rva world

the new standard

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Plant Breeding Investment for China

China has begun investing heavily in plant breeding programs to improve the quality of their fruit, vegetables, wheat, rice, corn and potatoes. To introduce the advantages of applying the RVA to plant breeding problems, a seminar entitled 'Rapid Visco Analyser Applications to Plant Breeding: An Introduction for Plant Breeders', was held at the Academy of Agriculture, Beijing, recently.

Professor Lu Xiao at the China seminar

Attracting around 50 scientists, the seminar was co-ordinated by the Ministry of Agriculture and organised by Professor Lu Xiao from the Rapid Visco Analyser Support Centre China, with the assistance of Professor Jiang Shiquiang and Professor Wu Yide. The speakers, all presented papers on a variety of topics and included: Prof Lin Liping from Guangxi (sweet potatoes); Dr Yao Danian from An Hui (noodles); Dr Bao Jinsong from Zhejiang (rice); Mr Chen from Zhejiang (rice); and Professor Lu Xiao from Shandong (general applications).

Customer Service 'Europe Direct'

During the coming year, customer support for our European RVA users will be available direct with Mark Bason establishing a Newport Scientific office in Italy.

Mark can be contacted for applications and software assistance any time via your local Newport Scientific representative. Meet up with him at conferences or arrange for him to visit your site where you can explore the application of RVA technology together.

Thailand Seminar Success

Charpa Techcenter, RVA local representatives in Thailand, are delighted with the response to this year's RVA Special Interest Group Seminar where the focus was on novel RVA applications. Papers included 'Application of RVA to Optimisation of Sulfur Dioxide Concentration in Cassava Starch Manufacturing' by Dr Klanerong Sriroth, Assistant Professor of Biotechnology at Kasetsart University, Bangkok; and 'Measuring Gluten Quality in Flour - A Novel Method Using the Rapid Visco Analyser' and 'Progress Towards an Industry Standard for Starch Analysis' by Bronwyn Elliott, Newport Scientific's Product Manager.

RVA Goes to Tibet

RVA will reach new heights in 1999, with the first installation in Tibet at the Plant Breeding Institute at Lhasa. The RVA will be operated at an altitude of over three thousand metres or 10,000 feet(!) and will be cared for by Miss Deji Ju Zhen and Miss Cizhen Tzujun. It will become an integral part of a program to breed improved wheat, suitable for the growing conditions in Tibet.

What's New at Newport

Newport Scientific understands how important Y2K compliance issues are to our customers. Keep in touch with the latest news and updates through our website: **www.newport.com.au**

Thermocline for Windows Version 2.1 is now being shipped with all new RVA-4s and RVA-Super3s. TCW version 2.1 includes new features, fixes and, of course, universal four digit year format for year 2000 compliance.

In this issue

If you're serious about starch . . . there is only the Rapid Visco™ Analyser

The Correlation of Classical Starch Fluidity Analyses with Pasting Curve Analyses by Rapid Visco Analyser

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Introduction

Fluidity determinations of starch pastes have been used since before the turn of the century to measure the degree of thinning or degree of depolymerization imparted to a starch by various modification processes such as acid modification and oxidation. Fluidity is reported as the volume of starch paste of a specific concentration that exits a calibrated orifice in a specified length of time. Generally, the smaller the average size of the starch molecules, the thinner the starch paste, and the higher the fluidity measurement. Principal among the refined, time-honored fluidity tests are the Clinton Funnel Fluidity Test (Fetzer and Kirst, 1959) and the Buel Fluidity Test (Buel, 1912).

Thinned, depolymerized starches are used in mining, paper making, textile weaving, adhesive manufacturing, and processed food applications. The fluidity range and reasonable lot to lot reproducibility are required to achieve uniformity in the manufacturing process and the resulting product.

The fluidity tests require unusual equipment which is, at best, hard to find and often must be fabricated. The tests are fraught with pitfalls which can mislead even the most expert technicians into producing erroneous results, and which also contribute to the high relative standard deviation of some of the fluidity tests.

Since the tests require a relatively long time to run and to produce an answer, they are expensive in terms of costly technician time, and in-process tests which require over 30 minutes, places control of the batch process of product in some jeopardy.

