Sean Lawry
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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

Sean Lawry	Austin Smith	Adriaan Riet

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

Sean Lawry	Austin Smith	Adriaan Riet

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

Sean Lawry	Austin Smith	Adriaan Riet

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

Sean Lawry	Austin Smith	Adriaan Riet

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

Sean Lawry	Austin Smith	Adriaan Riet

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

Sean Lawry	Austin Smith	Adriaan Riet

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

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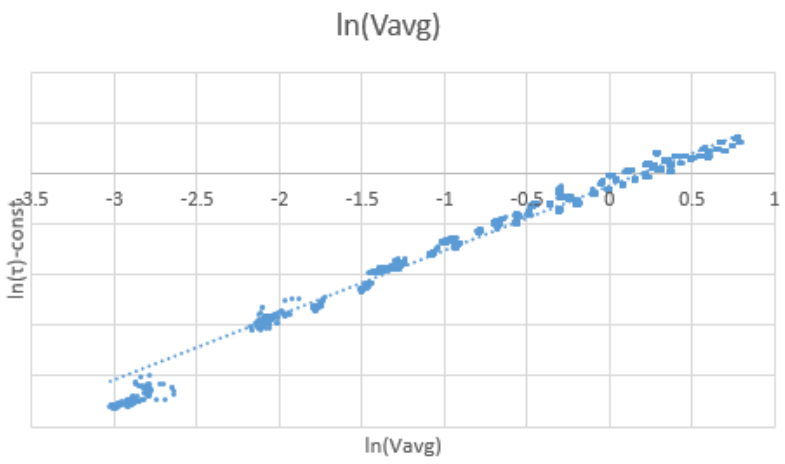
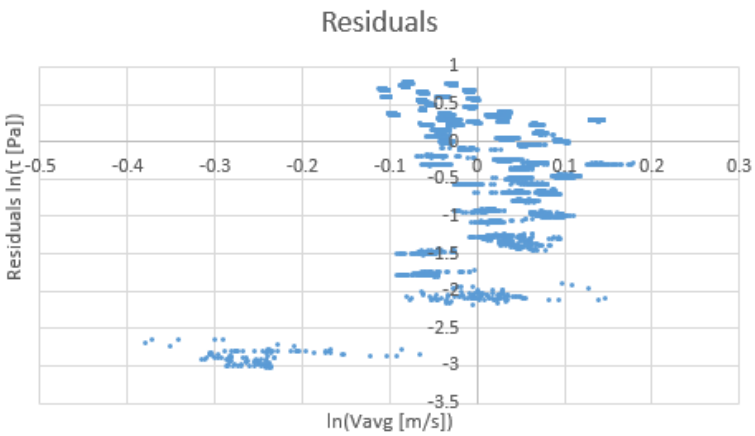
Final Plots





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.