Rheology Results for Sludge & Polymer

Data from April 11th brought to you by
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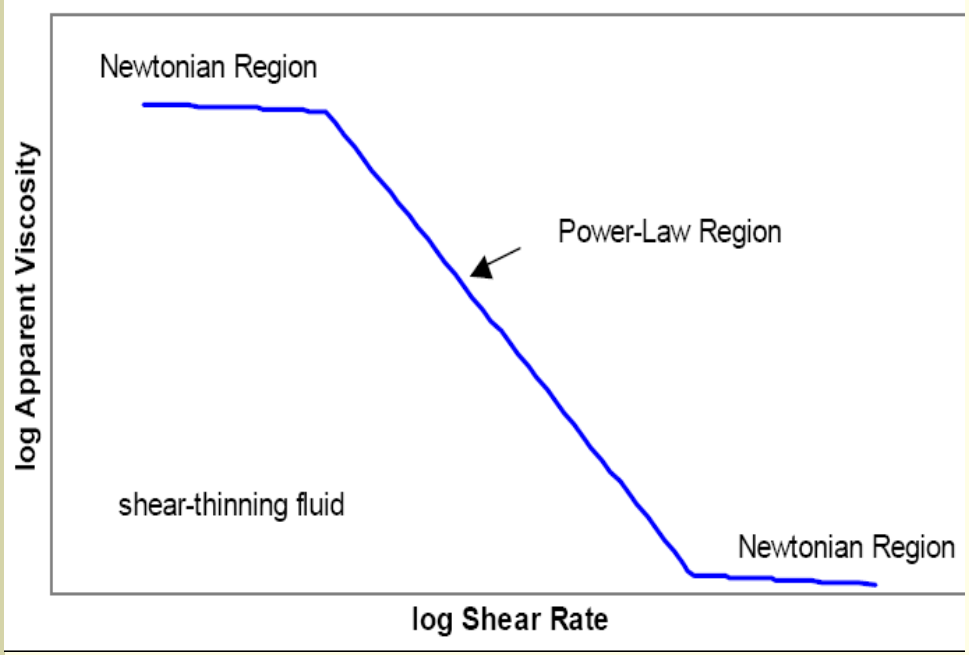
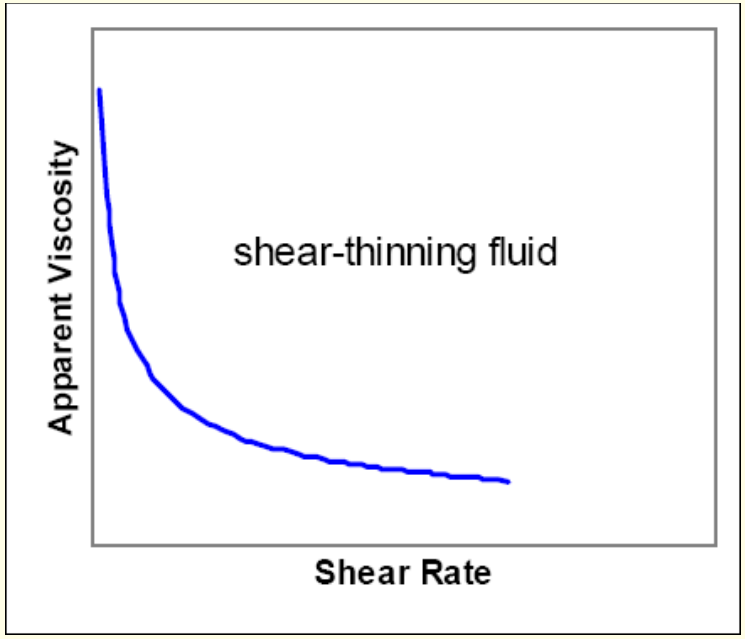
Experimental Set Up

- Two cups of each of Digested Sludge and Polymer samples were obtained
- Transported carefully to Sharpe Mixer Labs for Viscosity testing
- Different spindles were used for various viscosity ranges

