PROQUIP IN THE MIX

By Dave Grutzmacher

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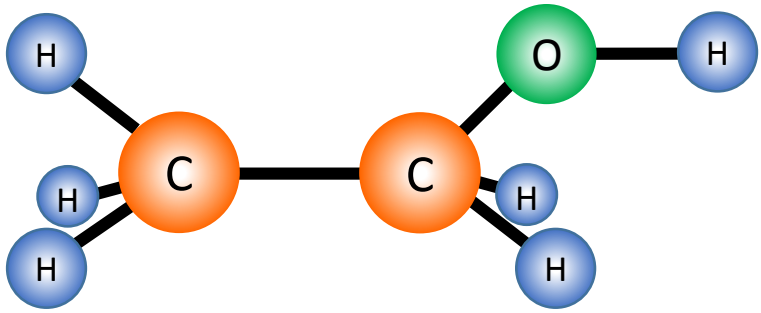
Three Important Considerations for Mixing Biomaterials

Over the past couple of decades, the use of biomaterials and processes has increased dramatically. This goes well beyond traditional fermentation used in production of pharmaceuticals. For example, ethanol production in the U.S. has grown exponentially and exceeded 14 billion gallons in 2014.

With increased processing of biomaterials comes an increased need to understand how to mix them. In this blog, we will look at three important considerations for mixing biomaterials:

1. The rheological properties of the biomaterials you are mixing
2. The effect of shear on non-Newtonian fluids
3. Agitator design for mixing non-Newtonian fluids



*Ethanol **production** is an example of a bio-based **process** that has grown dramatically in recent decades. Production in the U.S exceeded 14 billion gallons in 2014.*

1. Rheological Properties of the Biomaterials You are Mixing

Many biologically-based mixing processes involve high percent solids slurries. Understanding the rheological properties (flow and deformation under applied forces) for these materials is important. For example, it is not unusual to have slurries which exhibit relatively high viscosity (as measured in centipoise) and have non-Newtonian fluid behavior. Read on for considerations related to non-Newtonian fluids.

2. The Effect of Shear on Non-Newtonian Fluids

Non-Newtonian fluids do not have a fixed value for viscosity as measured in centipoise. They have an "apparent viscosity" that usually goes down in value as they are stirred faster. Figure 1 is an example of the effect of shear, or mixing faster in a non-Newtonian, shear-thinning fluid. Agitator design is critical to properly mix these fluids.

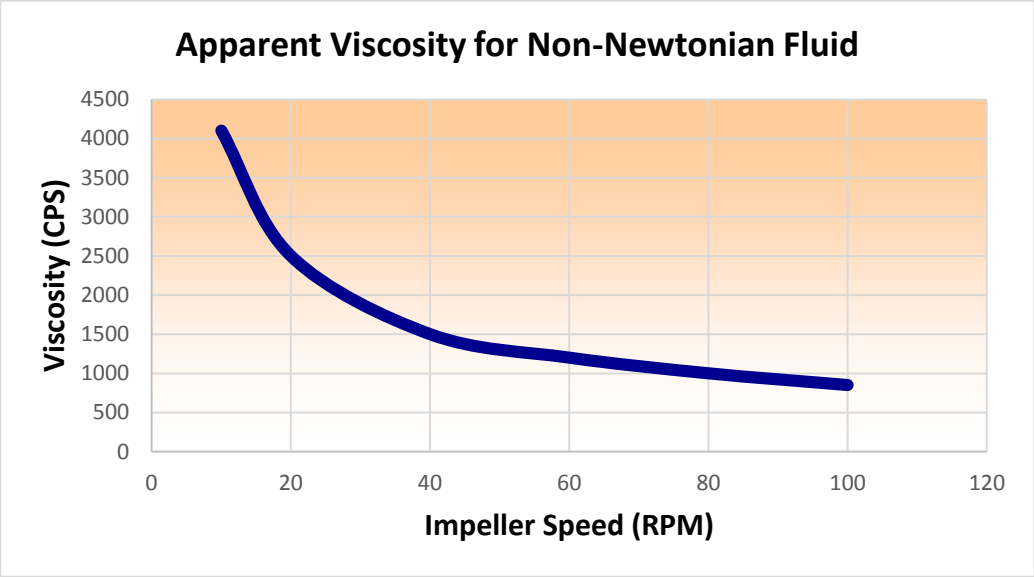


Figure 1. The apparent viscosity for Non-Newtonian fluids usually goes down in value as they are stirred faster.

3. Agitator Design for Non-Newtonian Fluids

Non-Newtonian fluids require special consideration for agitator design. For a shear thinning material, the liquid moves vigorously near the impeller. As the material moves away from the impeller, the mixing action reduces and the impeller can "cut a hole" in the batch. To mix the material properly, the impeller size and speed are adjusted - looking at viscosity in both the impeller region and the overall tank. Larger diameter impellers are typically required for effective mixing depending on how non-Newtonian the fluid behaves.

For More Information

ProQuip has extensive experience in the design of agitators for non-Newtonian fluids. If you have any questions on material properties and their effect on mixing performance, we recommend sending us a sample. We will do your product viscosity testing for you, and it's free. If you are interested in this service, contact us at 330-468-1850 or applications@proquipinc.com.