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Using RVA™ Analysis to Study the Effect of Milling on Rice Pasting Characteristics

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INTRODUCTION

The primary purpose of milling is to remove the germ and bran layer from the kernel endosperm. The quantity of bran removed is referred to as degree of milling (DOM) and the intended use of rice dictates the level of bran removal (Terry & Meullenet, 2004). The aim of this study was to show the effect of milling degree on pasting properties of nine Australian rice varieties.

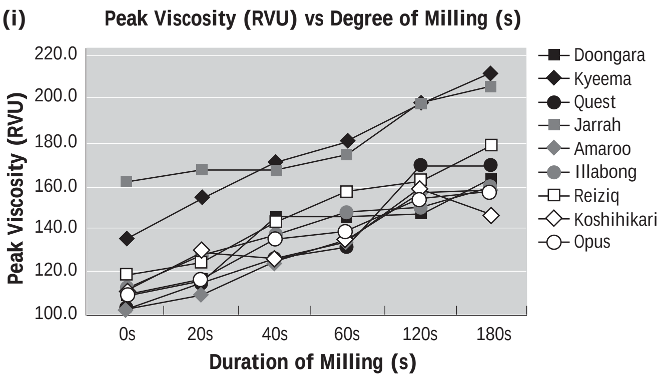
MATERIAL AND METHODS

Nine Australian rice cultivars (Doongara, Kyeema, Quest, Jarrah, Amaroo, Illabong, Reiziq, Koshihikari, and Opus) were used in this study. Paddy rice from each cultivar was first dehusked using a THU35A Test Husker (Satake, Japan) and subsequently milled for 0s, 20s, 40s, 60s, 120s or 180s. Milled rice was then ground into flour and each sample was analysed in duplicate. A sample of 3g rice flour was added to an RVA canister and made up to 28g using de-ionized water. Samples were analysed using the standard Newport Scientific RVA rice method.

RESULTS AND DISCUSSION

Pasting parameters of different cultivars changes at different rates with increasing milling degree (Figure 1). These changes could have been due to alteration of the chemical composition due to removal of the bran layer. Most of the RVA parameters increased with increasing milling degree, however, some parameters (for example, Koshihikari Setback) showed a decrease with increasing DOM. This suggested that DOM may need to be optimised for each cultivar in order to obtain the best pasting performance.

Figure 1 (i-v) *Effect of DOM on Peak Viscosity (PV), Breakdown (BD), Trough (TR), Setback (SB) and Final Viscosity (FV) for nine Australian rice cultivars.*



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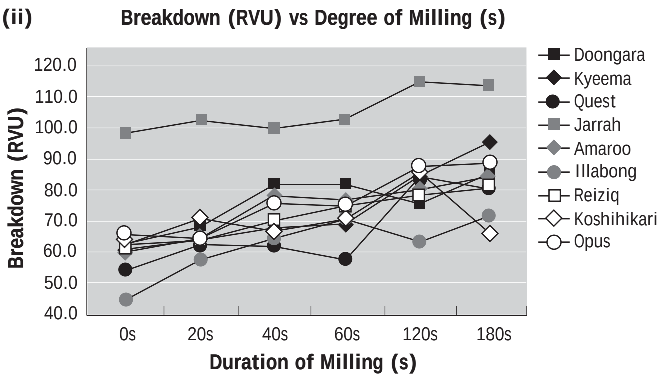