Expectations and Analysis

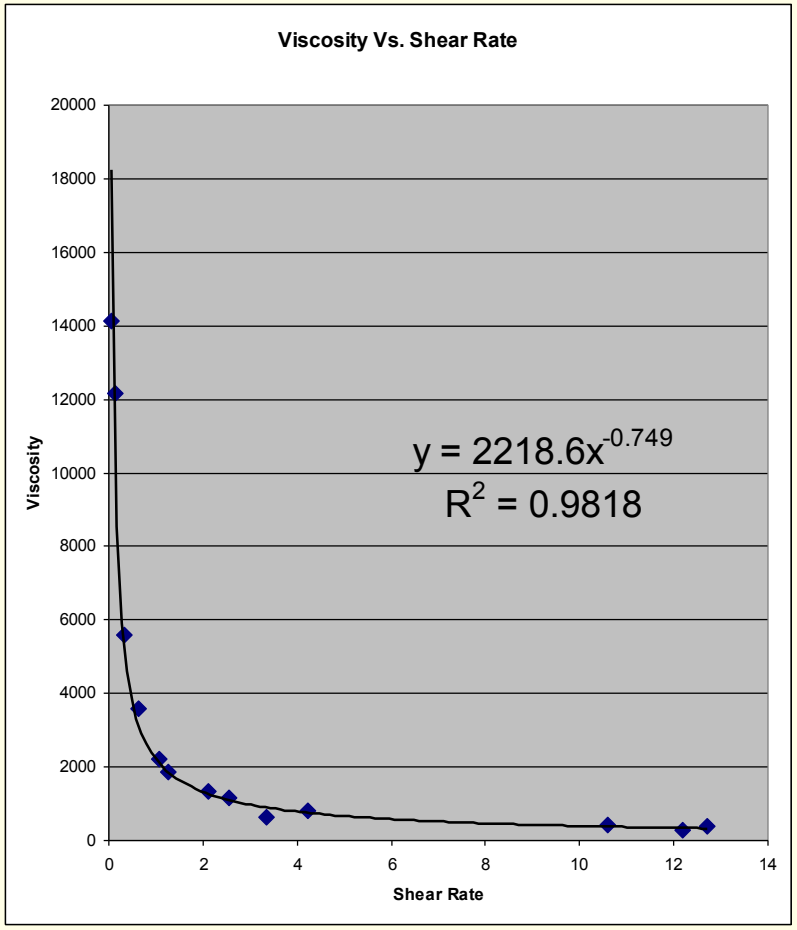


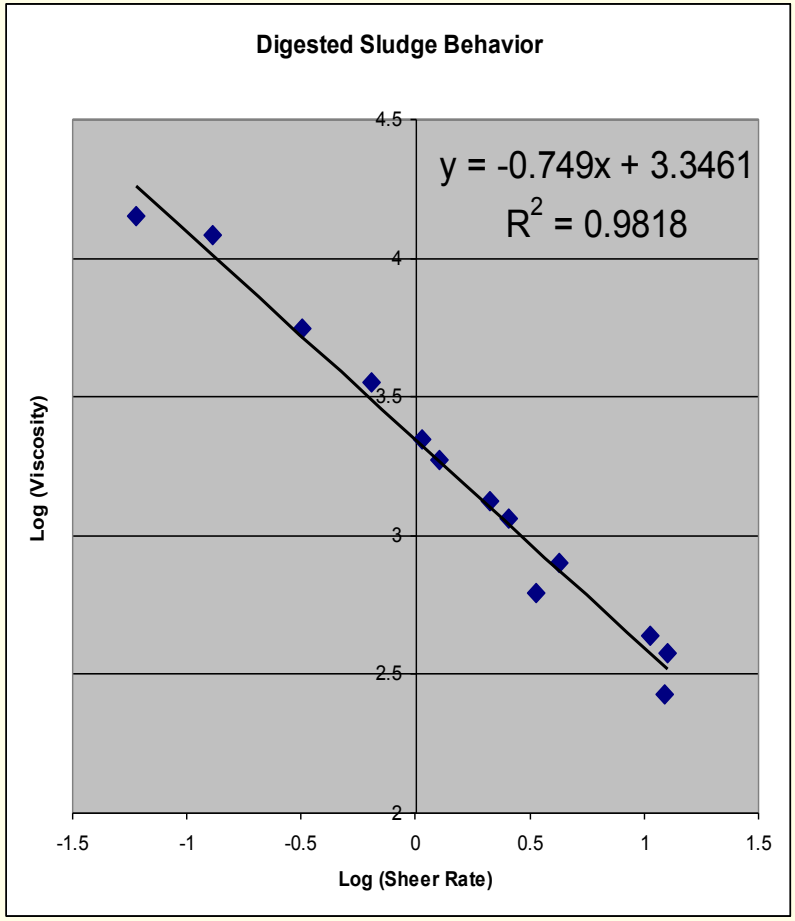


Curve fits can quantify the behavior of this fluid which is known to have power law properties. Power law fluids are governed by the following equations:

