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## Danisco's Hydrocolloid Diagnostics with the RVA™

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Danisco utilises the RVA to aid our determination and diagnosis of hydrocolloid blends as a reliable and robust tool to ensure satisfactory product development quality and standardisation. The gelling/thickening profile of a system as it is cooled from 80°C to 20°C can give a fingerprint of that particular hydrocolloid's behaviour.

Highlighted here are examples of carrageenan—kappa, iota and hybrid—as well as guar, LBG and xanthan. Hybrid carrageenan contains domains of kappa and iota molecules within the same chain and, as such, has properties of its own. It is well known that guar and LBG interact with xanthan where the optimum ratio of mixing is 1:1 and 1:2 respectively.

The carrageenan samples contained starch, sugar, milk protein and 0.2% carrageenan in each case. The guar, LBG and xanthan systems were made up from 1% aqueous solutions in the appropriate blending ratios. In each case the run conditions of the RVA were: cooling from 80°C to 20°C at the rate of 1°C per minute after an initial holding time of 5 minutes at 80°C and 5 minutes at 20°C. The speed used was 160 rpm

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Seen in Figure 1 are the gelling profiles of three types of carrageenan: kappa, hybrid and iota. Each clearly shows individual profiles and this information is easily obtained from the RVA. It can then be used to aid product formulation and quality as well as provide insight into the likely textural properties as the system is cooled. These fingerprints are very useful to determine quickly the types of carrageenan present in a system and potentially estimate their quantities.

Figures 2 and 3 show the gelling profiles of guar, LBG and xanthan; and guar-xanthan and LBG-xanthan mixtures respectively. Again, it is clearly seen that each hydrocolloid produces a specific fingerprint profile from which it can be characterised. The data from the RVA can be used not only to give insight into product quality etc. but also to examine onsets of structural transitions within hydrocolloid mixtures, as seen for LBG-xanthan. The onset temperature of the presence of junction zones or coil transitions can be hinted at by these results.

The RVA, therefore, represents for us a quick and easy-to-use instrument that provides us with gelling/thickening profiles from small quantities of sample. The profiles gained act as a fingerprint for

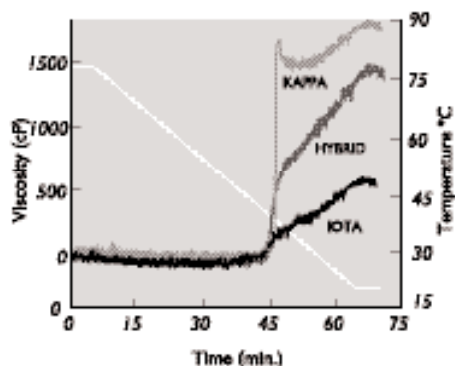


FIGURE 1

The gelling/thickening profiles for three types of carrageenan: kappa, hybrid and iota.

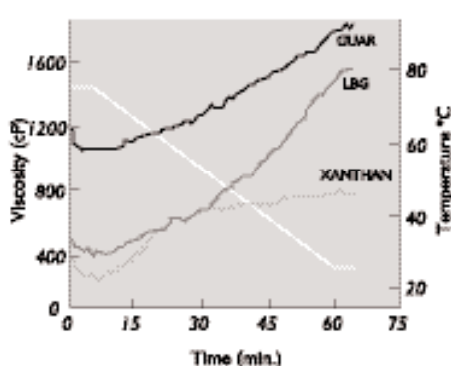


FIGURE 2

The gelling/thickening profiles for aqueous 1% guar, LBG and xanthan solutions.

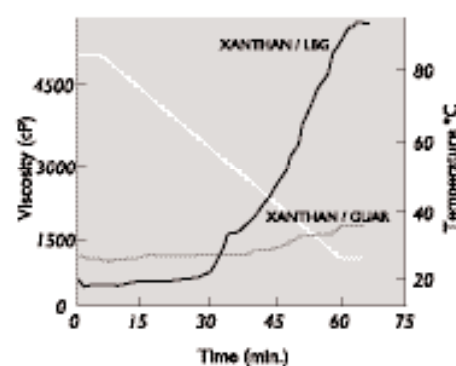


FIGURE 3

The gelling/thickening profiles for xanthan-guar and xanthan-LBG mixtures.

