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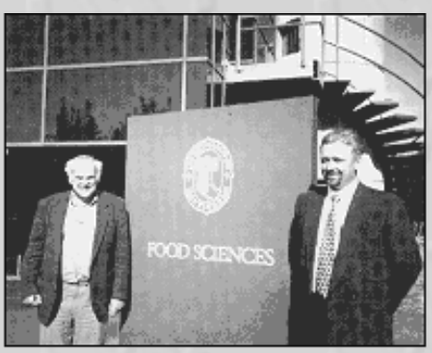
RVA™ at Nottingham University

Professor J. R. Mitchell, Professor of Food Technology in the Department of Applied Biochemistry and Food Science, has just taken delivery of a new RVA-4 on behalf of The University of Nottingham, Sutton Bonington Campus in England.

Professor Mitchell has formed the 'INTERACTIF Club' to formalise the relationship between the University and a group of large food companies who will meet regularly to hear scientific presentations and discuss possible joint research initiatives.

The RVA will be a vital part of a project to increase the understanding of thermal mechanical conversion of starch, and measurement of starch conversion during the extrusion process. It is hoped that this information can then be applied to more conventional forms of starch processing. The objective of the work will be to provide for wheat, potato and maize systems, calibration relationships between the RVA and more fundamental techniques.



Professor Mitchell and Stephen Pike, Calibre Control UK (the UK/Scandinavia Distributor).

Chinese Institute for Nuclear Agricultural Research

The Institute for Nuclear Agricultural Research located in Hangzhou, China, has purchased a Rapid Visco Analyser for their work in developing improved rice varieties for China. The Institute is recognised as being a significant contributor in the field of nuclear agriculture and has received a grant from the United Nations Development Program to purchase the RVA. Professor Shu, who recently completed his doctorate studies in the USA, is in charge of the project.

Rod Booth, Managing Director of Newport Scientific, visited the Institute to oversee the installation of the instrument and train staff in its operation. Newport Scientific continues to cooperate with a number of laboratories in China on the development of RVA techniques suitable for testing Chinese cereal crops and traditional Chinese foods.

Chinese National Research Institute

Recently, Newport Scientific entered into a cooperative research project with the China National Rice Research Institute. The objective of the project is to develop methods and techniques for assessing the quality of Chinese table rice and processed food rice using the RVA. Newport Scientific will donate an RVA-3D+ to the Research Institute and, initially, they will test the applicability of the international methods approved for the RVA to Chinese rice varieties. The Institute will then develop techniques for selecting raw materials and process control for traditional Chinese rice-based foods such as rice noodle, cakes and snacks.

Interlaboratory Ring Trial

The American Association of Cereal Chemists Physical Testing Committee has given their approval to commence an interlaboratory ring trial of the "A. E. Staley Methods". The methods have been designed for use on the RVA-3D+ and RVA-4 instruments and aim to clearly demonstrate starch functionality, reliably, repeatably and consistently between sites. The trial will most likely be conducted in conjunction with the AOAC.

In this issue

Summary of RVA Papers Presented at the 1997 Annual Australian Cereal Chemistry Conference

Natalie Turner
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Australia is a major producer and exporter of cereal products and has a very active research community in the cereal chemistry area. The Royal Australian Chemical Institute has an annual Cereal Chemistry Division Conference with the latest one being held in Perth on 14-19 September 1997. Over 100 research papers were published in the conference proceedings. Of these, 14 papers involved the use of the Rapid Visco Analyser (RVA). These proceedings are not readily available in many parts of the world, so a summary of the latest work presented at the conference which involves the RVA is given below.

