Sean Lawry

Austin Smith

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Project #1 Lab Notebook

**Project Description**

Methocel is to be pumped from a railway terminal to a nearby plant. A delivery system is already in place, but must be adequate to transport the non-Newtonian fluid without exceeding the rupture disk pressure rating (250 psig). An apparatus has been constructed to study the rheology of methocel. The apparatus measures flow rate and pressure drop as a function of distance. This rheological data will be used to determine the adequacy of the transport system.

**Project Objective**

To use acquired rheological data to determine if the current system can transport 75 gallons per minute of a 1% (by weight) methocel solution without exceeding the rupture disk pressure rating (250 psig).

**Notebook Entries**

September 4, 2014

**Description**

Today we met and discussed the problem we were assigned to solve. So far we have a general idea as to how to solve this issue. We know we will need to acquire flow rate and pressure drop data to determine the rheology of the fluid. To determine if the pressure will be too great in the pipe, we will need to use the

**Observations**

We may need to meet with Dr. Lignell if we get stuck on our solution procedure. We are not sure what to do with the concentration of methocel information.

**Notes/Calculations**

The two important fluid parameters are n and K. We can determine these values from equations found on Dr. Lignell’s slides. The equations will be on our project proposal.

**Signatures**

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| Sean Lawry | Austin Smith | Adriaan Riet |

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September 9, 2014

**Description**

We started our rough draft of the project proposal. We created a group folder in J drive to keep everything organized.

**Observations**

We need to clean up the rough draft next time. We should only need 30 minutes to complete it.

**Notes/Calculations**

Troy assisted us with the content of our proposal. The major point he made was to break up our equations more and explain them step by step. Dr. Hecker mentioned that we will need to also create a powerpoint slide that summarizes our project.

**Signatures**

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September 11, 2014

**Experiment Details**

Today we completed our project proposal and set up our experiment. Jordan gave us a quick overview of startup and shutdown of the experiment. All that we needed to do was turn on the mixers and pull up the pipe viscometer control panel. We decided to take 100 pressure readings with a 1 sec time interval. We will perform 11 pressure experiments for each the large and small pipes, each for a different flow rate ranging from 10 to 25 gal/min. However, the small pipe maxes out at 17.5 gal/min. We set up a spreadsheet to which we can transfer the data to, which will then calculate our n and K values through linear interpolation.

**Observations**

Everything seems to be running smoothly, other than the pump making a little noise. We have to wait a few seconds before the flow rate reaches steady state before taking measurements.

|  |  |  |
| --- | --- | --- |
| Experiment Description | Time | Data File |
| Small pipe, 14.5 gal/min | 5:59 p.m | 14.5\_Small1.txt |
| Small pipe, 11.5 gal/min | 5:59 p.m | 11.5\_Small1.txt |
| Small pipe, 10.75 gal/min | 5:59 p.m | 10.75\_Small1.txt |
| Small pipe, 13 gal/min | 6:00 p.m | 13\_Small1.txt |
| Large pipe, 10 gal/min | 6:07 p.m | 10\_Lmall1.txt |

**Notes/Calculations**

Large pipe: 3/2 in OD

Small Pipe: 1 in OD

Order of testing was randomized

Avoid using Google Chrome

**Signatures**

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September 16, 2014

**Experiment Details**

Today we continued and completed our data collection. We completed all 22 experiments, which includes data for both the large and small pipe. After retrieving all our data, we plan on making plots and performing data analysis to see if there are any outliers. We have begun writing our group paper as well.

**Observations**

We expect our results to change somewhat after we have fully analyzed our data and made adjustments.

|  |  |  |
| --- | --- | --- |
| Experiment | Time | Data File |
| Large pipe, 25 gal/min | 4:24 p.m | 25\_Large2.txt |
| Large pipe, 11.5 gal/min | 4:28 p.m | 11.5\_Large2.txt |
| Small pipe, 15.25 gal/min | 4:34 p.m | 15.25\_Small2.txt |
| Small pipe, 17.5 gal/min | 4:41 p.m | 17.5\_Small2.txt |
| Small pipe, 13.75 gal/min | 4:47 p.m | 13.75\_Small2.txt |
| Large pipe, 16 gal/min | 4:52 p.m | 16\_Large2.txt |
| Small pipe, 16.75 gal/min | 4:57 p.m | 16.75\_Small2.txt |
| Small pipe, 12.25 gal/min | 5:00 p.m | 12.25\_Small2.txt |
| Large pipe, 13 gal/min | 5:09 p.m | 13\_Large2.txt |
| Small pipe, 10 gal/min | 5:13 p.m | 10\_Small2.txt |
| Large pipe, 17.5 gal/min | 5:21 p.m | 17.5\_Large2.txt |
| Large pipe, 14.5 gal/min | 5:24 p.m | 14.5\_Large2.txt |
| Large pipe, 22 gal/min | 5:29 p.m | 22\_Lmall2.txt |
| Large pipe, 23.5 gal/min | 5:35 p.m | 23.5\_Large2.txt |
| Large pipe, 20.5 gal/min | 5:39 p.m | 20.5\_Large2.txt |
| Large pipe, 19 gal/min | 5:42 p.m | 19\_Large2.txt |
| Small pipe, 16 gal/min | 5:47 p.m | 16\_Small2.txt |
| Small pipe, 14.5 gal/min | 5:57 p.m | 14.5\_Small2.txt |
| Small pipe, 11.5 gal/min | 6:05 p.m | 11.5\_Small2.txt |

**Notes/Calculations**

Control panel should be accessed through “Mozilla Firefox”, not “Firefox”

**Signatures**

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September 18, 2014

**Experiment Details**

Today we spent time adding to the report, collecting more data, and analying data. We found some mistakes in our calculations, leading us to be more confident in our calculated n value.

