Testing Soft-Solid Dairy Products for Consistency

Two Methods - Both Work

Dairy products like yogurt and soft butter have a consistency that makes them easy to spoon out of a container and spread with a knife respectively. Manufacturers want to ensure that the consistency of these products is repeatable with each batch that is produced. Testing the product directly in its container after packaging is the recommended approach to ensure that the customer gets the correct consistency when the product is used.

The commonly practiced test method in Quality Control for evaluating consistency is the viscometer with Helipath Stand and T-bar spindle. See Figure 1. The Helipath drive on the lab stand has a motor which moves the viscometer head downward into the product during the test.

Standard disc and cylindrical spindles do not work well with yogurt and butter because material moves away from the spindle as it rotates, causing the viscosity reading to drop steadily. Consequently, it is impossible to establish a useful control set point for viscosity unless a special spindle like T-bar is used.

T-bars come in various lengths for the "T" section of the spindle. Standard kits offer 6 choices. See Figure 2. The longest "T" is called "T-A" and is used to measure the lowest viscosity materials that are of a soft-solid nature. The "T-F" is the shortest and is used for the highest viscosity materials. The chuck assembly which holds the spindle is also shown in the image. Note that there is an extra weight in the assembly to provide vertical stability as the T-bar moves downward into the material during the test.

One consideration when using T-bar is to choose a spindle that fits into the container opening. Yogurts and soft butters do not present any problem in this regard so the choice of T-bar depends only on the viscosity range that is measured. Other soft solid materials like salad dressings come in bottles with narrow openings, so the smaller T-bar is needed to fit into the bottle.

The QC test method requires a low rotational speed between 0.5 and 12 rpm to make the viscosity measurement. This ensures that the spindle moves in a vertically downward direction as the Helipath drive moves the T-bar spindle into the material at a rate of 7/8-inch per minute. Viscosity readings will typically be in the range between 10,000cP to 1 million cP, depending on consistency of the product and the temperature at which it is tested. Total time needed to perform the measurement is usually 1 to 2 minutes, depending on depth of penetration for the T-bar spindle.

Common practice is to test viscosity at refrigeration temperature around 4°C. This is important because it establishes what the customer will experience when first taking the product out of the refrigerator. Some QC Departments run a second test at room temperature as well – 20 to 25°C – to verify how the product consistency changes when it is left out of the refrigerator. This practice is optional, but can be important for higher quality brands that want to ensure total customer satisfaction.

One potential challenge with the viscosity measurement is the variability of the reading as the T-bar descends into the material. It can fluctuate depending on the homogeneity of the product. Yogurts with fruit particles are especially tricky because the viscosity reading will suddenly jump to a higher value, then settle back down. See

Figure 1: Brookfield AMETEK Viscometer with T-bar Spindle

Figure 2: Brookfield AMETEK T-bar Spindle Kit

See Figure 3. The test procedure must address how the operator records the test data.

Gaining attention as an alternative test method to the T-bar is the Texture Analyzer with wire mesh probe. See Figure 4. Texture Analyzers are instruments that push into or compress a material with a probe of defined shape and measure the resistance of the product in grams of force. The test method defines the rate of penetration and the distance or depth to which the probe moves. The recorded data from the test is the peak load (maximum force) measured by the probe during its downward travel and the amount of work performed (measured in joules) to move the probe through the material to the defined depth.

Advantages of this method compared to T-bar include the following:

a) It is a quicker test to perform, usually under 30 seconds
b) It provides two pieces of data, peak load and work done
c) The measured force typically reaches a steady state peak load value within seconds

Both equipment systems are roughly the same price to purchase. T-bar spindle is the traditional method. Texture Analyzer has more recently come into use. Choice of test method is the responsibility of the manufacturer. Dairy processors who are looking for ways to improve productivity should consider the Texture Analyzer as an alternative.

Figure 3: Viscosity Reading for Yogurt with Fruit Particles

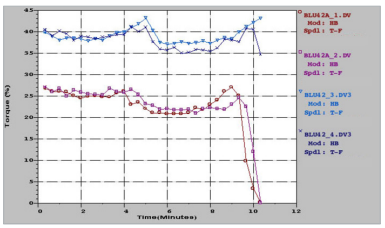

Figure 4: Brookfield AMETEK CT3 Texture Analyzer with Mesh Probe.

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