This study demonstrated the usefulness of Rapid Visco Analyser pasting curves for predicting the results that have historically been obtained from fluidity measurements and efflux time measurements.

Materials and Methods

Samples used in this study were a commercially produced yellow dent corn starch, acid modified starches produced according to Shildneck and Smith (1967), and hydroxyalkyl starches prepared according to Hjermstad (1967), some of which were subsequently hydrolysed to varying degrees of depolymerization according to Shildneck and Smith (1967).

Phosphate Buffer at pH 6.0 was prepared according to AACC Standard Method.

Clinton Funnel Fluidity was determined according to Fetzer and Kirst (1959).

Buel Fluidity was determined according to Buel (1912). Alkaline inherent viscosity was performed according to the Standard Analytical Methods of the Member Companies of Corn Refiners Association with the modification of cooking the starch in the RVA at 30% ds in distilled water using the pasting profile described below. Following completion of the pasting curve, the canister was brought back to its initial weight to offset evaporation. A portion of the paste was diluted with water and 2.00 M NaOH to 0.5% starch solids in 1.00 M NaOH. The efflux time of this diluted solution was measured using a calibrated Cannon size 1 viscometer.

results between countries although the Australian wheats generally had higher peak viscosity and breakdown values than the Chinese wheats. Protein content did not affect RVA pasting properties of these samples.

Starch Pasting Profiles

Time (min.)	Value
Idle Temp	50.0°C
0.0	160rpm
1.0	50.0°C
7.0	95.0°C
17.0	95.0°C
20.0	65.0°C
25.0	65.0°C
25.0 min.	(end of test)

Table 1.
RVA Profile for Clinton Funnel Fluidity Comp.

Time (min.)	Value
Idle Temp	50.0°C
0.0	160rpm
1.0	50.0°C
5.0	95.0°C
6.0	95.0°C
6.0 min.	(end of test)

Table 2.
RVA Profile for Buel Fluidity Comparison

Time (min.)	Value
Idle Temp	50.0°C
0.0	160rpm
1.0	50.0°C
5.0	96.0°C
16.0	96.0°C
20.0	38.0°C
32.0	38.0°C
32.0 min.	(end of test)

Table 3.
RVA Profile for Inherent Viscosity Comparison

Starch Pasting Profiles

Starch pasting profiles were produced using Newport Scientific Rapid Visco Analysers. Starch was weighed into a tared aluminium RVA canister, and the total weight adjusted to 30.00 g with AACC pH 6.0 buffer or water. Solids levels were adjusted to keep the pasting curves on scale. The stirring paddle was inserted into the canister and manually spun and pumped for 30 seconds to suspend the starch thoroughly. The pasting test was begun immediately.

The relationships of the fluidity measurements and the inherent viscosity measurements to their RVA pasting values were determined with Table Curve 2D Automated Curve Fitting Software, Jandel Scientific, San Rafael, CA.

Results and Discussion

Clinton Funnel Fluidity

The average time for a Clinton Funnel test is approximately 40 minutes, with the technician spending 4-8 minutes on the analysis. The corresponding RVA analysis takes 25 minutes, with technician time reduced to approximately 2-4 minutes.

The relative standard deviation of an acid modified starch analysed 6 times by Clinton Funnel was 2.0% with an average of 103 +/- 2mL. The corresponding RVA analysis (8 replicates) had a relative standard deviation of 2.1% when the average was 1108 +/- 23 cP.

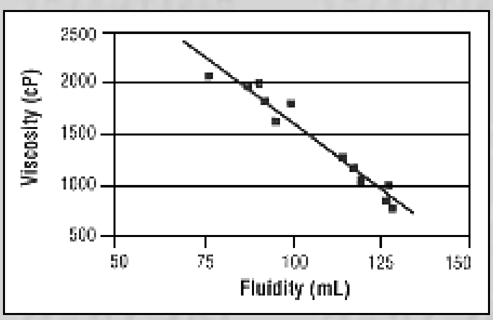

Figure 1. Relationship of RVA Viscosity @ 25 min. to Clinton Funnel Fluidity
RVA = 4227 - (25.95 * Fluidity)
R^2 = 0.95

Buel Fluidity

Once a laboratory is set up to run Buel Fluidities, a measurement requires about 45 minutes, with technician time of about 19 minutes, The corresponding 6 minute RVA test reduces technician time to about 2 minutes. When hundreds of samples are being tested, the economic saving in costly technician time becomes significant. When an acid modified starch was tested 10 times for Buel Fluidity, the relative standard deviation was 2.5% with a mean of 34.4 mL, while 10 replicated RVA viscosity measurements gave a relative standard deviation of 3.8% with a mean of 3043 cP.