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particular hydrocolloids allowing us to determine which hydrocolloids are present in a blend and, indeed, allowing the estimation of quantities. The RVA represents, for us, a practical tool for product development and an excellent tool for product standardisation.

Grateful acknowledgements are paid to Tina Knudsen and Dorte

Stenbæk who carried out the experiments presented here.

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## Pasting Characteristics and Tandoori Roti Quality

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Summary of a presentation at the Inaugural RVA™ Interest Group Meeting in Delhi, India, March 2003

Tandoori roti is a staple bread item in India and neighbouring countries and is now gaining popularity in Western countries. The dough is made from wholewheat flour sheeted traditionally by palm to 15 cm diameter and 3 mm thick and baked in a tandoor oven.

Flour produced in a plate mill has high damaged starch content (up to 15% or more) and is most suitable for preparation of tandoori roti, although if the amount of damaged starch is >15% the flour is unsuitable because the roti is too sticky to sheet evenly.

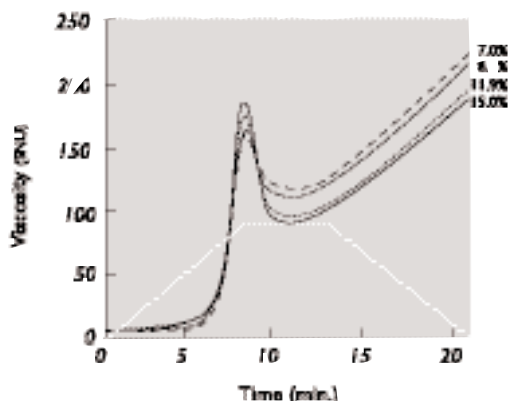
An RVA heating rate of 6°C per minute was found to be optimum for RVA analysis of flour with varying levels of starch damage to be used for roti making, and revealed increasing peak viscosity and

decreasing hot paste (trough) and cold paste (final) viscosity with increasing starch damage (see graph).

The appearance, mouthfeel, handfeel and texture of tandoori roti improved with damaged starch content in the flour, although mouthfeel became doughy and moist over 15% damaged starch. The optimum damaged starch content for tandoori roti was found to be 14.0-15.0%.

There was a good correlation between starch damage and RVA parameters (see table) indicating that the RVA could be used to predict quality of flour for roti making.

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Effect of damaged starch on the pasting behaviour of wholewheat flour.

VARIABLE CORRELATED	CORRELATION COEFFICIENT
Starch damage vs peak viscosity	+0.73*
Starch damage vs hot paste viscosity	-0.88**
Starch damage vs cold paste viscosity	-0.91**
Starch damage vs overall quality of roti	+0.91**

\*P<0.5, \*\*P<0.01

## CONGRATULATIONS

**P**rofessor Chuck Walker, Professor of Grain Science and Industry at Kansas State University, has been elected Fellow of the American Association of Cereal Chemists.

Professor Walker has been involved with the RVA since 1987 when, on sabbatical in Sydney, he eagerly undertook the task of evaluating the RVA's potential for starch characterisation which has since become the main application of the RVA world wide.

Professor Chuck Walker (left) with Newport Scientific's Managing Director, Rodney Booth.



## Use of the RVA™ for Bench-scale Manufacture of Stirred Yoghurt

Summary of a poster paper by Adrian Pollard, Louise Bennett, Martin Houben, Jennifer Robertson, Geoffrey Smithers, Ragini Wheatcroft, and Hubert Roginski presented at 26th IDF World Dairy Congress, Paris, 2002

It is difficult to control variables in bench- and pilot-scale manufacturing of stirred yoghurts precisely which undermines these approaches for troubleshooting or undertaking process optimisation.

The RVA has been used to simulate stirred yoghurt manufacture on a miniaturised scale (30 g). The method involved standardising the milk and homogenising at 50°C. A sample of standardised, homogenised milk (30 g) was placed in the RVA and heat treated (93°C for 6 min.) before inoculating with starter cultures. After fermentation at 42°C to the target pH of 4.55, the sample was subjected to a post-production storage period for 18 hours at 4°C.

The final viscosity of the yoghurt was determined using an RVA program designed to stir the yoghurt to a smooth consistency of constant viscosity, before averaging the final 20 readings (750 rpm for 3 min., then 500 rpm for 3 min., then 150 rpm for 10 min., conducted at 10°C). The yoghurt was further characterised in terms of firmness, syneresis, nodulation, and particle size using standardised and validated methods.

