THE EFFECT OF IMPROVER ON DOUGH RHEOLOGY AND BREAD PROPERTIES

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ABSTRACT

The influence of bread improver on dough rheology and bread properties was investigated. The effect of bread improver on extensographic parameters of analyzed flours with different rheological properties was more pronounced in comparison with farinographic. Regarding the effect on bread properties, the improver enhanced loaf volume and average cell area. Using improver had possitive effect on flours with medium dough strength, through improvment of loaves volume and shape with satisfying crumb structure. However, improver significantly destroyed viscoelastic properties of flours with strong dough with negative effect on loaves shape, avarage cell area and crumb porosity parameters.

Key words: rheological dough properties, bread improver, crumb structure

INTRODUCTION

The dough improver has been used to improve all aspects of the bread and give bakers the required tolerance and flexibility during all stages of the baking process: mixing, fermentation, baking and shelf life [1]. Technological wheat quality is one of the key factors when considering which improver should be used. For better acting, dough improvers are often consisted of oxidizing and reducing agent [2, 3]. Oxidizing agent such as L-ascorbic acid (E300) increased dough strength by oxidized sulfhydryl groups (-SH) to disulfide bond (S-S). Oxidation generally affects the resistance and extensibility of dough. Its effect can be clearly demonstrated by extension tests measured by the extensograph or the alveograph [4].

MATERIALS AND METHODS

The flours (T-550) were obtained by grains milling on a Brabender Quadromat Senior Mill of six winter wheat cultivars (Žitarka, Golubica, Srpanjka, Janica, Osk. 266/03 and Soissons). Cultivars were grown at the experimental field of the Agricultural Institute Osijek. The dough rheological characteristics were determined by Brabender Farinograph (Brabender, Duisburg, Germany) and Extensograph according to ICC standard methods No 115/1 and No 114/1, respectively. Baking tests were made using the following recipe: 100% flour, farinographic absorption water minus 2%, 2% salt, 2% fresh yeast and with or

without (control group) bread improver. The bread improver Platinum Pek (Credin AS, Denmark) had the next components: wheat flour, emulgator E472e, L-ascorbic acid E300 and enzimatic substance. According to the manufacturer's recommended doses improver was added in concentration of 0.3%. The ingredients were mixed at San Cassiano spiral mixer with 3 min at slow speed and 6 min at high-speed. Dough were divided, rounded and proofed for 50min (28^{o}C, 87% RH) and baked at Roto oven (Miwe-roll-in) for 32' min at 250 to 230 ^{o}C. Bread volume of 700g Loaves was measured by tailor centimeter and loaves shape (height/diameter ratio) was measured too. Image analysis of the sliced loaves was done using GlobalLab Image/2 software [5]. A crumb cells evaluation was made by calculating average area of cell and total cells area as measure of crumb porosity. A statistical analysis of data was carried out in SAS System 8.2 Software [6].

RESULTS AND DISSCUSION

The effect of addition improver on farinographic dough properties were shown in Table 1 and Figure 1.

Table 1: The impact of improver on farinographic properties

FARINOGRAPHIC PROPERTIES	WA[a] (%)	DDT (MIN)	STAB (MIN)	DS (FU)	QG
CONTROL	59.7^{A}	2.1^{A}	0.7^{A}	70^{B}	B1
PLATINUM PEK	59.7^{A}	1.7^{A}	0,.^{A}	87^{A}	B2

[a] WA=water absorption; DDT=dough development time; STAB=stability;
DS=degree of softening; QG=quality group
Average values marked with the same level are not significantly different at 0.05 level

Water absorption, dough development time and stability of flours haven't been significantly affected by improver addition in comparison to the control. Added improver had significant (P<0.05) affect on degree of softening what resulted in lower quality group of those cultivars.

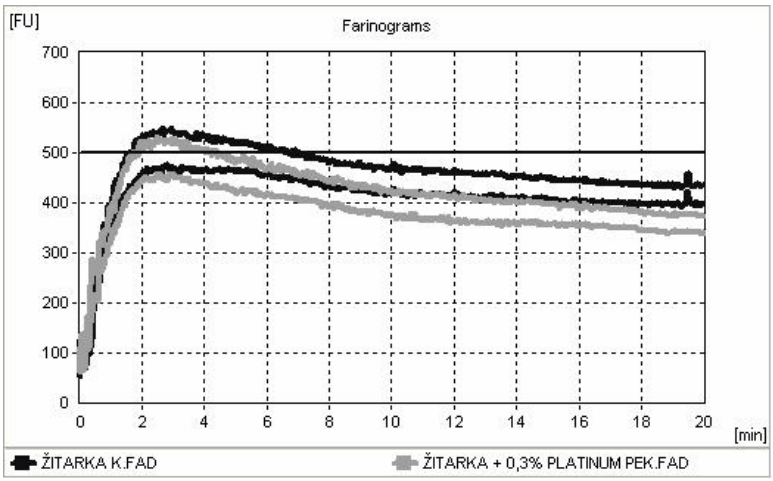

Figure 1 The comparison of farinograms with and without added improver (cv. Žitarka)

The impact of improver was more emphasised on extensographic properties compared to farinographic. The improver addition significantly (P<0.05) increased dough resistance measured after 5 min and resistance at curve maximum. The elasticity of a dough, expressed as R/EXT, was a significant disturbed by improver addition as result of dough resistance increased and extensibility decreased (Table 2 and Fig. 2).

