ChEn 533

Final Exam Project Proposal

The paper my final exam project will be based on is *Dispersion of soluble matter in solvent flowing slowly through a tube* by G.I. Taylor. This is an important paper because it discusses how solutes diffuse through bulk movement of a fluid. This dispersion is called Taylor dispersion. Taylor dispersion is more significant when the Peclet number is large (much for bulk flow than diffusive flow). According to the Wikipedia page on Taylor Dispersion, flows in porous media are a relevant case for Taylor Dispersion.

Taylor dispersion is a clear case of transport phenomena. Taylor dispersion is about mass transfer, and how bulk flow relates to diffusion.

To conduct their experiments, the researchers used a tube with a small inner diameter. They injected a good electrical conductor into a flowing stream of water (assumed to be a poor conductor of electricity). They were then able to measure the conductivity at the end of the tube as a function of time to determine the velocity profile of the fluid. They also injected a coloring dye to measure concentration as a function of length down the tube. They actually measured the distance where the color of the fluid in the tube would match the color of a prepared sample, and thus got a length as a function of concentration.

For my project, I'm going to solve for the concentration profile in a tube when a solute is injected into a flowing fluid. I'll use large Peclet numbers and a long-time limit so that Taylor diffusion will be significant. Once I have the analytical solution to this problem, I'll make some graphs comparing the concentration profiles when some factors change, such as the ratio of length to diameter of the tube, Peclet number, and potentially the fluid (changing to a more viscous fluid perhaps).

Table 1 shows the estimated dates of how I will accomplish this project.

Table 1 – Timeline for Final Project

4-Dec	Turn in Final Project Proposal.
7-Dec	Read the paper in further depth and read Section 20.5 in BSL.
10-Dec	Finish the analytical solution to my Project.
11-Dec	Make graphs of the solution with varying factors.
12-Dec	Finish PowerPoint Presentation.
14-Dec	Turn in Final Project. Present project to the class.