SMALL SAMPLE BROOKFIELD (SSB) VISCOSITY

PRINCIPLE

The Brookfield SSB System provides a rapid method for measuring the viscosity profile of a starch slurry throughout temperature and time controlled cycles. The consistency of the starch slurry is continuously measured and recorded through a controlled temperature cooking program.

SCOPE

This method has been tested with unmodified and modified corn starch. The method can probably be applied to unmodified and modified starches from other botanical sources with changes of viscometer spindle speed, sample concentration and temperature/time cycle.

SPECIAL APPARATUS

1. Brookfield SSB System, consisting of RVDV II+ (or equivalent) viscometer, Small Sample Adapter, solid shaft spindle SC4-21SD (Note 1) and TC-111P programmable water bath (Note 2). Available from Brookfield Engineering Laboratories, Inc., 240 Cushing Street, Stoughton, MA 02072-2398. Telephone, 1-800-628-8139.

2. Strip-chart recorder or PC computer, compatible with data gathering software, as available from Brookfield Engineering for DV series viscometers.

3. Syringe for slurry sample injection, 10 mL, Varipet Teflon Tip, or equivalent, catalogue no. 71-620-100, Manostat, Inc., 519 8th Avenue, New York, NY 10018. Telephone, 1-212-594-6262.

PROCEDURE

Instrument Standardization and Calibration: Use an ASTM certified viscosity oil of 500 cps at 25 °C and an additional calibration at 49 °C. Run oil through a full sample test cycle, described below. The variation at 50 rpm should be no more than ± 15 cps from the stated ASTM value.

SMALL SAMPLE BROOKFIELD (SSB) VISCOSITY — continued

Preparation of Test Sample and Analysis: Determine the moisture content of the starch by an approved method. Choose an appropriate solids level for the specific starch, such that viscosity will not be less than 50 cps when cooked and held at 97 °C and in the range of 100-600 cps when cooled and held at 49 °C. Tare a beaker. Calculate the amount of starch needed to the nearest 0.01 g. Add a small amount of purified water (80-85% of the starch weight) and mix thoroughly to a thick wet mass (Note 4). Add additional purified water to bring the slurry to the desired total weight. Add a magnetic stirring bar, cover with a watch glass and stir for 5 mins. Preheat the viscometer cup and spindle to the cook temperature and hold for at least 3 mins. Start the recorder and/or the data gathering program. Inject 8.0 mL of the slurry sample and immediately start the viscometer and the water bath program (Note 5). See typical dry basis concentrations and instruments parameters in table below (Note 6).

STARCH Modifications	STARCH Solids, % db	SPINDLE Speed, rpm	COOK Temp., °C	COOK TIME Minutes	COOL Temp., °C	COOL TIME Minutes
Unmodified	6-7	50	97	10	49	9
Oxidized	10-30	50	97	10	49	9
Hydroxyethyl	5-25	50	97	6	49	9
Thin Boiling	10-30	20	97	10	60/65	9
Cationic, Thin B.	5-25	50	97	10	60	9

At the end of the final cycle, turn off the viscometer, push RUN/STOP to end the water bath program and to stop the data gathering, and/or turn off the strip chart recorder. Clean and replace the viscosity cup and spindle.

CALCULATIONS

Viscosity at peak, at the end of cook and cool times are reported in cps (centipoises) or mP (milliPascals) or the full graph is shown to illustrate starch cooking properties.

NOTES AND PRECAUTIONS

1. A flexible link spindle, SC4-21, also available form Brookfield Engineering, may precess at 50 rpm with some highly viscous starches and is not recommended.

SMALL SAMPLE BROOKFIELD (SSB) VISCOSITY — continued

2. A 2-bath system (MVA viscometer) has also been used and may still be available at some laboratories. It requires careful monitoring of the temperature in the sample cup, which is quite sensitive to small variations of water flow rate.

3. Refer to Brookfield Engineering manuals nos. M/92-161-G894 and M/94-075 for utility requirements, optimum placement and system set up. Since circulating water is at high temperature, use only reinforced tubing and insure that all tubing connections are tight and secure. Avoid touching the water jacket during the heating cycle.

4. The consistency of the wet mass should be such that the stirring rod will "cut" it. This sample preparation is essential when dealing with dry starch samples. The purpose is to achieve complete hydration of the test sample outside of the viscometer, thereby greatly increasing the reproducibility of the method.

5. There should not be a delay of more than a few seconds between introduction of test sample and start of test.

6. The parameters may be changed depending on the properties of the individual starch (starch code) being evaluated.

REFERENCE

Anderson, K., and Naujoks, B., The SSB Viscometer System: Starch Application, Cargill, Inc. (1994).

METHOD HISTORY

Corn Starch (Unmodified), Small Sample Brookfield Viscosity (SSB) (B-54), Date of Acceptance 4-09-1998.