Assessment of Wheat Quality

Batey et al (1) used the RVA to determine pasting differences of wheat starches and compared these results with starch compositional results. They found that peak viscosity was negatively correlated with residual protein content in the starch ($r^2 = -0.75$). There was no relationship between protein content of wheat and the viscosity of the isolated starch. The higher the content of B-type starch granules the lower the peak viscosity while starches with a larger mean granule size had a higher peak viscosity. They showed (Figure 1), as also reported by Sharma et al (2), that there was a negative correlation between starch peak viscosity and amylose:amylopectin ratio. The RVA was also used by O'Shea and co-workers (3) to study the effect of amylose:amylopectin ratio. They were able to classify wheats into low, medium and high viscosity samples.

A series of Australian and Chinese wheat flours were tested using a range of methods, including RVA analysis by Zhu et al (4). They found that there were no significant differences in RVA 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.

Allen et al (5) reported the use of the RVA for determining pasting properties of wheat for use in the production of steam buns. They found that steam buns produced from flours grown in different locations had different bun scores, which are dependent upon flour, crust and crumb colour. Further work is being carried out on the use of pasting characteristics to evaluate wheat quality for production of steam buns.

The RVA was successfully used to predict expansion ability of starch/protein premixes for extrusion applications (6). Wheat flours were blended with lupin flour, tested raw, then extruded. Raw physical properties were compared to final product (after extrusion) quality. RVA pasting temperature and setback were found to be good indicators of extrusion quality.
Raw and cooked pasta made from Australian and imported wheat flours were tested using an RVA by Clarke and co-workers (7). They found that there were small differences between the raw pasta samples but the cooked pasta made from the Australian wheats was significantly different to the pasta made from the imported wheats. The pasta made from the Australian wheats had higher peak, breakdown, final and setback viscosities than those made from the imported flours.

Corke (8) reported the usefulness of the RVA for determining the suitability of a range of starches for end use. The RVA was used for wheat, sweet potato and chemically and physically modified starches. The RVA has been shown to be able to differentiate between starches suitable for different products such as wheat and sweet potato starches for noodle manufacture.

Assessment of Oat Quality

Zhou et al (9) presented three posters, which involved the use of the RVA for determining differences in oat quality. They studied the effect of oat lipids, storage, processing, sowing date, soil nitrogen and plant density on oat pasting properties. They found that the quantity and source of the oil affected pasting properties. Peak and trough viscosities were negatively correlated with oil content while setback and pasting temperature were positively correlated (Figure 2).

Final viscosity changed for ground groats during storage, which may be attributed to lipid rancidity or interaction between lipids and starches, while there were few changes for whole groats. There was no common trend in the changes between varieties or with varying lengths of storage time. Processing (rolling, steaming or kilning) increased the viscosity of the oatmeal compared to the raw curve. RVA results for the processed samples showed little variation between the processing methods (10).

Trough and final viscosity and pasting temperature increased with late sowing while increased use of nitrogen decreased peak viscosity. Viscosity curves also varied with variations in plant density, increased plant density increased trough, final and setback viscosities (11).

Barley for Malting

The RVA was used to investigate the pasting properties of barley, barley starch and enzyme treated barley by Dunn and co-workers (12). It was found that there were differences in pasting characteristics between varieties and sites. Peak temperature, peak viscosity and trough viscosity were negatively correlated with mean large starch granule diameter (MLSGD) which is in contrast to the results found for wheat (1).

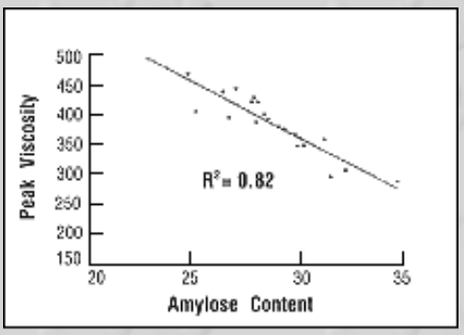

Figure 1.
Relationship between starch amylose content and peak viscosity. (From Batey et al., 1997, Proc. 47th Cereal Chem. Conf., Melbourne, Australia, p. 370.)

