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Ideas and information from milling and baking research

Milling & Baking News
NEW ZEALAND

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What does the Falling Number measure?

Anomalous results of some mill stream samples

The Falling Number is routinely used as an empirical measure of sprout damage in wheat flour. Falling Number values below 200-250 s are assumed to indicate high α-amylase levels. However some unusual test results from the Millstreams project recently demonstrated the fallacy of assuming that Falling number results measure or relate directly to α-amylase levels.

For the Millstream Project several wheat lines were milled at BRI Australia. All mill streams (stocks) were tested for their content of α- and β-amylases, Falling Number (FN) values and by other tests. Few of these have previously been measured in different millstreams.

For most cultivars, the millstreams gave Falling Number results of 300-500 s. However, for the strongest cultivar, Frame, most millstreams gave Falling Number results of over 500 s and the break 2 and 3 samples had Falling Numbers of 835 and 1203 s, respectively.

Therefore, it was a great surprise to find that they also had the highest α- and β-amylase levels. The graph compares the α-amylase and Falling Number results for the straight run flour and break stocks for Monad and Frame.

To understand why the relationship between Falling Number and α-amylase results is different in Frame, we examined other analytical data for this cultivar. Falling Number values measure the hot paste viscosity of the flour or meal, which mainly depends on starch properties. Alpha-amylase affects that result because it degrades the starch.

Firstly, Frame millstreams break 2 and 3 had very high protein contents of 22 and 26% and therefore contained less starch. The break 4 flour had even higher protein than these but its Falling Number was lower, although still very high. These millstreams also had strong mixing properties.

The structure or type of starch could affect Falling Number results. Less starch was damaged during milling of these Frame millstreams than in any other millstream/cultivar combinations, which would make them less vulnerable to amylases. The ratio of amylose to amylopectin could also affect pasting temperature and strength. Both of these starch properties seem to be involved, as shown by their weak correlations with Falling Number results.

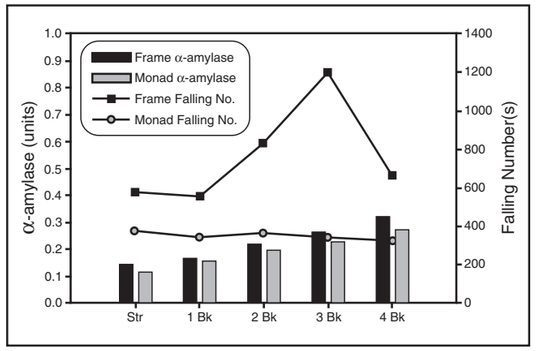

Figure: α-amylase content and Falling Number values of Frame and Monad straight run and break millstreams.

When barley α-amylase was added to the Frame break 3 flour, its Falling Number value reduced similarly to other samples. However, the bread made from this mixture showed less deterioration in crumb doughiness, texture and loaf volume than similar mixtures of other flour samples. The very high Falling Number results for Frame seem to result from a combination of high protein, low starch content, low starch damage and a changed amylose/amylopectin ratio, but may also depend on other factors.

Dr Dale Every delivered the poster paper, "Amylase, Falling Number, Polysaccharide, Protein and Ash Relationships in Millstreams", by Dale Every, Jafar Al-Hakkak, Marcela Ross, Lyall Simmons and Sarah Hawkins, to the "9th International Symposium on Pre-Harvest Sprouting in Cereals" in South Africa in late June. The conference proceedings will be published in "Euphytica". A poster entitled "Breeding white grained sprout-resistant wheat in New Zealand" by Steve Shorter, Bill Griffin, Cathy Munro and Kevin Sinclair was also presented at the conference.

Government to form new Ministry of Food

In May the Government announced the intention of creating a separate Food portfolio with its own Minister, vote and advisory board. The new agency's responsibilities are still being decided. It will work with the Ministry of Health, MAF, ANZFA and the District Health Boards and will use MAF's administrative services.

The Flour Milling and Baking Industry Research trusts publish this newsletter with Crop & Food Research to present the results of levy-funded research and other information relevant to New Zealand industry.

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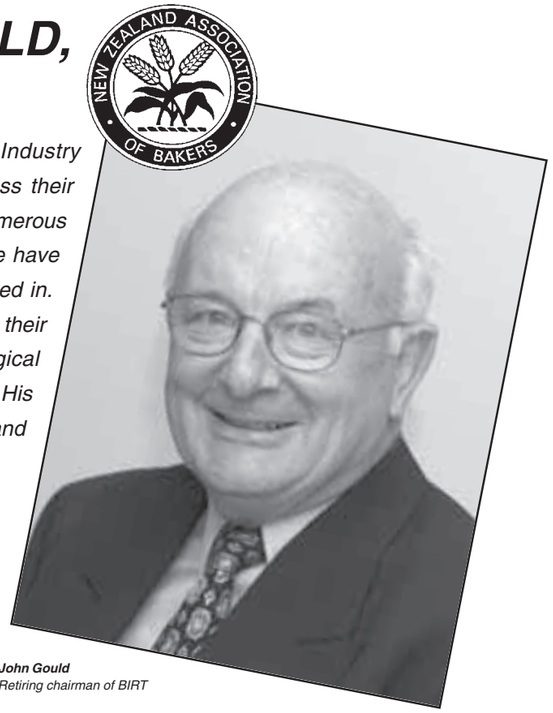
A TRIBUTE TO JOHN GOULD, retiring chairman of BIRT

