Polymer Mixing in Wastewater Treatment: Effect of a Low Power Law Index (n)

Under the direction of

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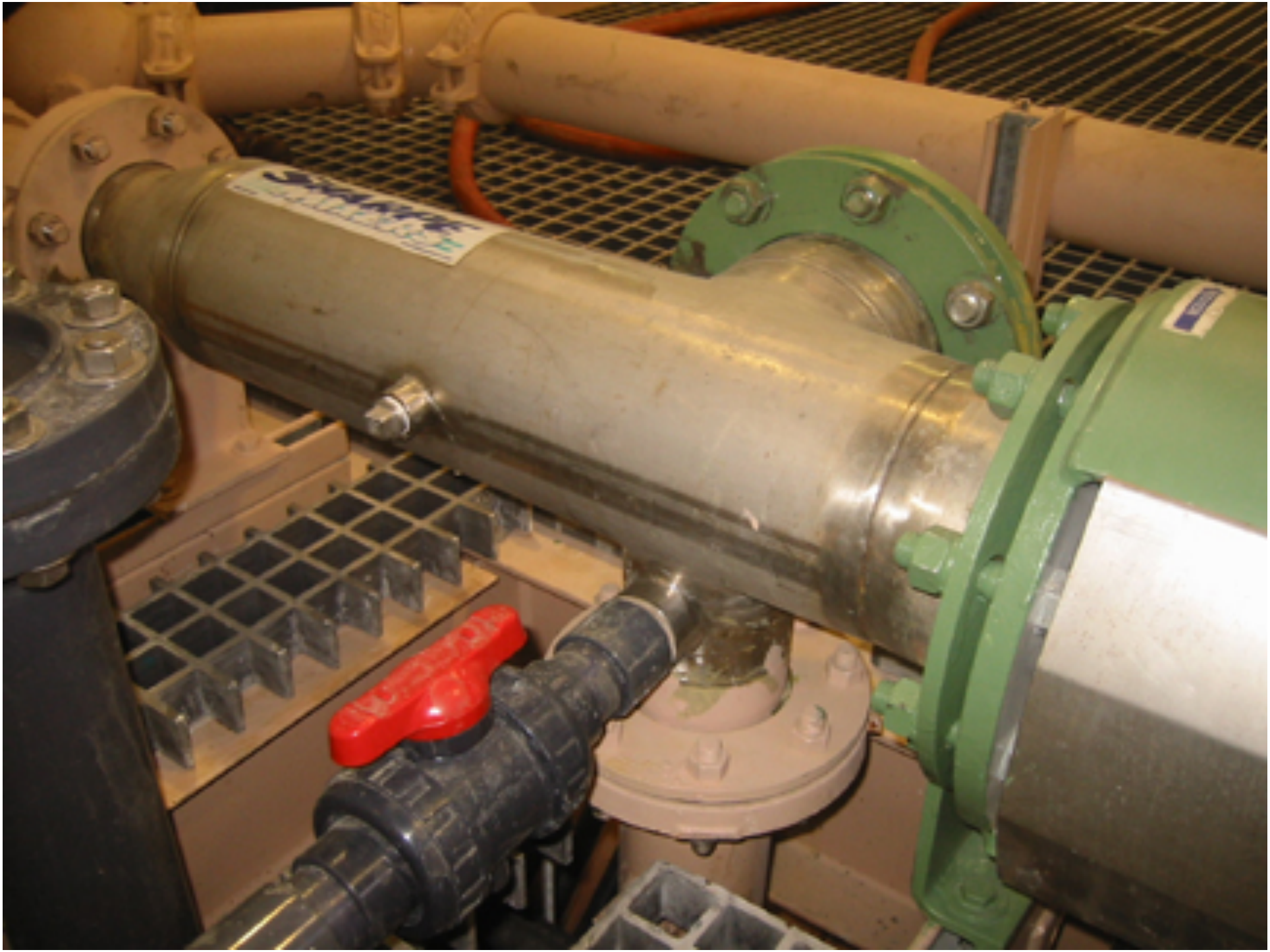
- A polymer solution is added to digested sludge in order to cause it to flocculate. The sludge is then sent to a centrifuge to separate the water from the sludge, which is used for fertilizer. This project began as a study of the incomplete mixing of the polymer. The goal of the Renton Wastewater Treatement Plant is to reduce the cost of the polymer by achieving good mixing with less polymer.

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Projects

- Measure viscosity of polymer solutions
- Study mixing at the mixing point
- Study mixing in a static mixer
- See the effect of rotation of the ‘static’ mixer
- Estimate the mass transfer from the discharge channel
- Try to solve viscoelastic flow equations with FEMLAB
- Reconcile a discrepancy in the mass transfer literature

Approximations

- Treated it as a continuum, valid up until the point that flocculation occurs
- Had data fitting a power-law formula, sometimes used extrapolated values
- The static mixers are not like the actual mixers
- Limited by memory in computers in Benson Hall. However, students are able to solve 3D flow problems with non-Newtonian fluids.

What we've learned

- The power-law index is very small
- How the polymer is mixed affects the flocculation
- The flow is laminar and very little mixing occurs in a straight pipe
- Static mixers should work, but we've only studied a model one
- Rotating mixers work - need a high speed?
- The mass transfer coefficient discrepancy is really two different situations. Which is applicable?