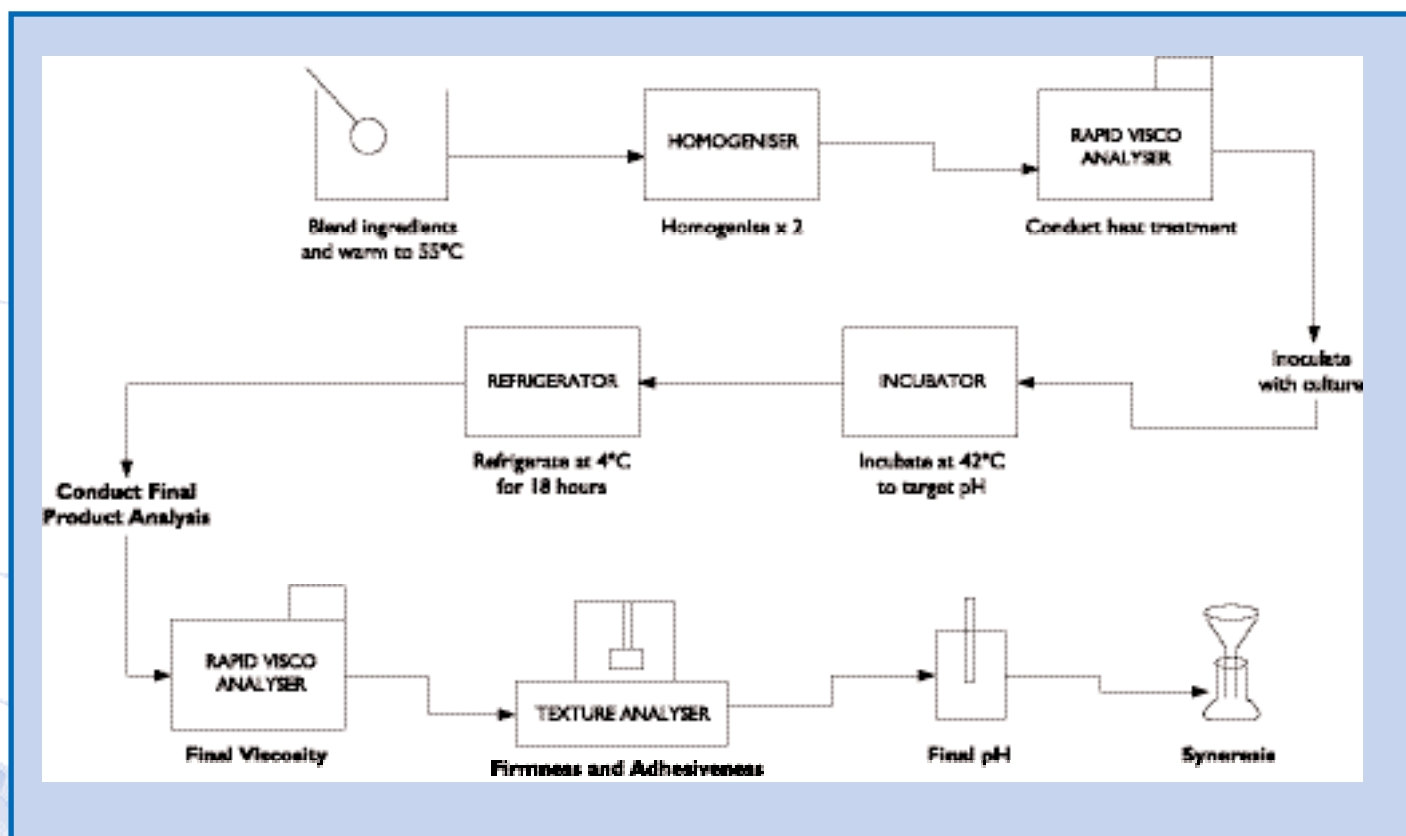
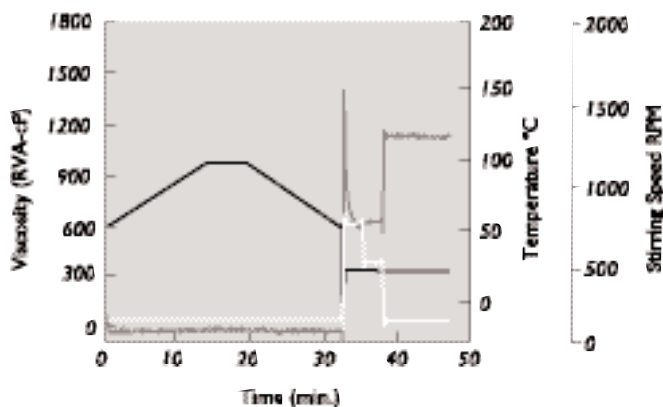
Using the RVA method, the final yoghurt properties of replicate batches are consistent to within 5%, demonstrating the usefulness of the RVA for systematic study of stirred yoghurt quality and troubleshooting of processing and formulation problems.