Table 2: The impact of improver on extensographic properties

EXTENSOGRAPHIC PROPERTIES	E[a] (EU)	R_{5min} (EU)	EXT (MM)	RMAX (EU)	R/EXT
CONTROL	87^{A}	305^{B}	150^{A}	458^{B}	2.1^{B}
PLATINUM PEK	110^{A}	497^{A}	132^{A}	704^{A}	4.1^{A}

[a]E=energy; R=resistance after 5 min; EXT=extensibility; RMAX=resistence at curve maximum; R/EXT=resistance to extensibility ratio
Average values marked with the same level are not significantly different at 0.05 level

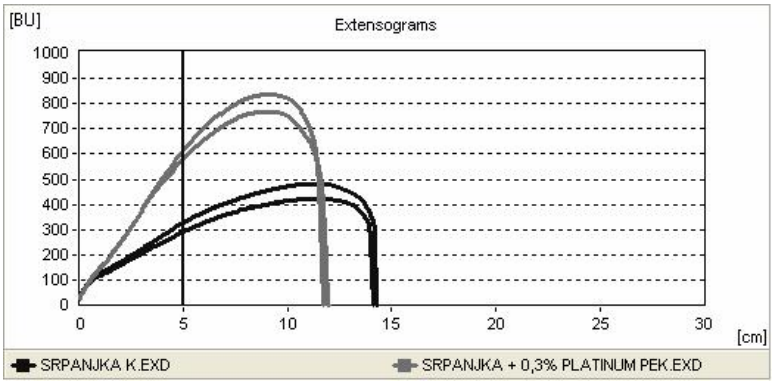

Figure 2 The comparison of extensograms with and without added improver (cv. Srpanjka)

Platinum Pek addition increased loaves volume for up to 16%. Improver addition didn't significantly (P<0.05) influence on loaves shape expressed as height/diameter ratio. Regarding crumb cell analysis obtained by image analysis, there was observed a significant (P<0.05) influence of improver on average cell area, while the crumb porosity expressed as total cell area was on the same level when compared with the control group.

Table 3: The impact of improver on bread properties

BREAD PROPERTIES	V[a] (CM3)	H/D	TCA (%)	ACA (PIXELLS)
CONTROL	3197[B]	0.66[A]	39.3[A]	114.8[B]
PLATINUM PEK	3787[A]	0.68[A]	38.2[A]	129.2[A]

[a] V=Loaf volume; H/D=height/diameter ratio; TCA=total cell area;
ACA=average cell area
Average values marked with the same level are not significantly different at 0.05 level

In accordance to dough characteristics obtained by rheological analyses, with emphasis on extensographic parameters, the analyzed cultivars were divided into two groups. Cultivars Žitarka, Golubica and Janica belong to the first group with medium dough strength. The improver addition had possitive impact on dough rheological properties and bread crumb structure of these cultivars through volume and H/D ratio increasing (Fig. 3 and 4). Under improver addition average cell area of these cultivars were increased, except for cv. Golubica, followed by increasing crumb porosity.

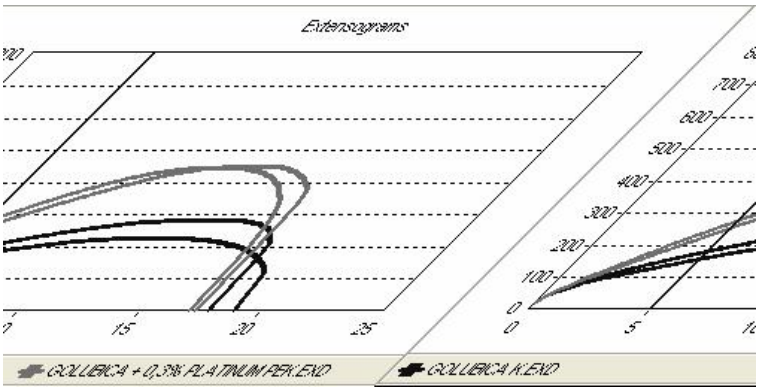

Figure 3 The extensograms of flour with medium dough strength (cv. Golubica)

Figure 4 Possitive effect of improver addition on bread crumb properties (cv. Golubica)

Cultivars Srpanjka, Soissons as well as line Osk 266/03 belong to the second group that is characterized with strong dough. The classification of analyzed cultivars related to dough strength characteristics was in accordance to our previous investigations of cultivars rheology properties [7,8]. The improver had negative effect on dough rheological properties and bread crumb structure of these cultivars through significantly increase of R/EXT ratio followed by H/D ratio decreasing (Fig. 5 and 6). Under improver addition, average cell area of these cultivars were significant increased, except for line Osk. 266/03, followed by decreasing crumb porosity [9,10].