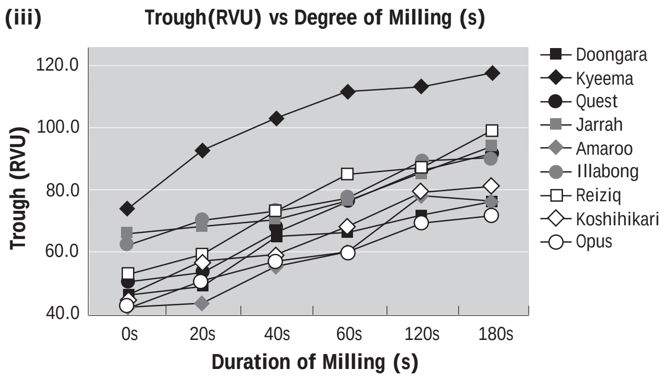

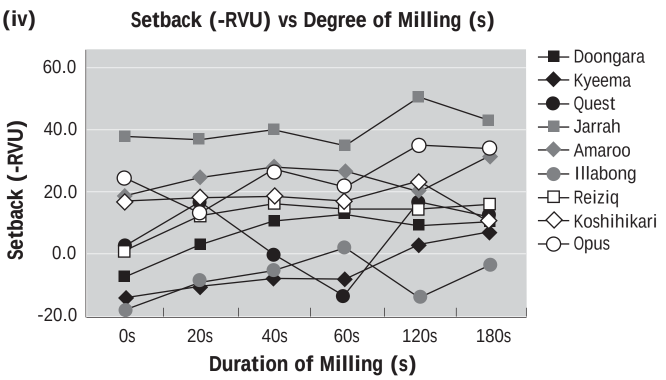

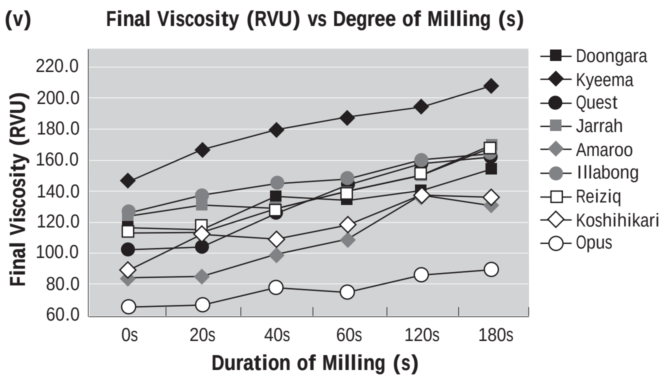

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Optimised Methods for Detecting the Effect of Flour Additives in the doughLAB™

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A SUMMARY OF THE PAPER PRESENTED AT THE ICC JUBILEE CONFERENCE, 4–7 JULY 2005, VIENNA

Flour additives play an important role in the modern bakery. Recent advances in enzyme technology, in particular, opportunities for new product types, and some regulatory changes, have led to the development of new and improved additives with a wide range of functionality. These include imparting tolerance to variation in raw materials and process conditions, and improving dough handling properties, loaf volume, taste, texture, nutrition and shelf life. Bakeries are actively seeking improved methods to assess the effects of these additives, to check efficacy and dosage levels, for a wide range of yeast-leavened products. To meet this need, Newport Scientific has initiated research aimed at developing optimised methods to measure the effects of flour additives in the doughLAB, a z-arm dough mixer that tests the quality and characteristics of doughs. Methods have been devised for assessing oxidants, reducing agents, emulsifiers, salt, sugar, soy flour, amylase and xylanase.

Optimised Methods for Detecting the Effect of Flour Additives in the doughLAB™

CONTINUED

Unless otherwise stated, the AACC Method 54-21 (30ºC, 63 rpm) was used to test untreated flour on the doughLAB to determine the optimum water absorption (WA). This WA was used for subsequent tests with the additive for that flour.

Addition of 1% salt (NaCl) to hard flour resulted in a reduction in torque but a delay in dough development time (DDT) and softening. Addition of 2% and 5% salt resulted in stronger doughs, with higher torque, longer DDTs and delayed softening (Figure 1). Arogundade et al. (2004) noted that the solubility of seed flour protein increased with NaCl concentrations up to 2%, and a slight decrease with concentrations ≥ 5%, and attributed these observations with the 'salting in' and 'salting out' effects. At low NaCl concentrations (in the case of the current study, ≤ 1%), the low ionic strength allows dissociation of the ions, and results in their interaction with the proteins, thus increasing solubility of the protein (Arogundade et al., 2004), and reducing the torque of the mixed dough. At higher concentrations, NaCl produces a dehydrating effect on the protein, causing it to aggregate, and resulting in decrease of solubility (Arogundade et al., 2004). Hoseney (1986) stated that salt increases dough strength by shielding charges on the dough proteins. Note that at 5% NaCl, the doughLAB curve showed an initial sharp peak at ~2 min. The initial peak was considered a hydration peak while the second peak was taken to be the true mixing peak (Shuey, 1997).

Sugar (sucrose) at 5% flour weight caused an increase in torque for both soft and hard flours. This is possibly due to the fact that sugar acts as a competitor with the starch/protein for the available water in the dough system (Figures 2a and 2b).

Figure 1
doughLAB™ curves showing the effect of salt on the mixing characteristics of flour.

Figures 2a–b
doughLAB curves showing the effect of sugar on dough quality of soft and hard flours.

Figure 1

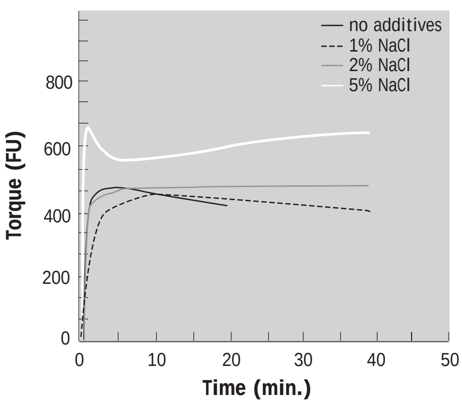


Figure 2a

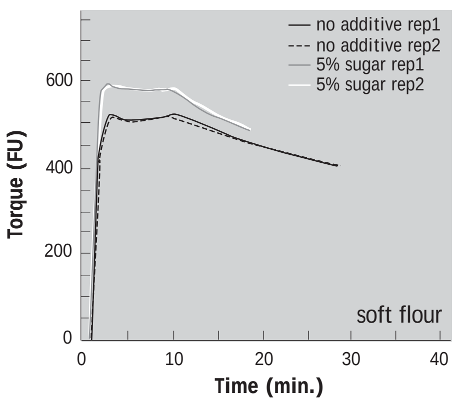
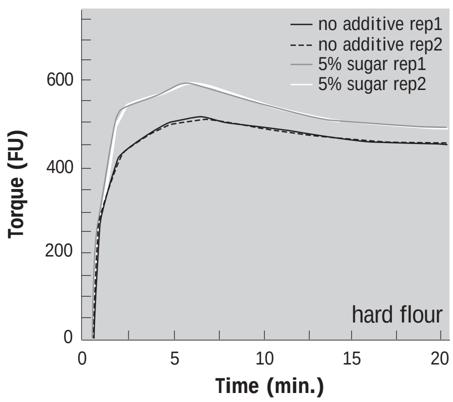


