**Executive Summary**

**Introduction & Objectives**

Agitation is a mixing technique used in chemical and biological industries that helps improve homogenization of the product, typically with decreased operational time. A 0.5% w/w xanthan gum solution, a non-Newtonian fluid, was mixed in a Hamilton-kettle agitated vessel. The effects of agitation speed and temperature on the heat transfer coefficient, power consumption, and the rheological behavior of the solution were analyzed in order to make predictions about the system behavior that would increase operational efficiency.

**Procedure & Results**

The agitation speed was set to the desired value, and steam was injected into the jacket at a constant pressure of 20 psi to heat the system. The power consumption of the agitated vessel and the time to heat the system from 30°C to 80°C, in 10°C intervals, were measured. The procedure was repeated for five different agitation speeds. Data for shear stress versus shear rate had already been collected at each temperature variation.

It was observed that the apparent viscosity of the xanthan solution decreased with the behavior of a power law fluid when agitation speed increased. Apparent viscosity also decreased when temperature increased. The mixing time of the solution decreased with increased agitation speed and increased temperature. There was not a significant change detected in power consumption over the range of agitation speeds examined.

**Conclusions & Recommendations**

* Agitation speed and temperature should both be increased to decrease mixing time
  + Increasing these variables creates a greater heat transfer coefficient and may lower power consumption due to decreased operational time
* Agitation speed and temperature should both be increased in order to decrease the apparent viscosity
  + Lower viscosity correlates with decreased mixing time, increased heat transfer coefficient, and lower power consumption due to decreased mixing time
* The agitated vessel should be operated at larger temperatures and agitation speeds to manufacture the quickest throughput of the 0.5% w/w xanthan gum solution
* Theoretically, increasing agitation speed should increase power consumption
  + Even with increased power consumption, operational costs may be lowered due to decreasing operational time requirements