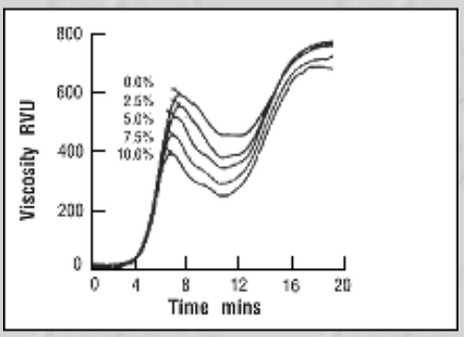

Figure 2.
Oat flour (Yarran) substituted with various levels of oil (Mortlock). (From Zhou et al., 1997, Proc. 47th Cereal Chem. Conf., Melbourne, Australia, p. 311.)

High MLSGD is related to high malt extract levels, therefore, there is a good correlation between peak temperature and malt extract (Figure 3). The pasting temperature of barley starch could be used to predict the malt extract potential of barley.

Legume Starch Functional Properties

A range of legume starches, including dun pea, faba bean, vetch, mung bean and wheat were analysed in the RVA by Htoon and co-workers (13). They found that mung bean had the highest viscosity and breakdown while wheat and vetch starches had the lowest peak viscosities. Wheat had a high breakdown while vetch had one of the lowest breakdowns. In general, the pasting properties of wheat starch were very different to those of the legume starches.

Assessment of Triticale

The functional properties of triticale were compared to wheat (14). It was found that triticale did not produce a peak when tested at the same concentrations of wheat in the RVA. The triticale had a flat curve with little change in viscosity as it went through the heating cycle.

Conclusions

The RVA was used to analyse pasting properties of wheat used for pan bread, steamed buns, extrusion, pasta and noodles. RVA results correlated with residual protein, amylose:amylopectin ratio and starch granule size with growth site having a less dominant effect on quality. Peak temperature of barley starch showed promise as a means to estimate potential malt extract. The RVA was also used for oat, triticale and legume applications to indicate variously the effects of species, variety, growth site and of Processing.

References

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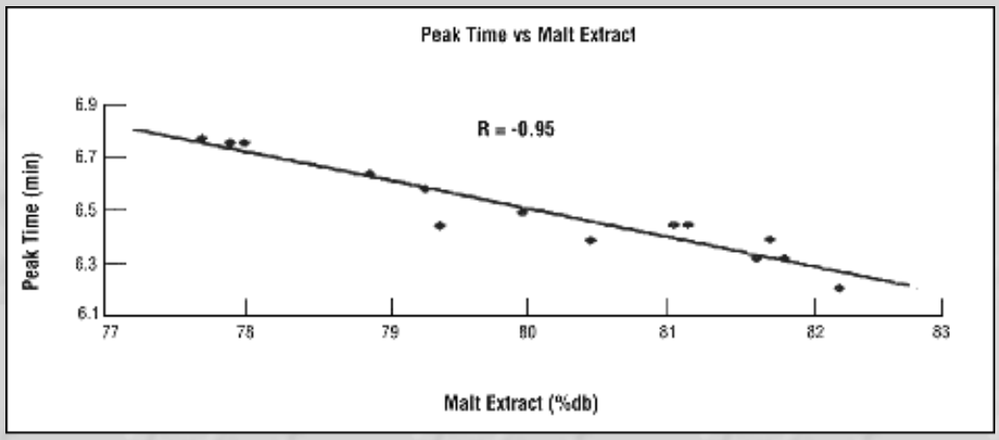


Figure 3.
Relationship between barley starch peak time and malt extract. (From Dunn et al., 1997, Proc. 47th Cereal Chem. Conf., Melbourne, Australia, p. 192.)

Rapid Visco Applications: Japanese Rice Method

Ken' ichi Ohtsubo, NFRI, MAFF, Japan

Japanese rices are carefully bred and selected to suit the Japanese preference for soft and tender cooked rice quality. Kinuhikari and Sasanishiki are excellent varieties in the Japanese rice market.