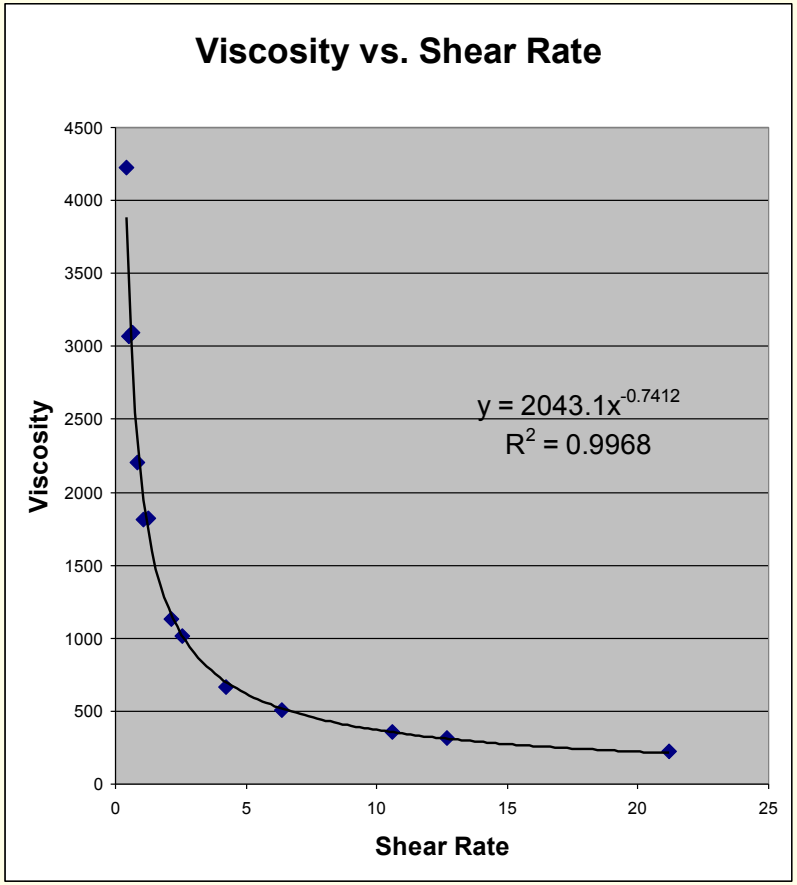
$$\eta = \kappa \dot{\theta}^{b} \qquad \& \qquad \log \eta = a + b \log \dot{\theta}$$

