

Speeding Up QC Throughput With Quicker Viscosity Measurements daily production

What can cause greater disruption to daily production than a food product that does not meet the viscosity test specification? The issue is one of timing. When did you find out that you were out of spec? Is rework needed for the existing batch and is it easily accomplished? Does already packaged product need to be pulled back? The plant manager will need to be involved in the decision making and you can bet that an investigation will take place to find out why this happened.

Almost all food products that flow or have a consistency are measured for viscosity. Typical examples range from beverages (juices, milk and related dairy products), batters, salad dressings, sauces, and soups to semi-solid items like purees, puddings and pie fillings. Each food type requires a specific viscosity test method with a unique spindle running at a defined rotational speed. The measured value is compared against established QC min/max limits in order to pass the test. Temperature control of the sample during the test may also be a requirement.

One significant irritant is the lost time between when the sample is collected on the production floor and the performance of the viscosity test in the QC Lab. Most samples do not get tested immediately when received because there is backlog that has accumulated and has first priority. What simple alternatives could help to alleviate the obvious need for faster turnaround time?

Testing product directly on the manufacturing floor as it is being produced seems to be a logical choice. There are rugged versions of viscosity test instruments designed specifically for use in a production environment. Figure 1 shows a rheometer with vane spindle that can be positioned near vats of food ingredients that are in process. The sample can be collected in a container of any kind provided there is sufficient diameter and depth to accommodate the measuring spindle used for the viscosity measurement. Best practice with the vane spindle is to have enough sample surrounding the vane so that edge effects during rotation do not inadvertently increase the viscosity reading. One rule of thumb is that the container has twice the diameter of the vane spindle and material below and above the vane equal to the diameter.

Note that the rheometer has a handle on the side for rising and lowering the head with the spindle attached. This allows for easy positioning of the container with sample on the base plate before the vane spindle is lowered. The actual viscosity measurement is probably the shortest part of the test procedure. The viscosity reading is displayed on the face of the instrument and either recorded by the operator manually or sent electronically to a database where the QC test information is stored.

Viscosity measurements made on the production floor allow for the process to continue uninterrupted when consistency targets are within specification. Temperature control of the sample may also not be an issue if the test procedure requires measuring viscosity at the process temperature. Therefore, no additional temperature conditioning is needed since the sample is being tested immediately after its removal from the process stream.

Further improvement with even quicker turnaround time for viscosity testing can be achieved with an In-Line Process Viscometer. Variations are viscosity

Figure 1: AMETEK Brookfield RST Soft Solids Tester for Viscosity Measurement



measurement can be charted using a real time histogram. Deviations outside of control set points can be detected instantaneously and corrected much more rapidly than the traditional grab sample approach. Savings from increased process efficiency can pay back the investment cost of viscometer purchase within a year. Many signs point to multiple advantages of in-line process measurement. So why don't more manufacturers move in this direction?

Lack of awareness that these instruments exist is perhaps the single biggest factor. Comparative cost of a process viscometer installation is at least 5 times greater than its laboratory counterpart. The need for a process champion within the company to do the necessary investigative homework is a major challenge. This work includes identifying potential instruments, deciding where in the process line to install the unit, appropriating the necessary budget for purchase and installation, and training staff on proper monitoring and maintenance.

Figure 2 shows an example of an in-line process viscometer. The food material passes through a chamber that surrounds the instrument. A small fraction of the fluid stream makes contact with the sensor, which provides the continuous viscosity signal output. The instrument can be used exclusively for data output or it can trigger a control loop that adjusts process conditions to maintain viscosity within established limits.

Location of the process viscometer is an important part of the design process when deciding to use this approach. Figure 3 illustrates a bypass loop installation relative to the main process stream. This allows the unit to be taken off line if needed for various reasons, such as cleaning or maintenance.

One objection sometimes heard with respect to process viscometers is that the viscosity value is different from the lab measurement. There are rheological reasons for this discrepancy. But rather than dwell on this fact, the important goal is to obtain a repeatable viscosity measurement signal that characterizes acceptable product. Manufacturers of process viscometers know that the ability to distinguish good product from bad in real time and make on-the-fly corrections is what justifies the investment in this solution to improving QC throughput.

Why investigate the bottle necks in your process and decide whether inline process viscosity measurement can improve your product quality and, at the same time, your bottom line?

Figure 2: Brookfield TT-100 In-Line Process Viscometer



Figure 3: Typical Location for a Process Sampling Point