As John retires from his role as Chairman of the Baking Industry Research Trust (BIRT), industry people would like to express their thanks for his contribution and dwell for a moment on the numerous innovations he has driven over the last 50 years. Few people have made a real and positive difference to the industry they worked in. Even fewer would be viewed as those with the vision to take their industry to another level through innovation and technological breakthrough. John Gould has achieved all of this and more. His services to the industry have been honoured with the New Zealand Order of Merit and life membership of the Bakers Association.



John Gould
Retiring chairman of BIRT

While many now in the baking industry may feel that MDD baking has been around forever, those who are a little older know that it is a relatively "new" baking process. John was, in fact, one of the key people responsible for implementing MDD technology in New Zealand and also drove many innovations to optimise it. In particular, his vision has meant that NZ bakers have been well-placed to harness the opportunities made available through new wheat varieties in a cost-effective manner and without "additives" such as potassium bromate. Many of the specialty bread products in the market place today would simply not be available without this research and even the standard white loaf would not be the same quality and volume that it now is.

Many will know that John has vast experience in the bread-baking arena and his time spent on yeast and enzyme technology has also been put to great use over the years. Recently, John was enthusiastically championing the process of patenting unique enzyme technology for both the bread and pastry sectors. The extended bread proovers now used throughout both the Australian and NZ factories had their beginnings in the yeast research work commissioned by BIRT.

Great communication and a passion for getting things done have always been some of John's key attributes. It is, therefore, no surprise that John has been the lynchpin for ensuring the various sectors of the baking industry have worked together to achieve a common goal on many occasions. John's work on the standardization of the Australian and New Zealand Food standards on behalf of the entire industry is also worthy of recognition. Who else would have had the stamina and the ability to see this process through?

Perhaps of most benefit, though, has been John's ability to "think outside the square" and ensure the baking industry looked externally as well as internally for new ideas. John is one of the truly creative people within the industry and he has used this creativity to ensure that all flour levy payers benefit from research. His broad interest base, including the complementary knowledge of wine and people, has always been put to good use.

From a committee perspective, John is a person of great integrity whom we admire immensely, not only for his contribution to the industry but also for his zest for life. We shall miss his contribution to BIRT and we thank him for ensuring that research still has an active role to play in the industry today.

Enjoy your retirement, John. It is bound to be filled with excitement.

(Annette Campbell, on behalf of the BIRT Committee.)

Take care if using microwaves to heat liquids

The University of Canterbury has emailed a warning that several people have received severe burns and scalds when using microwaves to heat liquids. In one case a vessel exploded, shooting the microwave door across the room. Simply heating water in a cup to make coffee has caused accidents when the liquid exploded over people's hands or face, in one case damaging their sight. This can also occur if microwaves are used to heat solutions such as sugar syrups.

The problem occurs when liquids are heated using microwaves in a very smooth container such as a glass beaker. In this situation, liquids can become superheated without forming any bubbles. As soon as the container is moved or something is added to it, the liquid can erupt out of the cup. Therefore, it is preferable not to heat liquids using microwaves, especially not large amounts. If a microwave oven must be used in this way, place something that provides a surface for bubble formation, e.g. a teabag or a plastic spoon, in the container before heating it. Ensure you don't overheat the liquid and after heating it leave the container in the oven for 30 seconds before moving it or adding anything.

How long before we can measure the elasticity of a single gluten molecule?

Dr Jafar Al-Hakkak recently used an atomic force microscope to see if it would provide useful information about starch structure. But what is an atomic force microscope?

Atomic force microscopes (AFM) provide a unique window to the micro-world of sub-cellular structures and biomolecules. AFM can be used to visualize objects of 5 and possibly even as small as 0.1 Angstrom. This means that AFM can form three-dimensional (3D) images of a wide variety of structures ranging in size from whole cells to molecules and even atoms. To put this in perspective, the smaller type of wheat starch granules are about 60 thousand angstroms in diameter (1m = 10 000 000 000 Angstroms).

AFM has several exciting advantages over electron microscopy. AFM can form images of biological specimens in their natural state and can scan a sample repeatedly to observe dynamic processes as they occur. AFM has been used to:

- picture changes in protein molecules as they are assembled or digested by enzymes (for example, collagen being degraded by collagenase).
- measure the changes in structure and volume of living cells and relate these to changes in cell biochemistry.
- measure molecular forces such as hydrogen bonds and electrostatic forces.