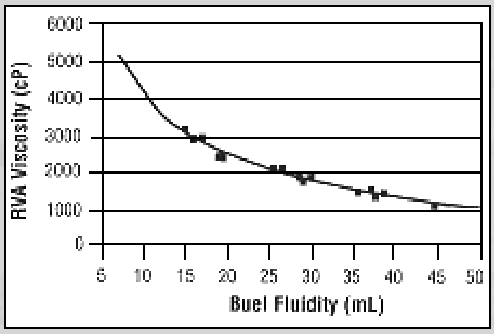

Figure 2. Relationship of RVA Viscosity @ 6 min. to Buel Funnel Fluidity
RVA = -3898 + 14278 * Buel-0.28
R^2 = 0.977

Inherent Viscosity

Inherent viscosity is a very precise measurement which can be related to average molecular size of polymers such as starch (Helm, 1986). A modified version of this method was used in which the starch was cooked in the RVA at 30% ds in distilled water.

An Alkaline Inherent Viscosity Test takes 2.0 to 2.5 hours, with the technician totally occupied during the measurement, making this a very costly analysis.

Technician involvement during the RVA test is only about 3 minutes, making the RVA test much more cost effective. Moreover, it is particularly important that since the response time of the RVA test is approximately 40 minutes, it is useful as an in-process test, while the lengthy Alkaline Inherent Viscosity Test would not be.

Final viscosities from the RVA pasting curves of acid hydrolysed hydroxyalkyl starches were compared with Alkaline Inherent Viscosity. A wide range of acid modifications were used, with each starch having the same level of molar substitution.

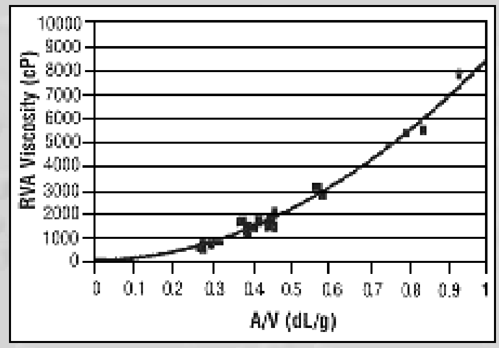

Figure 3. Relationship of RVA Viscosity @ 32 min. to Alkaline Inherent Viscosity
(RVA = 1.05 * AIV1.96)
R^2 = 0.98.

A precision study was carried out using a starch with a mid-range viscosity, tested 10 times using both methods. The Alkaline Inherent Viscosity had a relative standard deviation (RSD) of 3.8% with a mean of 0.557 dL/g, while the RVA final viscosity had a RSD of 3.3% with a mean of 2720 cP. Thus, the RVA results are at least as precise as the Alkaline Inherent Viscosity data.

concluded on page 4

Conclusions

When the appropriate pasting profiles and starch solids are selected, the Rapid Visco Analyser can be used to predict Alkaline Inherent Viscosity, Buel Fluidity, and Clinton Funnel Fluidity accurately. The results obtained are at least as precise as the historical methods. The Rapid Visco Analyser methods, however, involve much less technician time, and they usually provide faster analytical response times. This results in significant economic savings as well as better control of operations.

Acknowledgments

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Meet the People:

Robyn Day

Celebrating 10 years with Newport Scientific last December, Robyn joined the company in 1988 as Personal Assistant to the Managing Director. She is now the Executive Administrator which incorporates not only internal office management but also import and export duties and, with a background in banking, she oversees all aspects of the company's accounts.

Robyn is a real 'people person', always offering a warm welcome to visiting overseas customers and helping new members of staff at Newport settle in. This year you can see her smiling face at Seattle when she attends her first AACC Conference.

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