### ACKNOWLEDGEMENTS:

Financial support for this project by the Institute of Land and Food Resources, The University of Melbourne, Food Science Australia, National Foods Ltd, the Dairy Research and Development Corporation, and the Victorian Department of Primary Industries is gratefully acknowledged.

Left: RVA profile for yoghurt manufacture.

Below: Schematic diagram of yoghurt processing in the RVA.



## European Seminar Papers

Newport Scientific Europe, in conjunction with Foss Benelux, presented a European Seminar in Amsterdam in March 2003. The program, organised by Corinne Charrié (Newport Scientific Europe) and Nico Muts (Foss Benelux), included practical and theoretical workshops with presentations on RVA technology and applications by scientists from research and private industry throughout Europe. Papers included:

- An overview of RVA technique and performance capabilities, presented by Mark Bason, Newport Scientific Pty Ltd
- Starch and its behaviour when sheared above room temperature in water, presented by Professor Jan Delcour, Katholieke Universiteit, Leuven
- Significance of viscosity profile of pasted and gelled formulated doughs on bread staling, presented by Dra Concha Collar, Laboratorio de Cereales IATA-CSIC, Spain
- Processing of maize and the resultant RVA profile, presented by Sandra Hill, University of Nottingham, England
- The RVA and hydrocolloid diagnostics: unlocking the secret of hydrocolloid blends, presented by Niall W. G. Young, Danisco A/S, Braband, Denmark
- Tips and tricks for instrument operation, sample preparation, how to operate, dos and don'ts, and method development, presented by Corinne Charrié, Newport Scientific Europe
- The relationship between Hagberg Falling Number,  $\alpha$ -amylase activity of wheat grains and the wholemeal pasting properties determined by the Rapid Visco Analyser, presented by Jonathan Lenartz, Département Qualité des Productions Agricoles, Centre de Recherches Agronomiques de Gembloux, Chaussée de Namur 24, B-5030 Gembloux, Belgium
- Application of RVA to quality evaluation of Italian bread wheat cultivars (normally and partially waxy) and Triticum monococcum genotypes, presented by Gaetano Boggini, Experimental Institute for Cereal Research Section of S. Angelo Lodigiano, Italy (*Paper not available for distribution*)
- New tools for new tests in cereal rheology, presented by Mark Bason, Newport Scientific Pty Ltd

If you would like a copy of any of these presentations please contact [support@newport.com.au](mailto:support@newport.com.au)

## TIPS & TRICKS

### Solving Enzyme Problems in the RVA™

*Sometimes a little chemical assistance can be called for when there are enzymes in your RVA sample. Use of chemicals will usually affect viscosity results, so chemical type, amount and sequence of addition should be standardised for comparative tests.*

- To optimise enzyme activity, buffers can be used with the sample instead of water. For example, cereal  $\alpha$ -amylase pH optimum is approximately 5.6. Take care because change in pH can also affect protein solubility (isoelectric point).
- Silver nitrate 0.1 mMol per 1.0 g sample can be used to inhibit enzyme activity. For example, it is commonly used to inhibit  $\alpha$ -amylase activity. You will need to use coated RVA canisters and gloves when handling silver nitrate.
- EDTA 500 microequiv./g can be used to inhibit enzyme activity. For example, it is an anti-chelating agent useful for amylase. In addition, it is a food approved ingredient.
- Acids and bases (pH 3 or pH 11) are useful to inhibit enzyme activity. You will need to avoid pH extremes which can cause starch gelation (pH>10) or dextrinisation (pH<3).

### References

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