AFM has a great advantage over electron microscopy because samples do not have to be placed in a vacuum. This means that living cells can be used and samples don't require complex preparation which often distorts samples.

Integrating AFM with other techniques makes it even more powerful. For example, antibodies labelled with fluorescent markers have shown two active sites on the anti-blood clotting factor heparin. The binding of the proteins actin and myosin to form actomyosin during muscle function has been studied using AFM. AFM has been used to measure physical properties such as the elasticity of cells (hence the title of this article). To do this, a nano force is used to indent a structure such as a cell membrane and the depression in its surface is measured.

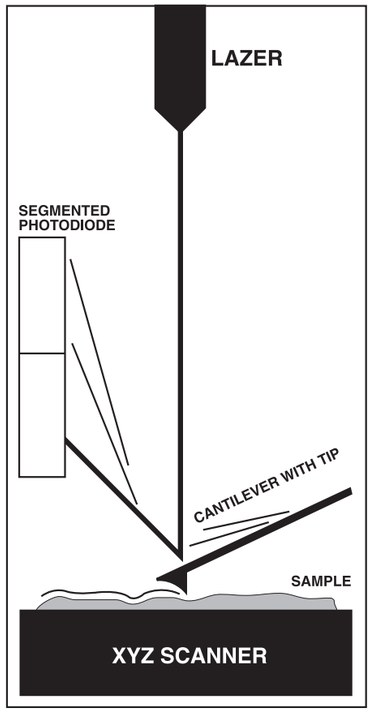


Figure: Atomic Force Microscope

The diagram shows how AFM works. AFM has been compared to an old-fashioned vinyl LP record player needle that runs over the surface of a sample and measures the height of the "needle" at each location. AFM measures the miniscule force between the "needle" and the atoms of the sample (hence atomic force). It uses this measurement to keep the distance between them at just a few atom diameters. Sophisticated electronics amplify the distance measurements to form a 3 dimensional scan of about 100 nm of the sample surface.

Milling & Baking Website live in July

The FMRT & BIRT Info Centre web site goes live on 13 July, the result of a joint venture between BIRT and FMRT, and Crop & Food Research, who are responsible for designing and maintaining the site.

The web site will augment the existing Information Project which makes scientific and technical knowledge readily available to the flour milling and baking industry, as well as to the public. The web site is an exciting new medium for promoting the industry, and aims to become the principal mode of communication for the provision of information services, with an online inquiries service, information search facility and links to relevant web sites in the pipeline.

The site will be developed in phases over the next two years, beginning with information about BIRT and FMRT, an events diary and electronic copies of Milling & Baking News, and finally becoming a fully functional online Info Centre. The web site can be reached on the web at:

www.bakeinfo.co.nz *and* ***www.flourinfo.co.nz***

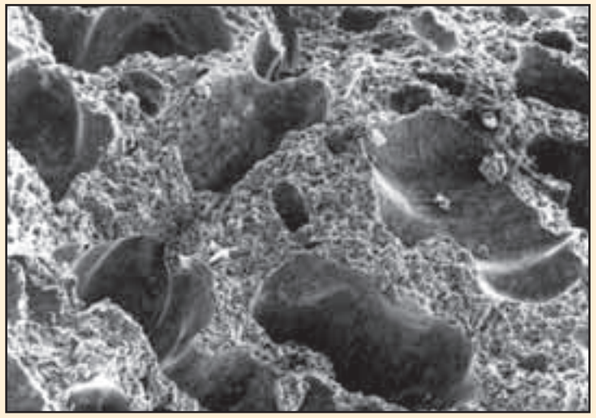


Photo: Gluten under the microscope - see info series for more information on gluten.

Flour Milling & Baking School Info Series available on CD Rom

The New Zealand Cyberguide to Flour Milling and Baking is now available on CD Rom from the Information Centre at Crop & Food Research. Initial research into the production of a CD Rom version of the Flour Milling & Baking School Info Series was funded by BIRT and FMRT. Crop & Food Research continued the development of the CD Rom and are now offering this excellent resource for sale.

The Cyberguide is a valuable source of information for teachers, students and anyone interested in wheat, flour, bread or baking. There are information and activity sheets on a wide variety of topics, from the history of wheat in New Zealand to the ingredient labels on bread packaging. These are accompanied by a teachers' guide and a guide to activity objectives. There are also recipes for bread, pastry, biscuits and pasta, as well as information on careers in the flour milling and baking industries.

The CD costs $50. Information and activity sheets are also available for purchase as hard copy. For more information or to place an order, email the Information Centre on millbake@crop.cri.nz, or telephone on (03) 325 2704.