ECHE 362

Group A - AVZ

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**Foreman’s Report**

**Safety:**

At first glance, the setup does not seem strikingly hazardous. The gases involved are air, pure nitrogen, and pure oxygen. These three gas tanks are placed behind the apparatus, and should be belted into place prior to the experiment. There should always be a vent open in order to prevent high pressurization of valves in the system, which could cause rupture. Permeate and retentate vents are located on the top right side of the system, next to the rotometers. While each nitrogen run is taking place, no personnel should be standing near the rotometers and vents, or else suffocation could occur due to high nitrogen concentration in the air near the vents. When flushing the oxygen analyzers with pure oxygen, flow should be shut off immediately after the procedure is complete in order to minimize oxygen content in the air. Oxygen is an oxidizer and can rapidly increase the spread of fire. While this particular lab does not involve the use of hazardous chemicals, lab coats and safety goggles should still be worn due to other chemicals being used around the lab.

**Procedure**

Calibration

1. Set the three-way valve on the left-hand side of the system to “air” to draw gas from the air tank. (Abhay)
2. Turn the valve on the bottom-left side of the system to “bypass”. This sends the gas straight to the oxygen analyzers for calibration purposes. (Abhay)
3. Turn the valve on the bottom right of the system upwards to divert the gas to the permeate oxygen analyzer. (Abhay)
4. Slowly turn the feed pressure regulator (right of the gas selection panel) until reaching approximately 100 psi. Continue flow of gas for 5 minutes until display reads 20.9% (Alton)
5. Turn pressure regulator counter close-wise until pressure reads zero on the gauge. Set the valve to “oxygen” on the gas selection panel. (Alton)
6. Turn pressure regulator clockwise until reaching approximately 100 psi. (Alton)
7. Note reading after five minutes. If reads 100% ± 2%, shut off oxygen flow. If outside that range, manually adjust meter to 100%, and repeat steps 1-3.
8. Repeat steps 3-7 for the retentate oxygen analyzer (for step 3, turn valve downwards to divert gas towards retentate oxygen analyzer)

Permeance Runs

1. Turn bypass valve away from the “bypass” option to redirect gas towards the columns. (Abhay)
2. Ensure the system is set to oxygen, and turn the pressure regulator to 100 psi. (Alton)
3. Wait 5 minutes for the system to reach steady-state, then enter the permeate flow rate, retentate pressure, and permeate pressure into the designated spots in the excel spreadsheet to determine the oxygen permeance value. (Sebastian)
4. Shut off the oxygen stream using the pressure regulator, switch to nitrogen, and repeat steps 1-3 to determine the nitrogen permeance value.

Stage Cut Runs

1. Set the valve to “air” to draw gas from the air cylinder. Turn the retentate pressure regulator to full open position. Turn the feed pressure regulator to reach 120 psi. Then, slowly close the retentate pressure regulator to reach the first desired retentate pressure. (100 psi for the first trial) (Abhay)
2. The permeate flow rate should be constant at any given retentate pressure. Enter the permeate flow rate (Vp) into the designated yellow cell in the spreadsheet. This should automatically calculate the desired flow rate for the retentate (Lr). (Sebastian)
3. Adjust the feed pressure regulator to reach the calculated retentate flow rate (green cell under Lr). If the retentate pressure deviates from the desired pressure for that trial, readjust it using the retentate pressure regulator. (Alton)
4. After the desired retentate pressure and retentate flow rate are reached and at steady state, record the feed pressure and oxygen contents for the permeate and retentate streams in the indicated areas on the excel spreadsheet. (Sebastian)
5. Repeat steps 2-4 for each stage cut (0.2, 0.3, and 0.4).
6. Repeat steps 1-5 for each retentate pressure (100, 115, 135 psi)

**Using the Excel Spreadsheet**

The first sheet (“Permeance”) is used to calculate the permeances of O2 and N2. The yellow cells are where experimental data should be inputted to calculate the permeances. The second sheet (“Air Trials”) is used for the portion of the experiment dealing with air separation. Nine trials are listed, in which 3 different pressures and 3 different stage cuts are desired. First, a value must be entered in the Vp column, which calculates Lr in rotometer units, which is shown in the green cells on the left. Once both conditions are met in the green cells, results should be entered in the last 3 columns.

Lab Layout for Safety