**Observations**

|  |  |  |
| --- | --- | --- |
| Experiment Description | Time | Data File |
| 13.8 set point, large pipe | 6:06 PM | 13.8\_Large3.txt |
| 12.6 set point, small pipe | 6:01 PM | 12.6\_Small3.txt |
| 17.1 set point, small pipe | 5:57 PM | 17.1\_Small3.txt |
| 16.8 set point, large | 5:51 PM | 16.8\_Large3.txt |
| 14.1 set point, small pipe | 5:42 PM | 14.1\_Small3.txt |
| 15.6 set point, small pipe | 5:38 PM | 15.6\_Small3.txt |
| 12.3 set point, large pipe | 5:33 PM | 12.3\_Large3.txt |
| 10.8 set point, large pipe | 5:29 PM | 10.8\_Large3.txt |
| 13.4 set point, small pipe | 5:16 PM | 13.4\_small3.txt |
| 11.9 set point, small pipe | 5:16 PM | 11.9\_Small3.txt |
| 11.1 set point, small pipe | 5:08 PM | 11.1\_Small3.txt |
| 14.875 set point, small pipe | 4:55 | 14.875\_Small3.txt |

**Notes/Calculations**

Calculated Reynolds numbers, determined that system should work. Data file “DataAnalysis-ad” & “DataAnalysis-ad” are important!

**Signatures**

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September 23, 2014

**Experiment Details**

We are performing more experiments with flowrates that correspond to areas of the graph that seem to be lacking data.

**Observations**

We noticed that there was a bend in the small pipe, which could have led to some slight miscalculations. However, we consider this unlikely. We found that we need more points for the lower end (flowrate) of the small pipe data because of a small offset between small and large pipe data plots.

|  |  |  |
| --- | --- | --- |
| Experiment Description | Time | Data File |
| descriptions embedded in data file name | find in folder | 23.5\_Large4.txt |
| descriptions embedded in data file name | find in folder | 13\_Large4.txt |
| descriptions embedded in data file name | find in folder | 5\_Small4.txt |
| descriptions embedded in data file name | find in folder | 8\_Small4.txt |
| descriptions embedded in data file name | find in folder | 3\_Small4.txt |
| descriptions embedded in data file name | find in folder | 2\_Small4.txt |
| descriptions embedded in data file name | find in folder | 7\_Small4.txt |
| descriptions embedded in data file name | find in folder | 4\_Small4.txt |
| descriptions embedded in data file name | find in folder | 9\_Small4.txt |
| descriptions embedded in data file name | 5:09 p.m | 10\_Small4.txt |
| descriptions embedded in data file name | 5:10 p.m | 1\_Small4.txt |
| descriptions embedded in data file name | 5:13 p.m | 6\_Small4.txt |

**Notes/Calculations**

**Signatures**

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September 25, 2014

**Experiment Details**

Today we worked on writing our report. We divvied out assignments to ensure that the workload is evenly distributed. We are set to finish on time!

**Observations**

We need to have an appendix, table of figures, table of contents

**Notes/Calculations**

**Signatures**

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September 30, 2014

**Experiment Details**

Today we came very close to completing the written report. We still need to do a lot of proofreading and

**Observations**

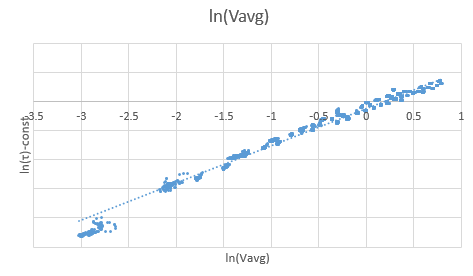
It would be helpful to “pretty up” the paper a little bit by adding some color to it and wrapping the text around the figures.

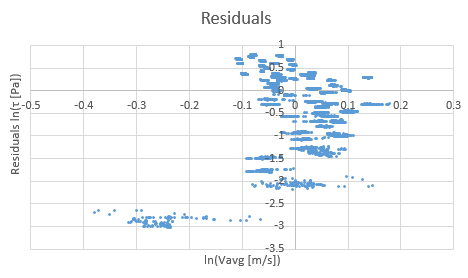
**Notes/Calculations**

**Signatures**

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**Final Plots**





**Project Conclusions**

The pipeline in place can transport methocel to the plant. The pressure drop of methocel in the current piping system is 81.4 psig, while the system can maintain up to 250psig. The data had a high level of confidence as shown in figure x. Methocel had a measured n value of 0.64 which determines that it is a pseudo-plastic fluid. Methocel is expected to run through the pipe with about three times the pressure drop as water would. This easily reaches the specifications of the existing pipeline and no new pipeline system is necessary.