffles on CSTR mixing, with a particular focus on cylindrical reactors. Design and construct a set of baffles that can be implemented into the CSTR without any permanent changes to the reactor. These will be a critical component to investigate the CSTR behavior during the CSTR II laboratory period.

Your treatment of the experimental data as well as the literature reading and design will need to be formalized as a written lab report. The due date for this report is 14 days after your team runs the CSTR I lab. The report will be scored out of 100 points. The report format is detailed below.

- a. The report must be printed on 8.5"x11" paper with 1 inch margins. The font size must be no smaller than 11 point font and no less than single spacing
- b. The report should be NO LONGER than 6 pages, including figures. For each page over the limit, your team will be penalized 10 points. Be clear and concise.
- c. These are the sections that must be included and their content (and suggested page length)
 - a. Cover page – Laboratory Title, names of team members, date lab was completed, data lab report is submitted.
 - b. Objective Statement – Why are we doing this lab? (1/4 page)
 - c. Theory – This should include the derivation of the ideal CSTR equation, a discussion on factors influencing mixing and deviations from “perfect” mixing. (1 page)
 - d. Experimental Procedure – In paragraph form, what did we do in the lab? (0.5 page)
 - e. Raw Data – show the plot(s) – both pH vs. t and [Acetic Acid] vs. t. Remember to include figure captions (0.5 page)
 - f. Analysis – Include derivation equations used to transform the pH into [Acetic Acid]. Use the experimental to discuss what was learned regarding the type of mixing in the reactor and what can be done to improve the quality of mixing (1.25 pages)

- g. Impeller Design – What was “wrong” with the impeller in class? What was considered when designing the new impeller? Show the new impeller in Solidworks and an image of the new impeller. Why will this one work where the other failed? (1.25 pages)
 - h. Baffles – Discuss when/why baffles are employed in existing reactors. Discuss the design considerations for your teams baffle design, including size/shape/etc. (1.25 pages)
 - i. References (Does not count against page limit).
- d. Your team must have at least 10 literature references that are used throughout the document. Acceptable references are textbooks and peer-reviewed articles. The references section does not count towards the 6 page limit.