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The Interaction of Sugar with the Population Balance of Bubbles in Bread

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INTRODUCTION

An investigation into the effect of sugar on the gas bubbles in dough and in bread has begun. Bubbles in bread vary in size, shape, orientation, quantity and distribution. This determines the texture of the bread. Bubbles are also responsible for the softness of the bread and as a result, breads perceived freshness. This is determined by the ability of the bubbles to spring back when compressed, as determined by the strength of the walls.

White bread contains 0-2% sugar, but sweetened raised bread (Figure 1) may contain up to 14% sugar. Sweetened raised breads make up a significant portion of the bread market, but little scientific research has been carried out in this area. Yeast rely on sugar as a substrate, therefore it is crucial that this interaction is understood.

Figure 1. Examples of sweetened raised breads

FLOUR CHARACTERISATION

2 flours were used for each experiment, a strong flour and a weak flour. This ensures that the experiments are repeated and allows generalisation of the results to more than one flour type.

Characterising the flour gives information required to conduct further experiments. The optimal water content required to form a dough and dough voidage are 2 ways of characterising flour.

To begin with, the optimal quantity of water required to form a dough was determined using a Farinograph and Micro-DoughLab. These work by measuring the torque when mixing. The water content was adjusted to ensure the chart produced lay on the 600 line.

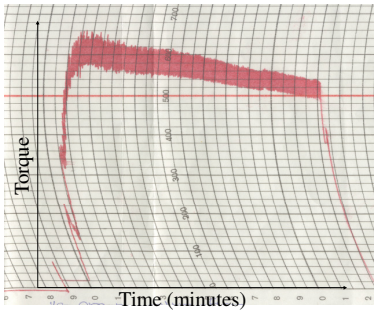

Figure 2. A Farinograph chart

The voidage is the quantity of air entrained by the dough and is dependent upon the flour used. The voidage is determined by a series of calculations, beginning with measurements of the dough density and calculations the gas free dough density.

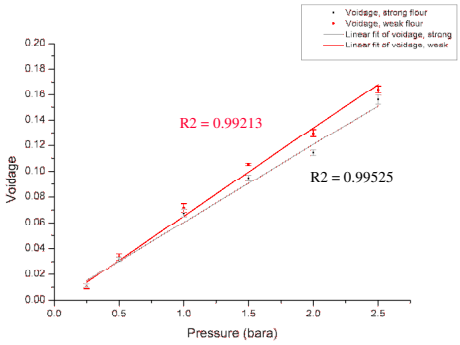

Figure 3. Voidage of strong and weak flour doughs over a range of pressures

C-CELL

C-Cell is an instrument for evaluating bread quality. The software analyses slices of bread to quantify bubble characteristics and external features.

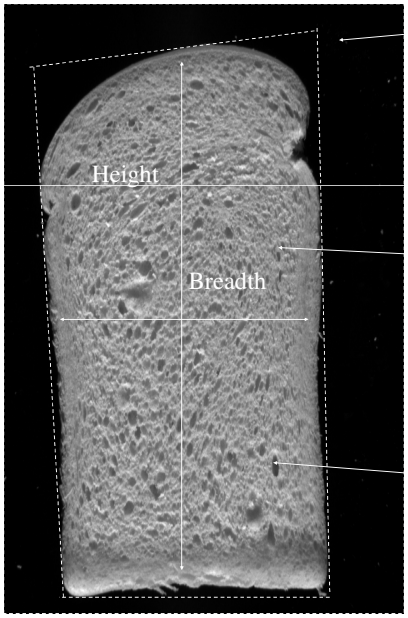

Figure 4. C-Cell image of a slice of bread and some parameters given by the C-Cell

Bread was baked at sugar contents of 0%, 5%, 10% and 15%. 6 loaves of each were made in total for each sugar content, 3 with the strong flour and 3 with the weak. Each loaf was mechanically cut into 10 slices of 12.5mm in thickness. 8 of these slices were used in the C-Cell to obtain the above results. Single factor anova tests were also conducted. For clarity of the figures, all of these results have not been illustrated.

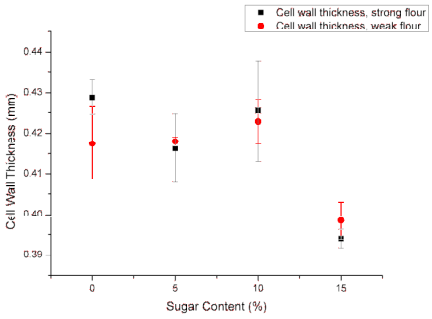

Figure 5. Cell wall thickness of bread slices over a range of sugar contents

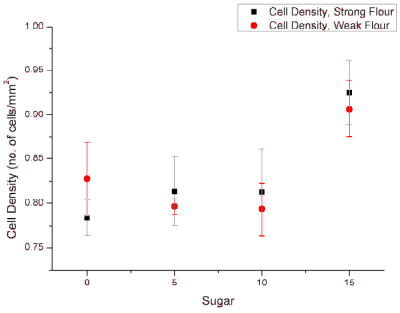

Figure 6. Cell density of bread slices over a range of sugar contents

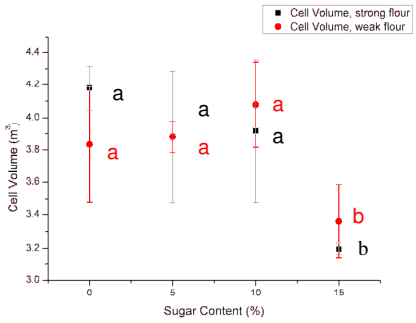

Figure 7. Cell volume of bread slices over a range of sugar contents

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