MATERIALS AND REACTIONS LABORATORY

LAB 1 – REACTION KINETICS MATH TA INSTRUCTIONS

Ch En 345

Lab Learning Objectives

Understand the Chemical Reaction Engineering (CRE) design equations and how they come from material balances and rate laws.

Students will perform a series of labs using the reaction between the red dye (Allura Red AC) and Sodium Hypochlorite. The reaction is of the following form:

$$C_{18}H_{14}N_2Na_2O_8S_2 \text{ (Red Dye)} + ClO^- \text{ (Hypochlorite Ion)} \rightarrow \text{Colorless Products}$$

In this series of six labs, students will determine the order of each reactant and the rate constant, k, in the rate law. Then they will use that information to design a CSTR and a PFR and compare theoretical and actual results.

This lab in the series will take some more time than the others following it because it lays the foundation for the labs to come. These reaction kinetics labs are cumulative and are meant to build on each other throughout the series so, they'll want to keep copies of the data they collect from each lab to use in the later labs.

Overview

- Students should spend about 1 hour in the lab. Part of this will be doing experiments, but make sure they are answering the analysis questions during waiting periods.
- You will need to ensure that bottles of stock concentrations of Red Dye and NaClO are ready for use.
    - Make sure to review the SDS/MSDS sheets for these compounds before using.
    - The chemicals will stain skin and clothing, NaClO is corrosive, so you will want to wear gloves and a lab coat when mixing these chemicals.
- Before operating the equipment alone, read the operation manual and pass it off with either Dr. Wheeler, Will Davis, or Mike Beliveau. The operation manual can be found here: http://fundamentals.groups.et.byu.net/che345/reactor-cart/

General Instructions

1. Do the following to prepare for students.
    a. Learn how to run the equipment and pass off your understanding with either Dr. Wheeler, Will Davis, or Mike Beliveau.
    b. Perform the experiments that the students will do.
2. You will setup the apparatus before each lab hour following the instructions below.

3. After students are finished with the lab, you will shut down the apparatus following the procedures below.
4. You can grade assignments when in the lab and not answering student questions; however, you should be closely monitoring the students.
    a. Keep them on task.
    b. Ask questions to deepen understanding.

Apparatus

Figure 1 is a picture of the apparatus. Notice the following.

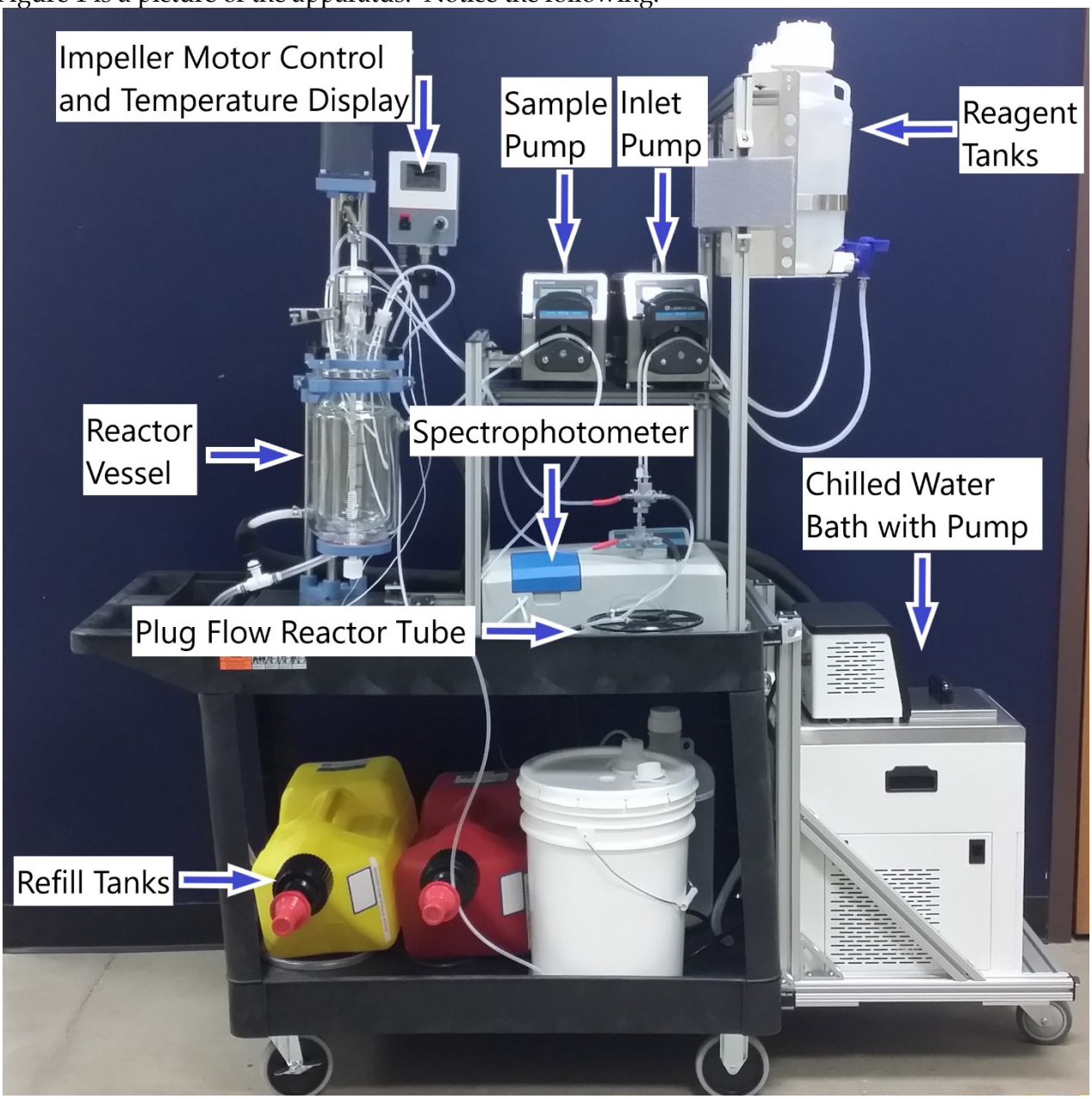

Figure 1 Picture of experimental apparatus.

Set Up of the Starting Configuration

Do the following, **before students arrive**, if not already done.

1. Mix up any stock chemicals that will be needed during the lab according to the Stock Solution Preparation Instructions to the following concentrations:
    a. 2.0×10^{-1} M Sodium Hypochlorite
    b. 5.0×10^{-3} M Allura Red AC
2. Turn on the Spectrophotometer to allow it time to warm up. Make sure each cart has a full set of equipment for the current experiment:
    a. 6 x test tubes in tube rack
    b. 1 x 10 ml graduated cylinder
    c. 1 x 250 ml graduated cylinder
    d. 2 x Cuvettes with caps
    e. 3 x transfer pipettes
    f. Spectrophotometer

The lab is now ready for students.

Lab Operation Procedures

1. Students will be answering several questions in preparation for performing experiments. You will check off their answers to these questions before they begin the experiment.
2. Students will use spectrophotometer and dilute solutions in the cuvettes.

The students can now proceed with the experiments.

Shutdown Procedures

1. Once the students are finished with the spectrophotometer make sure it is turned off to prolong the life of the bulb.
2. Make sure students have put away all chemicals and rinsed the equipment used with RO water and dried.

TAs will not have to prepare the apparatus for moving or long-term storage. This will be done by the lab manager or assistant lab manager.