

Pancake Syrup Viscosity Analysis

Viscosity testing of pancake syrup is crucial to ensure it meets desired flow characteristics, as viscosity directly affects pourability, texture, and user satisfaction. By measuring how syrup viscosity changes with temperature and shear rate, manufacturers can optimize the product for a consistent and enjoyable experience.

Background:

- Pancake syrup viscosity is influenced by temperature and shear rate, displaying shear-thinning behavior, where viscosity decreases with increased shear.
- Testing at different temperatures (4°C and 25°C) demonstrates the effects of temperature on viscosity, which is crucial for quality control.



Equipment:

- Instruments: DVNext Viscometer
- Spring Torque Ranges: LV and RV
- Spindles: SC4-31/13RPY for LV, SC4-18/13RPY for RV

Accessories:

- Small Sample Adapter
- TC-550 SD Bath for precise temperature control

Settings:

- Temperatures: 4°C and 25°C
- Speeds and Shear Rates:
 - 4°C: 1, 2, 3, 4, and 5 rpm (LV/SC4-31 and RV/SC4-18)
 - 25°C: 10, 20, 30, 40 rpm (LV/SC4-31); 10, 20, 30, 40, and 50 rpm (RV/SC4-18)

Procedure:

1. Connect the Small Sample Adapter's water jacket to the TC-550 SD Bath to stabilize sample temperatures at 4°C or 25°C.
2. For each test, immerse the sample chamber (SC4-31 or SC4-18) with the appropriate spindle in the pancake syrup sample.
3. Set the viscometer speed to the specified rpm for each temperature.
4. Record viscosity data at each speed increment, noting the shear-thinning behavior.
5. Repeat testing at both temperatures for a comprehensive viscosity profile.

Observations:

- Figure 1: Viscosity vs. Speed at 4°C and 25°C shows higher viscosity at 4°C than at 25°C, with viscosity decreasing as speed increases.
- Figure 2: Viscosity vs. Shear Rate demonstrates shear-thinning behavior across both temperatures.
- Figure 3: Log-log scale for Viscosity vs. Shear Rate provides a clearer comparison over a broad range, showing a larger viscosity range at 4°C.

Results:

- Pancake syrup exhibits higher viscosity at lower temperatures, confirming that viscosity decreases with increasing temperature and shear rate.
- Both instruments produce on-scale results across speeds and temperatures, though slower speeds were required at 4°C to maintain on-scale measurements.

Pancake Syrup at 4°C and 25°C / Small Sample Adapter

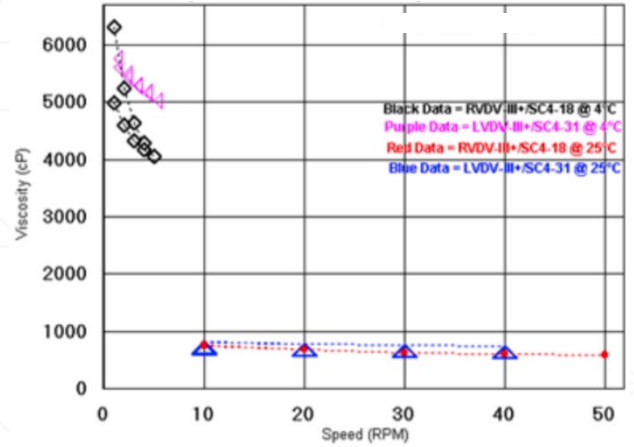


Figure I: Pancake Syrup at 4°C and 25°C; Viscosity vs. Speed, RPM

Pancake Syrup at 4°C and 25°C / Small Sample Adapter

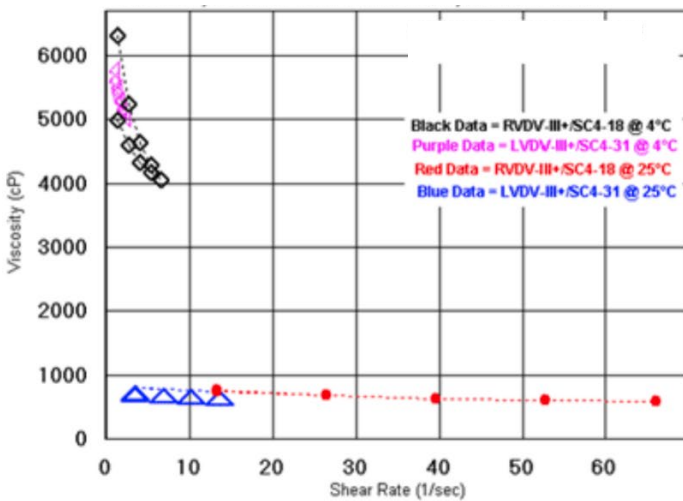


Figure II: Pancake Syrup at 4°C and 25°C; Viscosity vs Shear Rate, 1/s

Pancake Syrup at 4°C and 25°C / Small Sample Adapter

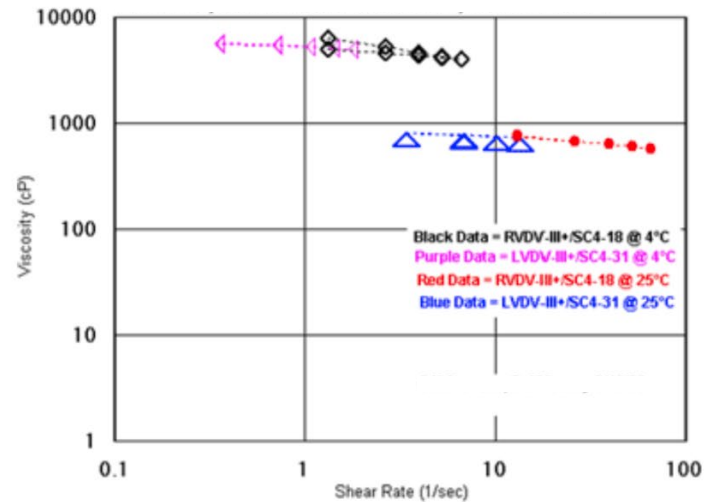


Figure III: Pancake Syrup at 4°C and 25°C; Viscosity vs. Shear Rate, 1/s "(log10 scale)"

Discussion:

Viscosity testing at multiple temperatures and shear rates ensures pancake syrup maintains its desired consistency under varying conditions. Shear-thinning behavior allows for easy pourability, while testing at 4°C and 25°C verifies the syrup's performance across storage and serving conditions.