



Evaluation of Wildland Fire Chemicals

Standard Test Procedures

4.5 Viscosity – Brookfield

Summary: The viscosity, or resistance to flow, of a material can be determined by a rotational viscometer. The viscometer can also be used to approximate other flow characteristics by relating viscosity and flow for a known composition.

Because the specific rotational speed and the spindle used as well as the temperature of the test sample can have a significant impact on the value determined, it is best to use the same conditions throughout a test series. To ensure that this is possible, the viscosity should be measured with all usable spindles.

The viscosity of long-term retardant products is normally measured using a #2 spindle for products having a viscosity between 1 and 500 centipoise (cP) and a #4 spindle for products having a viscosity greater than 500 cP; although the #3 spindle may also be used when the upper values are expected to be less than 2,000 cP.

Equipment:

Brookfield model LVF viscometer and spindle set Stopwatch

Thermometer

Sample in a straight-sided container with an inside diameter of 2 inches or more

Method:

1. Level the viscometer by adjusting the feet and/or rotate the viscometer on the mounting shaft until the bubble is centered before each use.
2. Set the speed control to 60 rpm; 60 should be on the upper surface of the knob found on the left side of the housing.
3. Place the sample and container under viscometer.
4. Measure and record the temperature of the sample.
5. Select a spindle appropriate for the viscosity to be measured. The number of the spindle is engraved at the top of each spindle.
6. Screw spindle onto the viscometer.
 - a. **This is a left-handed thread.**
 - b. **Spindle should be finger tightened only, holding onto the shaft to prevent movement of the gauge needle, and gently lifting upward.**
 - c. **NEVER pull down on the spindle!**
7. Using the adjustment knob on the viscometer stand, carefully lower the spindle into the sample to the immersion mark etched into the spindle shaft.
8. With one hand depress and hold the brake, found on the back of the viscometer head, firmly down while turning on the viscometer.
9. Release the brake once the viscometer is rotating smoothly and time for 60 seconds.

10. Depress the brake firmly and turn the viscometer off while continuing to hold the brake down.
 - a. This keeps the dial indicator in place until the value can be read.
 - b. If the dial indicator cannot be seen in the gauge window, turn the viscometer on and off quickly until the needle comes into view, maintaining firm pressure on the brake.
11. Read and record the value on the viscometer gauge. Also record the number of the spindle used.
12. Release the brake.
13. Refer to the table below to obtain the correct multiplier for the spindle used.
14. Calculate the viscosity in centipoises by multiplying the meter reading by the multiplier corresponding to the spindle used.

<u>Spindle #</u>	<u>Multiplier for Readings at 60 rpm</u>	<u>Viscosity Range</u>
1	1	1 to 100 cP
2	5	50 to 500 cP
3	20	400 to 2,00 cP
4	100	1,000 to 10,000 cP

Long-term retardants have typically been measured using a #2 spindle for viscosities up to 500 cP and a #4 spindle for viscosities greater than 500 cP.

15. Have the viscometers cleaned and calibrated by the manufacturer or other approved service company at least once a year.

References:

American Society for Testing and Materials. Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer; D2196-05.

National Wildfire Coordinating Group and USDA Forest Service. Lot Acceptance, Quality Assurance, and Field Quality Control for Fire Retardant Chemicals, Sixth Edition. 2000.