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ASCORBIC ACID INFLUENCE ON DOUGH'S BEHAVIOUR

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Abstract

Technological activity of ascorbic acid is representing by its influence on dough's behaviour. In this paper we will present the effect of this acid (in different doses) on the maximum pressure and on dough behaviour. We have made these determinations with Chopin Consistograph and Alveograph.
Keywords: *ascorbic acid, increases, influence, maximum pressure.*

Introduction

Acid ascorbic effect is in dependence with dough's temperature, kneading intensity and presence of oxidizing agent. That's why maximum effect of ascorbic acid is reach in 25 – 26°C on an intensive kneading (Graybosch, 1993).

Theoretical, optimum measure of ascorbic acid must be established with laboratory tests, taking into account purpose and initial quality of flour. It also take into account the fact that ascorbic acid is inter-working with dough's redox systems and that's why it's effect is decrease (Ceapoiu, 2002).

Experimental

For studying the effect of ascorbic acid we made tests and we follow the influence of ascorbic acid on the maximum pressure (Pr Max) measurement at constant hydration (CH), on dough behaviour during mixing at adapted hydration (AH), on the Alveographic parameters at CH and AH. For this, we used Chopin Consistograph and Alveograph (Bordei, 2004).

Measurements were made using the same flour, white flour type 650 with the characteristics from table 1. Measurements were done using the following ascorbic acid concentrations: 0%, 0.0015%, 0.0025% and 0.0035%. Premixes are done using 1 kg of flour with calculated quantities of ascorbic acid in order to obtain the desired concentrations. For all tests, salt water (25 g/l) is used.

Table 1. Main characteristics of white flour type 650

Parameter	Unit	Value	STAS
Humidity	%	14.2	SR ISO 712:1999
Ashes	%	0.645	STAS 90-88
Acidity	grade	2.1	STAS 90-88
Humid gluten	%	24.5	SR ISO 7495:1998
Formation number	mm	5	STAS 90-88
Falling number	sec	275	SR ISO 3093:1997

Using Consistograph we have made two tests:

- *Constant hydration 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 ascorbic acid concentration changes. The maximum pressure is the main parameter because it is directly linked to the water absorbtion capacity of the flour.
- *Adapted hydration test* is used in order to be sure the target consistency is obtained and to study the dough behaviour during mixing (T Pr Max, 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 ascorbic acid.

Using Alveograph, we have made also two tests (constant hydration test and adapted hydration test) in order to determinate 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 represented pressure at 4 cm from the beginning of the curve), as a function of concentration of ascorbic acid.

Results and Discussions

Results obtained after we have made tests with Chopin Consistograph are presented in table 1.

Table 1. Consistograph values for constant and adapted hydration tests

Protocol	Parameters	0%	0.0015%	0.0025%	0.0035%
CH	Pr Max (mb)	2594	2571	2502	2480
CH	T Pr Max (sec)	148	153	160	167
AH	HYDRA	52.7	53.1	52.8	53.2
AH	T Pr Max HA (sec)	124	126	125.5	128
AH	Tolerance (sec)	152	175	176	193
AH	D 250 (mb)	551	421	450	411
AH	D 450 (mb)	1151	1130	1072	108

These results show us that at constant hydration, the maximum pressure (Pr Max) and the tolerance for maximum pressure (T for Pr Max) are almost constant. Interesting in that at adapted hydration, the T for Pr Max is constant too. The tolerance tends to increase and the drops at 250 and 450 seconds decrease when we add ascorbic acid.

In conclusion we can say that the ascorbic acid action on dough is slow. It has an indirect action on thiol groups (SH) which lead the information of disulfide bonds. This effect is late, thus it is logical that the consistograph parameters remain constant and adapted hydration (the drops tendency decrease is due to the begining of the ascorbic acid action which is noticeable after several minutes of mixing).

With Alveograph, in constant hydration (CH) and adapted hydration (AH), we have obtained results presented in table 2. We observe that at constant hydration, the pressure increases when we add ascorbic acid except for the maximum dose (0.0035%) for which the pressure decreases (it stays higher than reference). We can notice a decrease of the swelling (thus the ratio P/L increases) except for the last dose. We also see that the elasticity index and the baking strength increase with ascorbic acid addition.

At adapted hydration, the parameters evolution is the same. We can notice that the saturation of ascorbic acid effect observed at constant hydration is not noticeable at adapted hydration. The tenacity increases

and the extensibility decreases (thus the ratio T/A increases). Also, the correct elasticity index and the baking strength increase.

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

Protocol	Parameters	0%	0.0015%	0.0025%	0.0035%
CH	P	56	59	64	70
CH	G	27	25.5	23	21
CH	P/L	0.45	0.58	0.93	1.12
CH	Ie	51.2	55	61.1	64.5
CH	W	211	242	268	291
AH	T	41	56	69	82
AH	Ex	27	25.3	21.7	20.3
AH	T/A	0.3	0.37	0.58	0.73
AH	lec	51.1	60	63.1	64.2
AH	Fb	211	245	250	241

The ascorbic acid action on protein oxidation (disulfide bonds formation) is noticeable on Alveograph. The reinforcement of the proteinic network is obvious on the whole Alveographic parameters at constant and adapted hydration. The results obtained for the maximum dose (0.0035%) show a saturation of ascorbic acid.

Conclusions

The slow action of ascorbic acid on dough is not clearly noticeable on Consistograph (the analysis time is too short). The whole alveographic parameters at constant and adapted hydration show the ascorbic acid action (reinforcement of proteinic network by disulfide bonds formation). We can notice that the low evolution of the parameters for the dose 0.0035% in comparison with the dose 0.0015% is due to a saturation of ascorbic acid. Then, the action of ascorbic acid addition on the flour which already contained this additive will not be noticeable if the saturation dose is reached.

References

Bordei, D. (2004). *Modern Technology in Bread Making*. AGIR Publish. House, Bucharest.

Ceapoiu, V., Giurea, A.M. (2002). *Parameters that influence properties of wheat,* AGIR Publish. Bucharest.

Graybosch, R., Peterson, C.J., Moore, K.J., Stearns, M., Grant, D.L. (1993). Comparative effects of wheat flour protein, lipid and pentosan composition in relation to baking and milling quality. *Cereal Chem.*, 70(1), 95-101