

RVA™ Viscosity of Cationic Starches

Newport Scientific Method ST-04, Revision 3, November 1998

Developed by A. E. Staley Manufacturing Co., Decatur, IL 62525, USA

Principle

A starch slurry is cooked at 95°C (203°F) then cooled to 50°C (122°F), and its viscosity measured, using a Rapid Visco Analyser (RVA). High shear is used during cooking to approximate typical processing conditions for these starches.

Scope

The method is applicable to cationic corn starches (waxy and dent), including those which have also been acid-thinned. These industrial starches are used widely for wet end, size press and coating applications in papermaking.

Procedure

See Method ST-00 for details on procedure, apparatus, reagent and sample weight calculation. Use deionized water for sample analysis.

Instrument Profile

Time	Type	Value
00:00:00	Temp.	50°C
00:00:00	Speed	960 rpm
00:00:10	Speed	160 rpm
00:01:00	Speed	900 rpm
00:01:00	Temp.	50°C
00:03:00	Temp.	95°C
00:25:00	Temp.	95°C
00:25:00	Speed	160 rpm
00:27:00	Temp.	65°C
00:37:00	Temp.	65°C

Idle Temperature: 50 ± 1°C

End of Test: 37 min.

Time Between Readings: 4 sec.

Starch Concentration

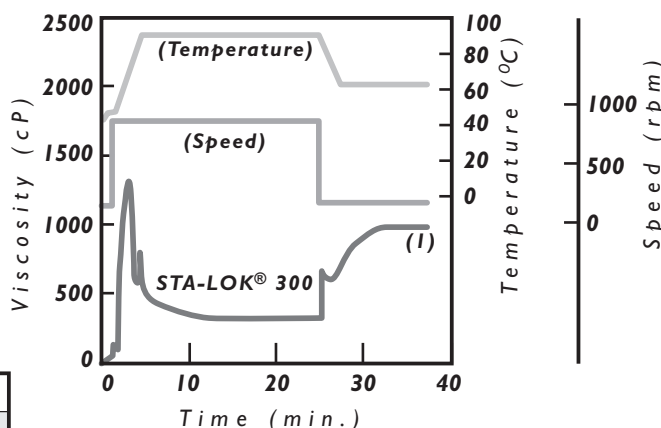
Relative Viscosity	Starch Concentration (dry solids, % w/w)	Example of Starch
High	10	STA-LOK® 180, 300
Medium	20	LOK-SIZE® 30
Low	30	ELECTRA® 7458

Results of Analysis

Analysis	Starch Type
(1) Viscosity at end of test (cP)*	All ✓

*Subtract viscosity at 0.50 minutes from value to give final result.

Example



Precision

The following precision statistics were obtained from analysis of five replicates of STA-LOK® 180 starch analysed by two operators on three different RVAs (n=15), using water.

Statistic	Analysis Type: End Viscosity
Mean (cP)	793
Standard Deviation (cP)	25
Range (cP)	85
Coefficient of Variation (%)	3.13



General Method for Testing Starch in the Rapid Visco™ Analyser

Newport Scientific Method ST-00, Revision 3, November 1998

Developed by A. E. Staley Manufacturing Co., Decatur, IL 62525, USA

Principle

A starch suspension is cooked under a defined temperature and shear protocol, and its viscosity continually recorded, using a Rapid Visco Analyser (RVA).

Scope

This general procedure is applicable to all of the Staley starch testing methods using the Rapid Visco Analyser (RVA). The specific information for each method is given in the subsequent method pages.

Apparatus and Reagents

1. Rapid Visco Analyser model RVA-3D, 3D+ or 4.
2. Computer, IBM compatible, capable of running RVA control software.
3. RVA canister and stirrer.
4. Balance, accurate to ± 0.01 g.
5. Teflon stirring rod.
6. NIR or other source for moisture value.
7. Deionised water, or unsalted pH 6.5 buffer.

Buffer Formula

Weigh 0.8 g methyl p-hydroxybenzoate and 0.2 g propyl p-hydroxybenzoate into a 250 mL beaker; add 150 mL distilled water; and heat to boiling to dissolve the solids. Put 700 mL of distilled water into a one litre graduated cylinder and add the hot solution to the graduate. Add distilled water to make one litre. Transfer the solution to a beaker and add 10.0 g anhydrous dibasic sodium phosphate,

2.0 g sodium benzoate, and 2.7 g granular citric acid ($C_6H_8O_7 \cdot H_2O$). When the solids are all dissolved, adjust the pH to 6.5 using a pH meter. Add citric acid if the pH is more than 6.5 or dibasic sodium phosphate if the pH is less than 6.5.

Safety Precautions

Observe all safety precautions from the manufacturers of the equipment used in carrying out this test procedure.

Instrument Preparation

Switch on the RVA and allow 30 min. warm up. Switch on the associated computer; run the RVA control software, and select or enter the profile for the chosen method.

Sample Preparation

1. Determine sample moisture content (% as is) using an approved method applicable to the sample matrix.
2. Select starch concentration based on starch viscosity from the relative viscosity table in the chosen method as outlined in Newport Scientific methods ST-01 to ST-06. The sample concentration should be selected to provide an end viscosity of 800-1500 cP.
3. Calculate sample weight (S) and water or buffer weight (W) to use based on the moisture content and selected starch concentration.

The following formulae may be used:

$$S = (28 \times C) / (100 - M)$$

$$W = 28.0 - S$$

where S = corrected starch weight (g)
C = dry starch concentration (%)
M = actual moisture content of starch (% as is)
W = water or buffer weight (g)

Example

For a sample of 11.4% moisture, at 5% dry concentration:

$$\text{Sample weight} = (28 \times 5) / (100 - 11.4) = 1.58 \text{ g}$$

$$\text{Water or buffer weight} = 28.0 - 1.6 = 26.4 \text{ g}$$

Sample Analysis

1. Weigh S g ± 0.01 g sample as calculated in Sample Preparation, Step 3 into a new canister.
2. Add water or buffer to sample to give a total mass of 28.0 ± 0.1 g, and homogenise suspension with a teflon stirring rod.
3. Place a paddle into the canister and insert the canister into the instrument. Initiate the measurement cycle by depressing the motor tower of the instrument. Remove canister on completion of test using an insulating glove and discard.

Results of Analysis

From the viscosity curve, determine the parameters listed in the results of analysis table for the chosen method.