The impact of mixing and resting time on dough rheology and bread quality in a No Time Dough (NtD) system – Trial 1

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1. INTRODUCTION

A wide range of bread-making processes are in use around the world. Essentially they all involve the mixing of flour, water, yeast, salt and other functional ingredients in the development of a gluten structure following the hydration of the proteins (Cauvain 2009). The different bread-making processes vary in the raw ingredients used and mixing process adopted to develop gluten network.

Four main processes are:

• Straight dough bulk fermentation (STD)
• Sponge and dough (S&d)
• No time dough process (NtD)
• Mechanical dough development (MDD) (Cauvain 2009).

The objective of the present research is to define the impact of mixing time, final dough temperature and resting time on dough rheology and test baking quality.

2. METHODOLOGY

2.1 Selection of dough-making processes

Four main processes are:

• Mechanical dough development (MDD)
• No time dough process (NtD)
• Sponge and dough (S&d)
• Straight dough bulk fermentation (STD)

The different bread-making processes vary in the raw ingredients used and mixing process adopted to develop gluten network.

2.2 The process of No Time Dough (NtD) baking:

Mixing → MOULDING → PROVING → BAKING

First moulding → Resting → Second moulding

The following equipment was used to measure dough rheology and bread quality (Fig. 1, 2, 3 and 4).

3. RESULTS AND DISCUSSION

The potential effects on dough rheology with changing combinations of mixing speed and final dough temperature (Table 1) were evaluated. Preliminary result showed: an increase in dough compression area (firmness/softness) after first moulding, a decrease with resting and a significant increase with second moulding (Figs. 5a, b and c). Increases in stickiness were observed after both first and second moulding. An increase in stickiness was associated with an increase in the stickiness stage between the moulding stages was most readily observed with the combination of 200 rpm and 36°C (Fig. 5d).

3.1 Combination of mixing speed, final dough temperature and resting time on dough rheology

Bread volume was greatest with the combination of 200 rpm and 36°C and least with 100 rpm and 24°C. Bread volume decreased slightly for all 3 speed-temperature combinations as the resting period between first and second moulding stages decreased. These observations suggest that the increase in dough compression areas seen with the Warburton stickiness test are largely associated with a firmer, more elastic and less extensible dough as shown in the following Fig. 6a. Crumb hardness was significantly higher at 24°C than that at 30°C and 36°C while there was no significant difference under the later two temperatures. Resting time showed no clear effect on crumb hardness (Fig. 6b).

3.2 Bread volume and crumb hardness

The total number of cells per unit area of the crumb slice was greatest with the combination of mixer speed at 100 rpm and dough temperature at 24°C and least with the combination of 200 rpm and 36°C. This measurement was consistent with the average cell diameter which was greatest with 200 rpm and 36°C and least with 100 rpm and 24°C (Fig. 7a and b).

4. CONCLUSIONS

• Significant differences were observed in dough rheology and bread quality among the combinations of mixing speed, dough temperature and resting time.
• Higher final dough temperature, longer resting time and higher mixing speed resulted in increased bread volume.
• Higher final dough temperatures (30°C and 36°C) produced softer bread compared to 24°C.
• The combination of mixing speed of 100 rpm and final dough temperature of 24°C resulted in the highest cell number/area but smallest cell size, while 200 rpm at 36°C resulted in the lowest cell number/area but largest cell.