Application Note
Change in viscosity during the breakdown of gelatinized starch

Industry	:	Food & beverage, Pharmaceutical
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 viscosity of gelatinized starch as it is broken down with amylase, 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: Gelatinized 3%-Potato starch solution (1,000 mPa • s)
- 0.03 wt% α-amylase solution
- deionized water

6. Procedure

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

✧ Temperature	:25°C or 37°C
✧ Motor rotation speed	:1,000 rpm
✧ Meas. time	: I (1 second: enzyme-containing samples) II (5 seconds: samples without enzyme)
✧ Repeat times	:100 Times
✧ Meas. interval	:1 second
✧ Hold time	:5 minutes/300 sec

2) Transfer a 4.7mm diameter aluminum probe (φ4.7mm), 0.03g of potato starch, and 1000μL of deionized water to a sample tube, cap it, and set it into an EMS Viscometer that has been preheated to a temperature of 55°C. Pretreat the sample by letting it heat up in the instrument for 5 minutes.

3) Gelatinize the sample by raising the temperature in increments of 2°C every minute until 75°C is reached. Keep the sample at 75°C for 5 minutes to complete gelatinization.

4) Remove the gelatinized starch sample from the instrument and let it cool down to room temperature.

5) For test samples add 10μL of 0.03wt% α-amylase to the gelatinized preparation from 4). For control samples add 10μL of deionized water to the gelatinized preparation from 4). Following the addition of either amylase (test) or deionized water (control) immediately cap and set the sample tube in the instrument and start measurement.

6) Once the first measurement is complete, repeat the remaining measurements using the appropriate settings (4 types: 37°C control → 37°C test → 25°C control → 25°C test).

7. Results & Discussion

From the data gained in this experiment, potato starch breakdown appears to not only be influenced by the presence of amylase but also by the temperature. One would expect this trend to occur owing to the fact that amylase's enzyme activity is expected to increase with rising temperature.

For reference, the time required to measure each sample 100 times varied, with the quickest run being 7 minutes long and the longest being 15 minutes.

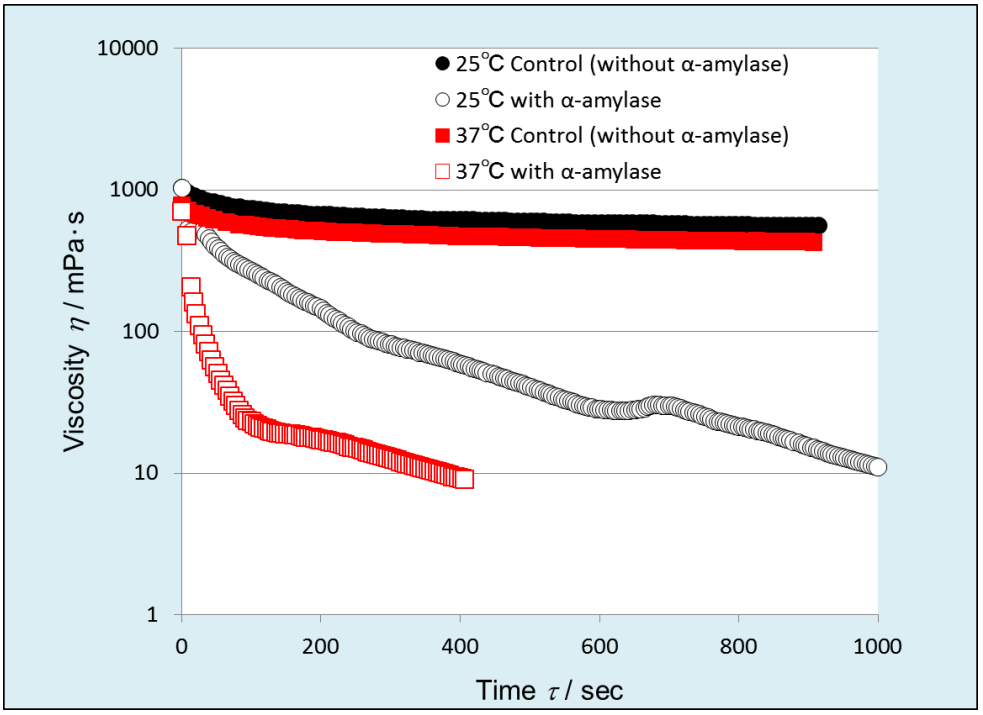

Figure 1. Change in viscosity during the breakdown of gelatinized starch

8. Summary

The viscosity-lowering effects of the amylase-directed breakdown of potato starch solutions were able to be confirmed by this application of the EMS Viscometer.

As the EMS Viscometer has fast, stable temperature control and uses hermetically sealable sample tubes, it provides great potential for researchers investigating the influence that concentration, temperature, and gaseous environment have on enzyme activity.

9. References

None.