GMIA STANDARD METHODS FOR THE TESTING OF EDIBLE GELATIN

2.2 Viscosity

PRINCIPLE

The viscosity of a 6.67% gelatin solution is determined at 60ºC by measuring the flow time of 100 mL of the solution through a standard pipette.

APPARATUS

1. PIPETTE: Calibrated 100 mL pipette with a precision capillary outlet and and upper and lower mark on the glass
2. THERMOSTATIC BATH: such as is available from Lurex Scientific (see Manufacturers of Equipment: Viscometer) equipped with thermostatic device, such as a heating circulator, to maintain 60.00 ± 0.05ºC.
3. PRECISION THERMOMETER: graduated in 0.01ºC with a long slim stem for measuring the temperature inside the pipette.
4. STOP WATCH: accurate to 0.01 seconds.
5. BALANCE: with 0.01 g sensitivity
6. WATER BATH: constant temperature at 65 ± 0.5ºC

PROCEDURE

1. Weigh 7.50 ± 0.01 g gelatin into a bloom jar or 150 mL beaker.
2. Add 105.0 ± 0.2 g deionized water, stirring often to suspend all gelatin particles
3. Cover and let stand 1 – 3 hours at room temperature
4. Dissolve the sample in a 65ºC water bath for 10 – 15 minutes, stirring or swirling as required.
5. When the temperature of the solution reaches 61ºC, and the sample is completely dissolved and thoroughly mixed, transfer the solution to the viscosity pipette and proceed with the viscosity determination.
6. Using a finger of the free hand cover the capillary end of the pipette and pour enough solution into the pipette to bring the level approximately 1 cm above the upper mark.
7. Place the thermometer inside the pipette and slowly raise and lower it until a constant temperature of 60.00 ± 0.05ºC is maintained.
8. Remove the thermometer from the pipette.
9. Read and record the time required for 100 mL of solution to pass through the capillary tube of the pipette by draining the gelatin solution and starting the stopwatch as soon as the meniscus of the liquid hits the top line of the pipette. Stop the stopwatch when the meniscus hits the lower line of the pipette.
10. Record the time obtained to the nearest tenth of a second; this value is the efflux time.

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CALCULATION OF VISCOSITY

The viscosity (to the nearest millipoise) at 60ºC of any sample with efflux time ***t*** (in seconds) may be calculated from the following equation:

$$V = (A\boldsymbol{t} - {}^{B}/_{\boldsymbol{t}}) \times d$$

V = Viscosity, in millipoises (mP)
A, B = A and B pipette constants (Refer to Annex I, Calibration of Viscosity Pipette, to obtain A and B constants, if not available)
t = efflux time, in seconds
d = solution density

Refer to Section D, Calibration, to obtain A and B constants, if not available.

For a 6.67% gelatin solution at 60ºC d = 1.001

PIPETTE CALIBRATION

1. Pipettes can be calibrated using two standard oils of different viscosities. The pipette must be thoroughly cleaned before the calibration and dried with reagent grade acetone.
2. Preheat both oils in a constant temperature bath set at 63-64ºC.
3. Obtain the efflux time (***t***), in triplicate, for each standard at 60ºC. Clean the pipette thoroughly between different oils using a suitable organic solvent for removing the oil and acetone to remove residual solvent and dry.
4. Calculation of the A and B constants:

$$B = \frac{\boldsymbol{t_1 t_2} (V_2 \boldsymbol{t_1} - V_1 \boldsymbol{t_2})}{\boldsymbol{t_2}^2 - \boldsymbol{t_1}^2}$$

$$A = \frac{V_1 + {}^{B}/_{\boldsymbol{t_1}}}{\boldsymbol{t_1}} = \frac{V_2 + {}^{B}/_{\boldsymbol{t_2}}}{\boldsymbol{t_2}}$$

V_1 = kinematic viscosity of lower viscosity oil, in millistokes
V_2 = kinematic viscosity of higher viscosity oil, in millistokes
$\boldsymbol{t_1}$ = average efflux time of lower viscosity oil, in seconds
$\boldsymbol{t_2}$ = average efflux time of higher viscosity oil, in seconds