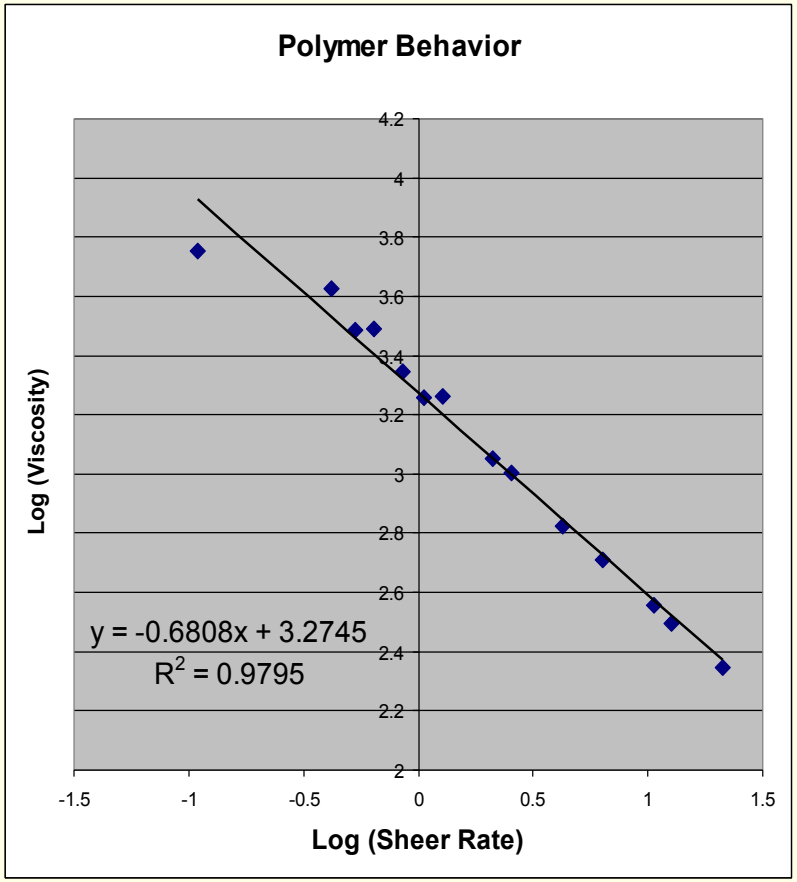
Viscosity of Digested Sludge





Viscosity of Polymer

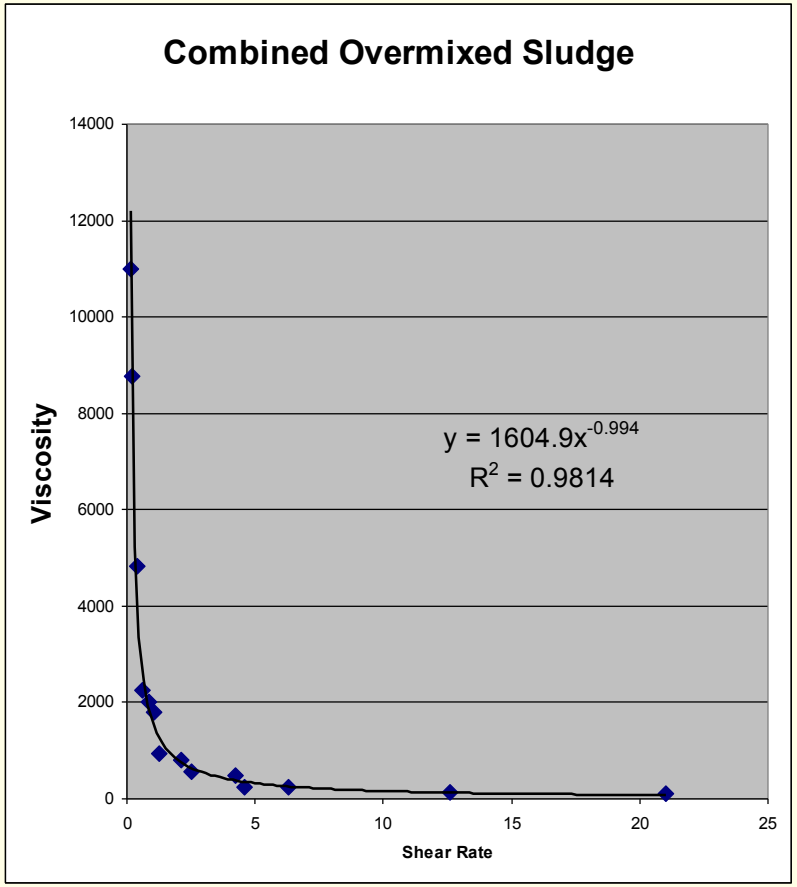


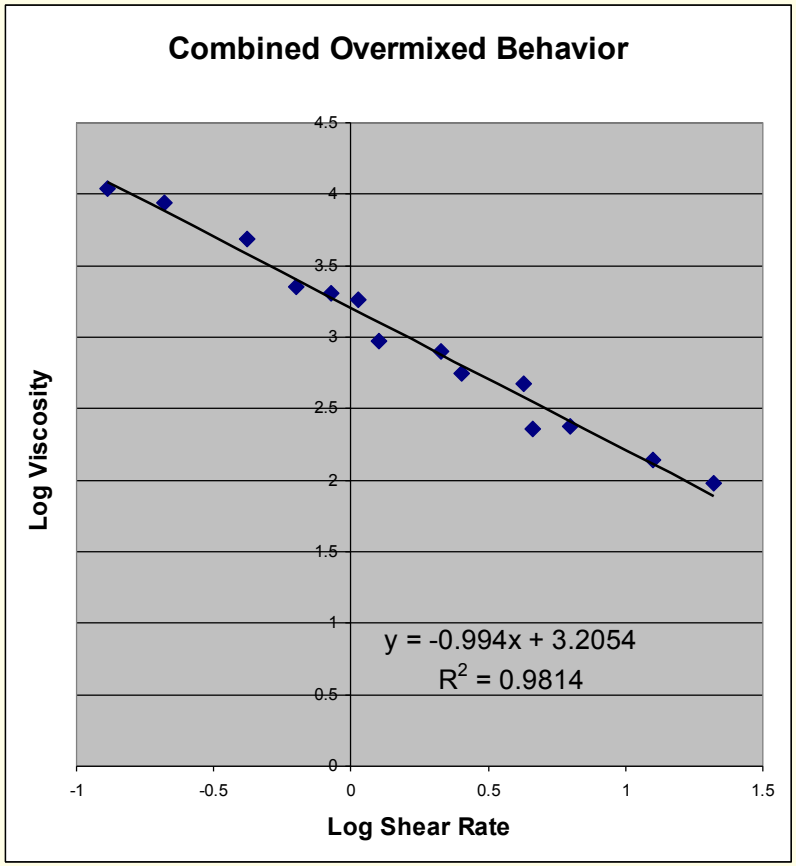


Mixture of Sludge and Polymer

- Recipe: 46 ml of polymer per 235 ml sludge (we overdosed slightly in experiment)
- Vigorous mixing produces flocculation and coagulation
- Produced jello like chunks in pretty clear liquid water
- Prolonged mixing produces chunks of smaller sizes and ultimately over-mixing reduces mixture back into a continuous fluid
- Unable to measure viscosity of anything that's not continuous because water forms a liquid bearing around chunks of coagulated solids

Viscosity of Over-mixed Sludge





Conclusion

- Overdosing makes it harder to over-mix the sludge and thus easier for the machinery to operate properly consistently
- Over-dosing is VERY expensive
- King County will love us forever if we can find optimum amount of mixing and thus consume minimal amount of polymer

Sincerely,

Albert & Sheena