

Application Note

Temperature dependence of viscosity of starch

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

1. Overview

Starch is a polysaccharide composed of two kinds of macromolecules, amylose, and amylopectin, that are linked by glucose produced by photosynthesis.

In the food industry, starch is used as a thickener, a water retention agent, a texture improver, and a dispersing agent. In the pharmaceutical industry, it is used as an excipient for tablets, and a fermentation medium ingredient in antibiotic production. Starches are also used as adhesives with industrial applications.

This note contains an example application for the non-contact, airtight, and sterile measurement of the temperature dependence of the viscosity of starches using an EMS Viscometer.

2. Precautions

None.

3. Post-measurement procedure

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

4. Apparatus

- EMS Viscometer
- Control Laptop PC

5. Reagents

- Sample: Potato starch, Corn starch, Wheat starch
- Deionized water (diluent)

6. Procedure

- 1) Select sequence mode in the control software and set the following measurement parameters:
 - ✧ Temperature:
 - (i) Heating at 50°C for 5 minutes as pretreatment
 - (ii) Heating from 50°C to 95°C (2°C / min)
 - (iii) Keep at 95°C for 30 min
 - (iv) Cooling from 95°C to 50°C (2°C / min)
 - ✧ Motor rotation speed: 1,000 rpm
 - ✧ Meas.: I (1 second) ~ IV (30 seconds)
 - ✧ Repeat times: 1 time (continuously measure during the rise and fall of the temperature)
 - ✧ Meas. interval: 0 seconds
 - ✧ Hold time: 0 minutes
- 2) Transfer a 4.7mm diameter aluminum probe ($\phi 4.7\text{mm}$) and 700 μL of sample 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 measuring the first sample, measure the remaining samples using the same parameters.

7. Results & Discussion

Figure 1 shows the viscosity of the different starches at different temperatures. This type of graph is also known as an “Amylograph” and it is used to elucidate the temperature dependence of viscosity of starches, providing information on consistency and gelatinization behavior.

Each starch sample took approximately 90 minutes to measure over the prescribed temperature range, taking approximately 4.5 hours to analyze the 3 starch types.

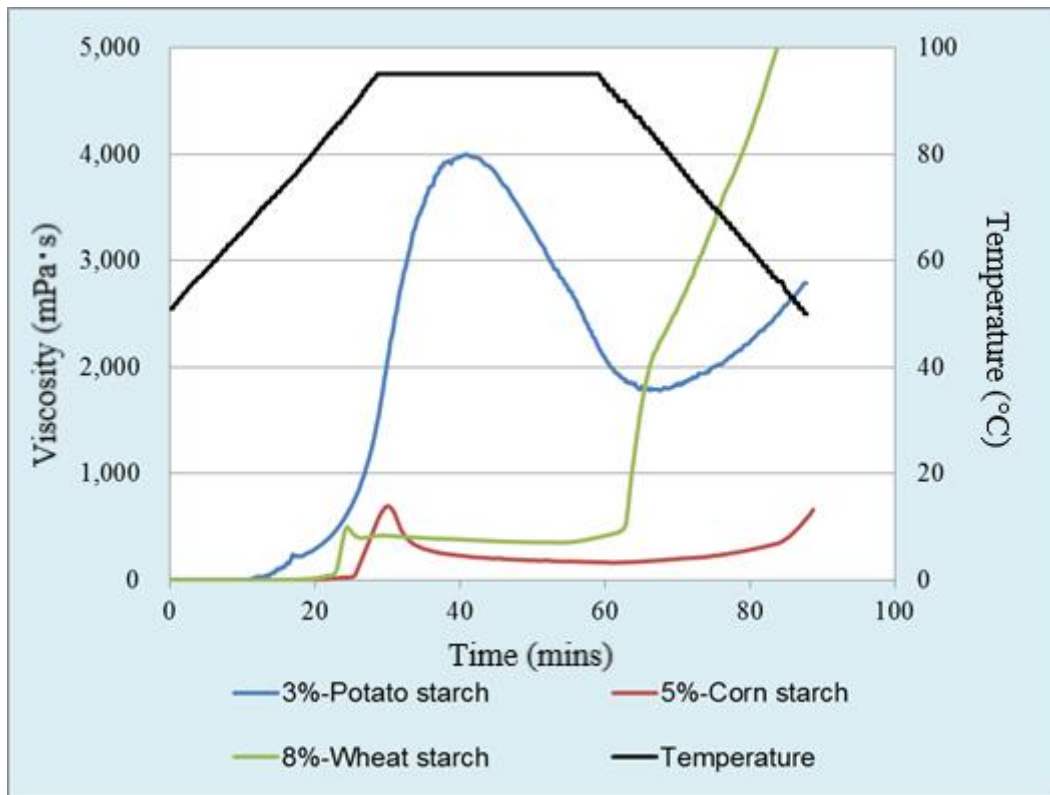


Figure 1. The temperature dependence of viscosity for 3 starch types

8. Summary

The EMS Viscometer was able to measure the viscosity of three 700 μ L starch samples over a temperature range of 50-95°C, providing an amylograph that can be used to elucidate characteristics such as each sample's consistency and gelatinization behavior.

9. References

None.