Labratory sessions

CHEN3010/ CHEN5040 - Chemical Reaction Engineering - S1 2024

1 Preamble

These experiments give students an opportunity to have a hands-on experience in applying theoretical concepts and developing scientific skills. Commencing in week 4, students will work in small groups conducting experiments on one piece of equipment, then rotate to another experiement on subsequent weeks.

We will use 4 different experimental setups to carry out the experiments. These four pieces of equipment are:

- Batch reactor (Armfield Transparent Batch Reactor CEB-MKIII). See pre lab module: Batch Reactor for more information.
- Catalytic reactor (Armfield Catalytic Reactor (CEU)). See pre lab module: Catalytic Reactor for more information.
- Tubular reactor (Armfield Tubular Reactor CET-MKII). See pre lab module: Tubular Reactor for more information.
- Continous stirred reactor (Armfield Continuous Stirred Tank Reactor CEM-MKII). See pre lab module: CSTR for more information.

2 Pre-lab modules

Pre-laboratory modules have been specifically developed for the four experimental setups to ensure you understand:

- the purpose of the experiment
- the underpinning theoretical concepts
- the equipment setup
- how to carry out the procedure

We invite you to provide feedback on the pre-lab modules to help inform the development for the remaining experiments.

Explore the below virtual tours and complete the quiz questions.

- Batch Reactor
- Catalytic Reactor

- Tubular Reactor
- CSTR

3 Things to do before labs begin

- Check lab schedule: Lab schedule: 2024 S1
- Familiarize yourself with lab instructions on the experiments you are performing.
- Go through lab safety presentation available on blackboard.
- Take a virtual tour of lab equipment.
- **Important**: Complete the following documents You won't be able to perform the experiments if you haven't completed these. You will need to upload the documents to blackboard. Document templates and MSDS are made available on blackboard.
  - Health and Safety Risk Assessment: The lab demonstrator will deny access to the lab if this document is not completed before the lab starts.
- **Important**: Make sure that you have appropriate clothing and PPE for the labs. You won't be allowed to enter the laboratory if you do not have compliant attire.

4 Performing experiments and marking

Each experiment has three steps for completion

1. Pre-experiment memo: (10 marks)

   This is Individual activity

   - Each person in the group should independently complete health and safety risk assessment (only once, before start of first experiment).
   - Watch and complete pre-lab modules (if available).
   - Prepare a half- to one- page memo about the aims and experimental set up for the experiment you will be performing. Also include details of when you completed the pre-lab activity. Bring your memo to the lab on the experimental day and give it to the lab demonstrator.

2. Conducting the experiment: (30 marks)

   The experiments will be conducted in a group of 3. You need to participate fully in the experimental activity. You will be assessed by your demonstrator on your conduct in the laboratory during experimental session.

3. Final report: (60 marks)

   Each group will submit a single report through blackboard. The format of report is prescribed in Section 4.1.

- Maximum length of your report should be 12 A4 pages (excluding coversheet and references).
- The submission will be through blackboard. Your group typically will have two weeks to submit the report. Exact submission dates are available on blackboard.

4.1 Report format

- **Cover page**:

  The cover page should contain following information

  - Group name: (e.g. 1-1)
  - Title: (e.g. Experiment 2: Reaction rate constant using a tubular reactor)
  - Lab demonstrator: Name
  - Experiment date: dd/mm/yyyy
  - Report submission date: dd/mm/yyyy
  - Group member:
    - `Name 1, Student ID number`
    - `Name 2, Student ID number`
    - `Name 3, Student ID number`

- **Contents**:

  1. Introduction (Section 1-4: 20 marks)
  2. Objectives
  3. Experimental setup
  4. Experimental procedure
  5. Data analysis – calculation (20 marks)

     This may also involve answering some theory questions posed in tasks section of the experiment description.
  6. Results and critical analysis (Section 7-9: 20 marks)
  7. Conclusions
  8. References
  9. Appendix

- **Critical analysis**:

  While discussing the results, provide a critical analysis of the experiments. Some guiding questions include:

  - What was the purpose of the experiment?

- What were the major findings?

- Did the model adequately represent the data obtained?

- What explanation can you think of for the findings?
- How could this experiment be improved or extended?

- How do you ensure the accuracy of the measurements, and analysis?