VALUE ADDED WHEAT CRC
FINAL REPORT

Project 2.1.2

Quality assessment and applications for new and novel germplasm

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Final Project Report

to Value Added Wheat CRC

Project Title:
Quality assessment and applications for new and novel germplasm

Project Number: 2.1.2.

Project Leader: Helen Allen

Prepared by: Dr Hon Yun (BRI Australia)

Date: 23 January 2003
Value Added Wheat CRC Project Final Report

1. A fractionation and reconstitution procedure was developed to evaluate the effect of starch granule ratio on biscuit quality.

The soft wheat variety, Thornbill, was selected and separated into starch, gluten and water-solubles. Starch was further fractionated into A (>10\(\mu\)m) and B (<10\(\mu\)m) granule groups (H. Yun et al, 2000). Recovery of flour components was 9.86% for gluten, 83.8% for starch and 6.34% for water-solubles on dry basis. The starch fraction contained 65% of large A granules and 35% of small B granules in mass.

2. The physical and chemical properties of flour and starch fractions were measured.

Protein content of the original flour was 9.3% and ash content was 0.46%. Water absorption and development time were 54% and 2.75min respectively. Extensibility was 19.6cm and maximum resistance was 145BU. RVA peak and final viscosities of flour were 395RVU and 317.5RVU respectively.

3. The effect of starch granule ratio on RVA pasting viscosity and swelling volume was evaluated.

A and B starch granules were combined in various ratios. RVA peak viscosity and final viscosity showed a proportional decrease with the addition of B starch granules, whereas setback viscosity did not show a proportional decrease with B granules (Table 1). Swelling volume increased as B granule content increased. This data was consistent with earlier CRC research using hard heat samples.

<table>
<thead>
<tr>
<th></th>
<th>Flour</th>
<th>Starch</th>
<th>100% A</th>
<th>50% A &amp; 50% B</th>
<th>100% B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak viscosity(^1)</td>
<td>395.0</td>
<td>404.3</td>
<td>391.9</td>
<td>313.5</td>
<td>242.8</td>
</tr>
<tr>
<td>Setback</td>
<td>138.1</td>
<td>146.1</td>
<td>163.5</td>
<td>125.5</td>
<td>106.0</td>
</tr>
<tr>
<td>Final viscosity</td>
<td>317.5</td>
<td>411.3</td>
<td>385.1</td>
<td>345.9</td>
<td>293.8</td>
</tr>
<tr>
<td>Peak time</td>
<td>5.8</td>
<td>6.1</td>
<td>5.6</td>
<td>6.1</td>
<td>5.9</td>
</tr>
<tr>
<td>Swelling volume(^2)</td>
<td>19.5200</td>
<td>27.8483</td>
<td>25.9233</td>
<td>35.1949</td>
<td>39.4476</td>
</tr>
</tbody>
</table>

\(^1\)RVU, \(^2\)V/W

4. The mixing property of starch granule reconstituted dough was measured using a Do-Corder (Brabender).

The mixing condition was 100rpm at 23°C. The level of water addition was adjusted on the basis of moisture content of starch A and B granules. The result showed higher dough resistance with more B granules. This was consistent with other starch samples tested. It is most likely that the result with 100% B granules indicates that the water adjustment was not adequate.
5. The processing conditions of small-scale biscuit making procedure were evaluated.

5.1 Based on the AACC ‘Baking Quality of Cookie Flour’ procedure, 225g of flour was reduced to a 30g scale with good reproducibility. The major challenge of reducing the scale was replicating the creaming of the shortening, sugar, salt and sodium bicarbonate. A dextrose solution and distilled water were mixed with a proportionally reduced amount of cream, followed by 30g of flour (14% moisture basis). Biscuit samples (37.8mm diameter x 7.3mm height) were made with 20g dough pieces. Reproducibility of the procedure was evaluated by measuring the width, thickness and spread ratio (W/T) of the small sized biscuit (Figure 2 shows width). The control was prepared at normal test scale with the same size of biscuit. Variation between 2 days trials was checked and showed similar results.

5.2 Three soft wheat varieties were tested by the small-scale procedure (Figure 3). The result showed that the small-scale results matched well with the large-scale results. The appearance of the large and small-scale biscuits is shown in Figure4.
5.3 According to water absorption property of starch granules, the optimum level of water addition was determined on the basis of starch granule ratio. For 100% A starch granules, 22ml of water was used while 50% A starch granules (50% B granules) and 0% A starch granules (100% B granules) required 24ml and 26ml respectively. When the same level of water was used with various ratios of starch granules for biscuit making, the size of biscuit decreased as B granule content increased. When water addition was increased to the same flour or the same reconstituted flour, the size of biscuit increased and the ratio of width to height decreased.

6. The effect of starch granule ratio of three soft wheat varieties (Thornbill, Rosella and Sunsoft) on biscuit quality has been evaluated (Figure 5).

With the adjusted water addition, three varieties showed the same trend in width with the various ratios of starch granules. Biscuits made with 100% A granule addition required 22ml of water, whereas 100% B granule needed 26ml of water for 225g flour at 14% moisture content. As the B granule content increased, the width decreased. The height showed a different result (Figure 6). Two wheat varieties showed a decrease in height, as B granule content increased, whereas Sunsoft showed increase in height. This may be due to different B granule property of Sunsoft. It
appeared that higher A starch granule content was desirable for biscuit making with low water addition.

![Figure 5 The effect of starch granule ratio on biscuit quality](image)

![Figure 6 Height of biscuit with various starch granule ratios](image)

7. Conclusion
A fractionation and reconstitution procedure for biscuit making was established using a small scale method with good reproducibility. Starch granule ratio was found to be one of the important flour quality parameters for biscuit quality. In general, when the B granule content increased, the size of biscuit decreased. It indicated that there was an optimum level of B granules for quality biscuit. It was also found that there was a varietal difference in B granule property. When 100% A granules were used the water absorption was the lowest and biscuit spread tended to be higher. Further work would be required to refine these outcomes.
Major achievements:

(i) The fractionation and reconstitution technique for biscuit making was established.
(ii) The effect of water addition on biscuit quality was clarified.
(iii) The effect of A to B starch granule ratio on biscuit quality was investigated.
(iv) The varietal difference in starch granule groups was identified.