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# SUGAR INFLUENCE ON DOUGH'S BEHAVIOUR

**Georgiana Gabriela Codina[1], Ionela Cretu[2], V. Paslaru[2]**
[1] "Stefan cel Mare" University of Suceava
[2] "Enzymes & Derivates" Co., "Cantacuzino Pascanu" Hall, Costisa, Neamt

## Abstract

*Sugars, in baking, influence dough's behaviour, yeast activity and products quality. In this paper we try to study rheological and technological effect of sugar, in different doses, on dough and on product quality. Rheological properties of dough were determinate with Chopin Consistograph and Alveograph and the effect on bread quality was determinate with baking tests.*
***Keywords:*** *sugar influence, rheological properties, bread quality.*

## Introduction

Sugar is ingredient most used in baking. It is hydrolyzes during kneading and transformed in glucose and fructose. So, sugar used in baking influence rheological properties of dough, activity yeast and products quality (Ceapoiu, 2002).

In dough, sugar determines fluidization thanks to hydration of flour's constituents. That's why, when we add sugar, flour's hydration is decreases. This decrease represents approximately 0.5% of sugar amount introduced. We also have to say that sugar is a stimulant for yeast (Graybosch, 1993).

## Experimental

We study the sugar influence on dough's behaviour. Measurements were made using the following sugar concentrations: 0%, 1%, 1.5%, 2%, 2.5%, 3%. Premixes are done using 1 kg of flour with calculated quantities of sugar in order to obtain the desired concentrations. For all tests, salt water (25g/l) is used.

For each concentration we have made the two tests with Chopin Consistograph and Alveograph (Bordei, 2004). *Constant hydration*

*Consistograph test* is made in order to measure the maximum pressure (Pr Max), thus the water absorbtion capacity using to obtain a target consistency.

The amount of sodium chloride solution which is added depends of the flour moisture content. For each test, the hydration is the same, only the sugar concentration changes. The maximum pressure is the main parameter because it is directly linked to the water absorbtion capacity of the flour.

*Adapted hydration Consistograph test* is used in order to be sure the target consistency is obtained and to study the dough behaviour during mixing (Tolerance, 250 seconds Drop and 450 seconds Drop). The hydration could be different; it depends on the water absorbtion capacity which is determined during constant hydration Consistograph test for each concentration of sugar.

With Alveograph we have made the same two tests in order to determinate the dough influence (adapted hydration) and the evolution of parameters ***P*** (tenacity, maximum pressure required to reshape the sample), ***L*** (dough's extensibility, curve length), ***G*** (extensibility number), ***W*** (baking strength), P/L (curve configuration ratio), ***Ie*** (P200/P elasticity, P 200 representing pressure at 4 cm from the beginning of the curve).

## Results and Discussions

After we made constant hydration test (CH) and adapted hydration test (AH) on the Consistograph, were have obtained results from table 1. We clearly see decreasing of PrMax, as well as T for PrMax, at constant hydration, when higher sugar concentrations are used. At adapted hydration, parameters HYD HA, T for Pr Max and tolerance decrease when high sugar concentration is used. This decrease is more important between concentrations 0% and 2.5% and is less noticeable between 2.5% and 3%. Drops at 250 and 480 seconds are higher when more sugar is added. Sugar has an action on dough behaviour during mixing. It shows, at constant hydration, a tendency to decrease dough consistency. This explains why bakers use less water when sugar is used. However, at adapted hydration, sugar shows a tendency to decrease dough tolerance during mixing, leading to more fragile dough.

**Table 1**. Consistograph values for constant and adapted hydration tests

| Protocol | Parameters | 0% | 1% | 1.5% | 2% | 2.5% | 3% |
|---|---|---|---|---|---|---|---|
| CH | Pr MAX(mb) | 3700 | 3612 | 3533 | 3418 | 3320 | 3275 |
| CH | T Pr MAX (sec) | 148 | 137 | 131 | 128 | 121 | 114 |
| AH | HYDHA | 57.7 | 57.3 | 57.0 | 56.4 | 56.1 | 55.7 |
| AH | T Pr MAX HA (sec) | 160 | 154 | 149 | 144 | 141 | 140 |
| AH | TOLERANCE (sec) | 227 | 215 | 208 | 192 | 186 | 184 |
| AH | D 250 (mb) | 225 | 239 | 256 | 271 | 298 | 313 |
| AH | D 450 (mb) | 711 | 732 | 754 | 769 | 782 | 791 |

The results obtained with Alveograph test at constant hydration (CH) and adapted hydration (AH) are presented in table 2.

**Table 2**. Alveograph values obtained for constant and adapted hydration tests

| Protocol | Parameters | 0% | 1% | 1.5% | 2% | 2.5% | 3% |
|---|---|---|---|---|---|---|---|
| CH | P | 111 | 106 | 101 | 95 | 89 | 83 |
| CH | G | 22.5 | 23 | 23.5 | 24 | 24 | 25 |
| CH | P/L | 1 | 0.94 | 0.86 | 0.75 | 0.62 | 0.58 |
| CH | Ie | 63 | 62.8 | 62.6 | 52.3 | 62.1 | 62 |
| CH | W | 431 | 423 | 414 | 407 | 396 | 388 |
| AH | T | 59 | 56 | 52 | 50 | 48 | 47 |
| AH | Ex | 26.6 | 26.4 | 26.3 | 26.1 | 26.4 | 27.1 |
| AH | T/A | 0.38 | 0.36 | 0.35 | 0.33 | 0.30 | 0.27 |
| AH | lec | 80 | 79.1 | 78.3 | 77.5 | 77.1 | 77.0 |
| AH | Fb | 301 | 291 | 283 | 275 | 264 | 250 |

From these results it can be observed that at constant hydration with sugar addition, tenacity (P), elasticity (Ie) and baking strength (W) decrease constantly at constant hydration. On the other hand, extensibility (G) increases, and at adapted hydration, tenacity (T) stays at the same level. Also, the extensibility (Ex) increases when 2.5% of sugar is added.

At constant hydration the observed effects are linked to dough loss of firmness when sugar is added.

## Conclusions

Sugar has an action on plastic qualities of dough. It decreases elasticity and increases extensibility. At constant hydration, sugar softens dough's. This effect is well known of baker who under-hydrates dough when sugar is added. At adapted hydration, Consistograph measurements show a loss of rheological properties during mixing. Effectively, drops are more important and tolerance decreases because sugar makes the dough "heavy" and fragile to use. Finally it is possible to characterize dough containing sugar on the Alveograph.

## References

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