Application Note
Change in viscosity during the gelatinization process

Industry	:	Food & beverage
Instrument	:	EMS Viscometer
Measurement method	:	Electro Magnetically Spinning Method
Standards	:	-

1. Overview

Gelatin, in addition to being a popular shape-preserving agent in desserts, is also widely regarded for its water retention, binding, stabilization, and emulsification properties.
In recent years, frozen meals have become popular, with gelatin playing a major role in the preservation of the quality and physical integrity of sauces, soups, and other meal components.
In this application note, the measurement of the dynamic viscosity of a gelatin solution during its gelatinization process using the EMS Viscometer, a non-contact viscometer that uses autoclavable and airtight sample tubes, is shown.

2. Precautions

If the instrument is set to measure at temperatures lower than ambient, make sure to introduce dry air into the instrument before starting measurement to prevent condensation.

3. Post-measurement procedure

All sample tubes and samples are discarded according to proper waste disposal procedures.

4. Apparatus

- EMS Viscometer
- Control Laptop PC
- Dry Air Unit
- Compressor

5. Reagents

- Sample: Jelly solution
  (0.75 g of leaf/sheet gelatin in 30mL of water, melted by heating to 60°C)

6. Procedure

1) Set the following measurement parameters in the EMSVisco software:

- Temperature :0, 5, 10, 15, 20, or 25°C
- Motor rotation speed :1,000 rpm
- Meas. time :I (1 second)
- Repeat times :100 times
  (measurements become interrupted as the sample starts to set/harden)
- Meas. interval :5 seconds

2) Transfer a 2mm diameter aluminum probe (φ2mm) and the gelatin sample (preprepared by heating to 60°C) into a sample tube, seal it with its tube cap and packing, set the sample tube into the EMS Viscometer, and then click the measurement button.

3) After the measurement has been completed, remove the sample, change the temperature setting, and after 10 minutes have passed, set a new sample into the instrument and begin measurement.

7. Results & Discussion

The viscosity changes that occurred during gelatinization are shown in Figure 1., and viscosity results recorded in 30 seconds intervals at each temperature point is shown in Table 1. The rate of gelatinization was notably dependent on the measurement temperature.

As one would expect, the jelly solution set/hardened faster the lower the measurement temperature was. The viscosity of samples measured at 20°C and 25°C showed little change over the 10-minute measurement period.

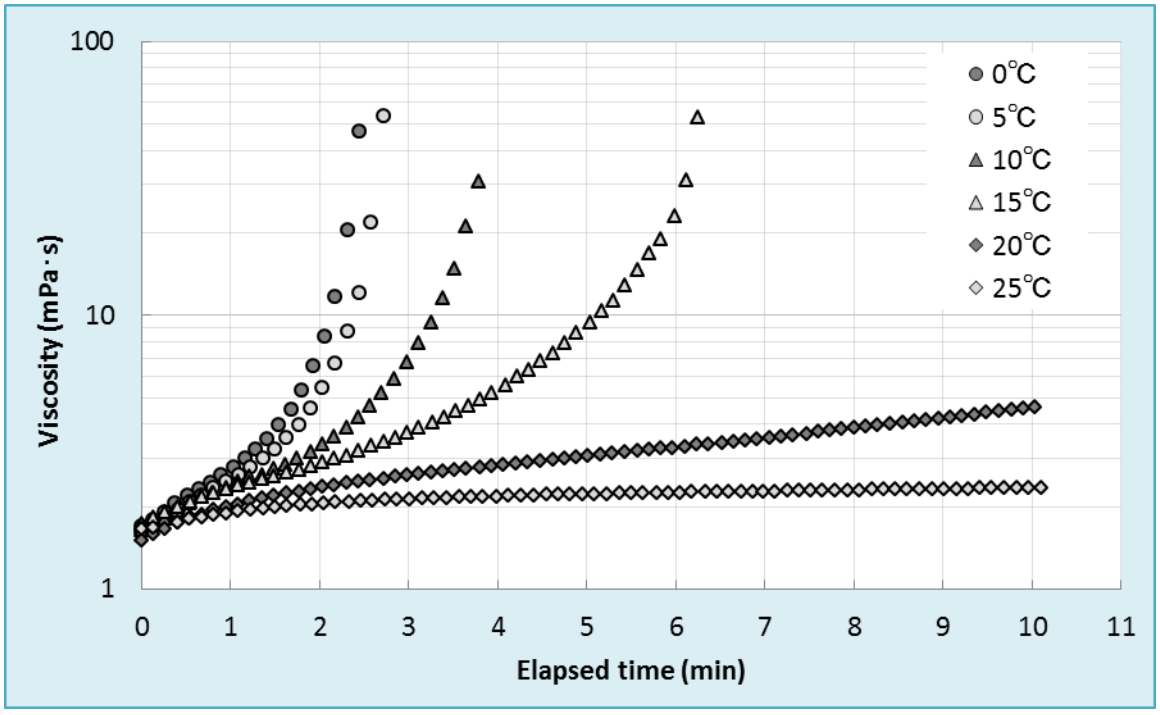

Figure 1. Change in viscosity of gelatin solution during gelatinization

Table 1.
The viscosity (mPa·s) of gelatin solution at 6 temperatures, measured in 30-second intervals

Elapsed time (min)	Temperature (°C)					
	0	5	10	15	20	25
0	1.69	1.61	1.64	1.67	1.52	1.66
0.5	2.19	2.08	2.06	2.01	1.83	1.81
1.0	2.78	2.48	2.49	2.25	2.00	1.90
1.5	3.96	3.24	2.76	2.52	2.20	1.99
2.0	8.41	5.42	3.37	2.82	2.36	2.05
2.5	47.0	21.8	4.68	3.09	2.48	2.10
3.0			6.76	3.57	2.60	2.14
3.5			14.8	4.24	2.72	2.16
4.0				4.94	2.81	2.19
4.5				6.34	2.94	2.20
5.0				8.60	3.06	2.22
5.5				11.3	3.16	2.24
6.0				18.9	3.29	2.25
6.5				85.0	3.43	2.27
7.0					3.55	2.28
7.5					3.71	2.29
8.0					3.88	2.30
8.5					4.01	2.31
9.0					4.20	2.33
9.5					4.41	2.33
10.0					4.63	2.35

8. Summary

The hardening process of gelatin can be confirmed numerically using the EMS Viscometer.

The EMS Viscometer handles smaller volumes of sample compared to conventional viscometers and features fast and accurate temperature control. As it only takes the EMS approximately 10 minutes to cool gelatin solution samples from 25°C to 0°C, you can evaluate the physical properties of them in a very short time.

9. References

None.