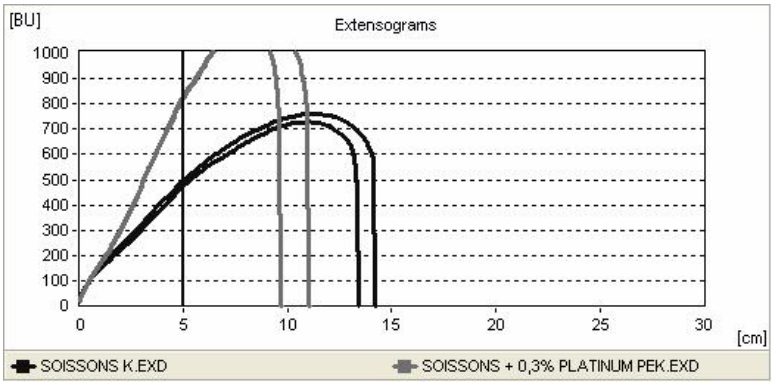

Figure 5 Extensograms of flour with overstrong dough strength (cv. Soissons)

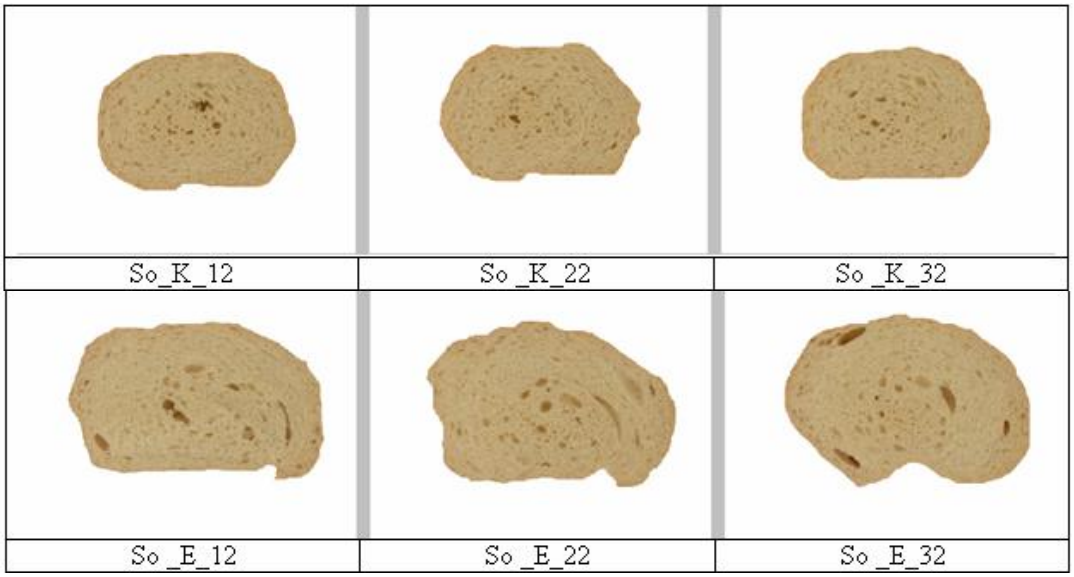

Figure 6 Negative effect of improver addition on bread crumb properties (cv. Soissons)

CONCLUSION

The obtained results showed that extensographic parameters are good indicators of dough strength and should be taken into consideration before the decision about improveres quantity is made. Bread improver had possitive effect on flour with medium dough strength through improvment of loaf volume and H/D ratio with satisfying crumb cell characteristics. However, addition improver significantly destroyed viscoelastic properties of flours with strong dough through negative effect on loaves shape, average cell area and crumb porosity.

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UTJECAJ POBOLJŠIVAÈA NA REOLOGIJU TIJESTA I SVOJSTVA KRUHA

SAŽETAK

U radu je analiziran utjecaj poboljšivaèa na reologiju tijesta i svojstva kruha. Na analiziranim uzorcima brašna razlièitih reoloških karakteristika znaèajnije je izražen utjecaj poboljšivaèa na ekstenzografske parametre kakvoæe u odnosu na farinografske. Što se tièe utjecaja poboljšivaèa na svojstva kruha uoèen je znaèajan utjecaj na poveæanje volumena vekni i velièinu pora. Poboljšivaè je imao znaèajan pozitivan uèinak na uzorcima brašna sa srednje jakim tijestom kroz poveæanje volumena, poboljšanje oblika vekni, te postizanja zadovoljavajuæeg izgleda sredine kruha. Međutim, ovaj tip poboljšivaèa znaèajno je narušio viskoelastièna svojstva tijesta uzoraka s jakim glutenom što se znaèajno negativno odrazilo na oblik vekni i poroznost sredine.

Kljuène rijeèi: reološka svojstva tijesta, poboljšivaè za kruh, poroznost sredine