Figure 2b



When a sugar-containing flour was mixed with 30% lipid (oil) using the standard Farinograph method (AACC 54-21, 30ºC, 63 rpm), a very flat curve was obtained without proper incorporation of the lipid. By increasing the mixing speed to 110 rpm, suitable mixing of the lipid with flour was achieved (Figure 3). This shows that the dough requires high intensity mixing to incorporate fat and develop.

Ascorbic acid functions as an effective oxidising agent. It is used in the industry as a maturing agent in flour, and as a dough improver in breadmaking. In this study, addition of 150 ppm ascorbic acid to the hard flour caused a dough strengthening effect, with a later peak and prolonged stability (Figure 4).

Figure 3
doughLAB curve showing torque profile of sugar containing flour with 30% added lipid.

Figure 4
Effect of oxidising agent ascorbic acid on the mixing characteristics of hard flour.

Figure 3

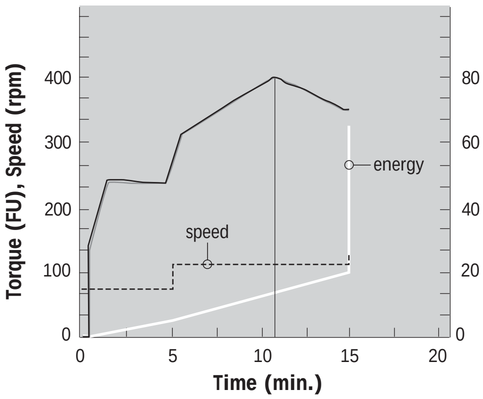
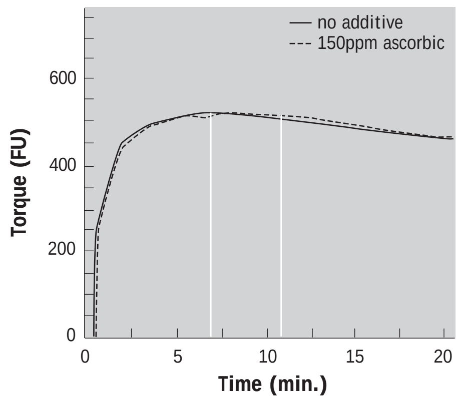


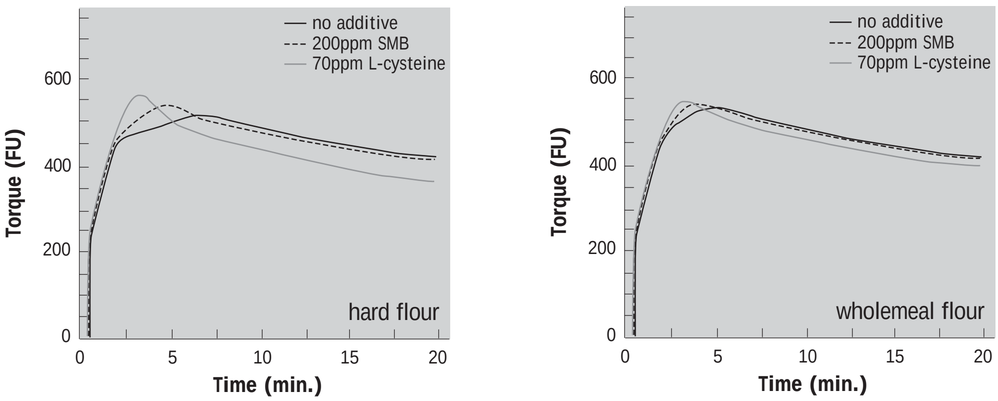
Figure 4



Reducing agents are used in industry to shorten the mixing time. The effect of two reducing agents, L-cysteine and sodium metabisulfite (SMB), on the mixing characteristic of a hard flour is shown in Figure 5. Addition of reducing agents resulted in earlier peaks. By reducing the disulfide bonds in flour proteins to dissociated sulfhydryl groups, the reducing agent causes the dough to become more pliable and extensible (Hoseney, 1986).

Similar experiments have been trialled and results achieved for other additives, such as emulsifiers (DATEM, mono- and diglycerides), hydrocolloids, and enzymes. Work is continuing on optimising the sensitivity and speed of these tests by altering mixing speed and temperature regimes, to suit both the product/process in question and the properties of the additive.

Figure 5
Effect of reducing agents L-cysteine and sodium metabisulphite (SMB) on the mixing characteristics of hard and wholemeal flours.



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