The rapid method for testing rice in the RVA, AACC Method 61-02, has been widely used to assess rice quality. Developed as a screening testing in rice breeding programs, the method involves a compromise between test speed and ability to distinguish similar varieties.

Through a joint study between several universities and national and public institutions in Japan, a slower and more discriminating test for rice quality using the RVA has been deveoped (Ohtsubo et al., 1995, see profile). This method uses 3.50 g ground white or 4.00 g ground brown rice (14% mb) in 25.0 ml water.

Profile

Time	Type	Value
00:00:00	Temp.	5O°C
00:00:00	Speed	960 rpm
00:00:10	Speed	160 rpm
00:01:00	Temp.	5O°C
00:05:00	Temp.	93°C
00:12:00	Temp.	93°C
00:16:00	Temp.	50°C

Idle temperature: 50 ± 1°C
End of test: 19 min.
Time between readings: 4 sec.

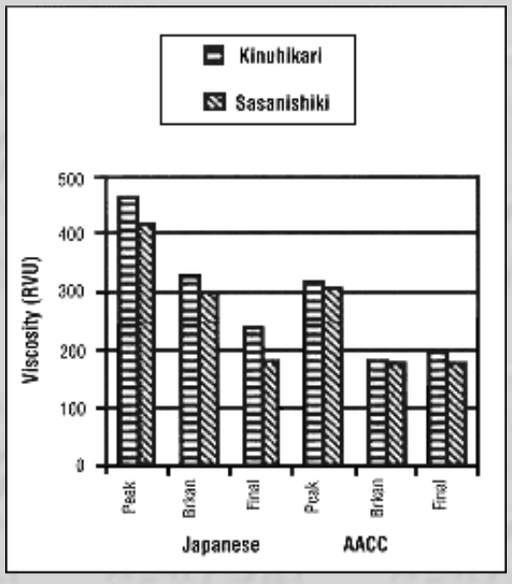


Figure 1.
RVA pasting viscosities of two varieties of Japanese rice using the Japanese and AACC methods.

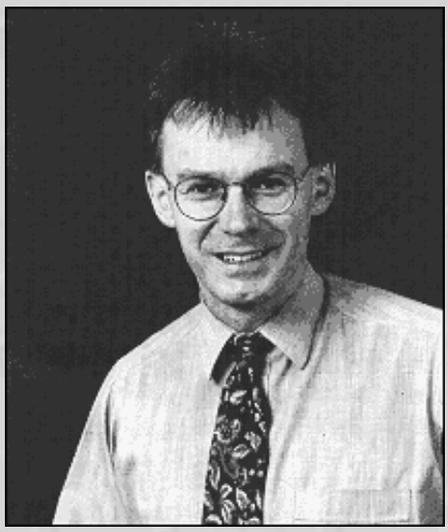
Kinuhikari and Sasanishiki rice varieties show very similar characteristics. These varieties were more readily distinguished by the Japanese Method than by the AACC Method, as shown by the increased differences in the peak, breakdown and final viscosity values (Figure 1). The Japanese method is useful for characterising rice varieties that are similar to each other.

Ohtsubo, K, Minamizawa, M., Yoshida, T., Nakajima, S. and the Food Agency. 1995 Rice Post-Harvest Technology, Chapter X - Quality Control. The Food Agency, Ministry of Agriculture, Forestry and Fisheries, Japan.

Meet the People:

Geoff Drane

Since August 1997, Geoff has been working at Newport Scientific as Senior Manufacturing and Development Manager. With degrees in both science and electrical engineering from Sydney University, he also has a Diploma of Computer Science from City University, London.



Prior to joining Newport, Geoff had 18 years' working in high technology electronic and electrical engineering, including experience in radar, industrial controls and extensive experience in medical electronics. He has also had experience in product design, development and manufacturing; quality systems operation; and project team and departmental leadership and management.

As Senior Manufacturing and Development Manager, Geoff is responsible for both development of new products, product improvements and variations and for oversight of operations in the manufacturing unit.

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