POSSIBILITY OF USING SOFISTICATED RHEOLOGICAL METHOD IN QUALITY DETERMINATION OF WHEAT FLOUR

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UDC 664.641.1 : 541.18.03 : 543.64

Abstract: *For acurate determination technological quality of wheat flour (Triticum astivum) it is necessary to examine its rheological properties. It can be done by using devices which are produced German company Brabender (have a long tradition in Serbia) and French company Chopin. It were examined two average flour sample from the wheat harvest in 2008 year by using farinograph, amilograph extensograph mixolab, alveograph and reofermentometer. The first sample (sample 1) had energy value higher than 40 cm^2, and the second (sample 2) had energy value smaler than 40 cm^2. Using mixolab it was gained that protein weakening for the both samples had lasted 18 min. However, protein breakdown sample 2 was faster than (-0.060 Nm/min) sample 1 (-0.026 Nm/min). The deformity work obtained by alveograph for sample 1 was 159 10^{-4} J and for sample 2 115 10^{-4} J. Some devices as reofermentometer and mixolab could be succsesfuly used in baking industry to avoid mistakes in determination the end of process fermentation and eliminate human factor, so as provide possibility of making the hole technological process.*

Key words: *rheology, method, technological quality, wheat*

INTRODUCTION

For acurate determination technological quality of wheat flour (*Triticum astivum*) it is necessary to examine its rheological properties. Although it can be done in different ways, from the 60 years of the last century till the present in Serbia for rheological investigation were used oftenly devices German producer Brabender. Milling and baking industry aceped the results rom farinograph, amilograph and extensograph. Because of that reason these gadets were utilizied for examination of technological quality of wheat harvest.

Contemporary with Brabender, Frech firm Chopin, also have developed devices for determination rheological properties. The oldes

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of them is alveograph which was mentioned in papers of many authors as device for investigations technological quality wheat flour, whereas in some studies alveograph was used as a tool for determination flour quality for needs cofectionery industry (Indrani et al., 2007). Also, it was utilizied for indirect selection of French wheat varieties in 15-th years study French breeders (Oury et al., 1999).

Mixolab is a new apparatures from Chopin, designed to measure physical doughg properties as stregh and stability. Also, it has ability that on the same dough at the same analysis examine viscous features of starch flour component (Collar at al., 2008). Since it is a new equipment, does not exist many data about it´s usage for examination on flours with different quality (Kahraman at al, 2008). Collar at al., (2008) used Mixolab for investigation rheological beahaviour different bread reciepies, whereas Kahraman at al, (2008) utilizied for prediction flour quality for needs cofectionery industry.

At the same time when Mixolab is presented Chopin produced reofermentometer for estimating dough properties during fermentation, by measurement released CO_2 or produced preasure, knowing the fact that produced CO_2 serve for expanding dough and achiving final bread loafe volume (Švec and Hrušková, 2004). Ktenioudaki at al. (2005) used reofermentometer for studing rheological properties wheat varieties different geographical origin and their application in bread making.

The aim of this paper was to examine rheological properties flour samples different technological quality on Brabender and Chopin equipmnent.

MATERIAL AND METHODS

It were examined two average flour sample from the wheat harvest in 2008 year. The first sample (sample 1) represents flours mixture from every region where measuered wheat energy at extensograph was higher than 40 cm^2, while the second sample (sample 2) represents flours mixture from every region where measuerd wheat energy at extensograph was smaler than 40 cm^2. Criterion wich is used for creating studied samples was the average energy value (38 cm^2) of wheat harvest in 2008 year in Republic Serbia.

Determination of rheological properties of wheat flour using Brabender farinograph, amilograph and extensograph were done by metohdes according to Pravilnik o metodama fizičkih i hemijskih analiza za kontrolu kvaliteta žita, mlinskih i pekarskih proizvoda, testenina i brzo smrznutog testa („Sl. list SFRJ“ br. 74/1988).

Examination rheological properties wheat flour using Chopin alveograph was done according to ICC method No. 121, whereas for reofermentometer measurement was used AACC method 89-01 and for Mixolab measurment ICC method No. 173.

RESULTS AND DISCUSION

The table 1 represents the values of rheological parametres for both samples measured by farinograph, amilograph and mixolab. Farinograph quality sample 1 had quality level A2, while sample 2 quality level B1. The both sample had favorable ratio stability and development, whereas level of softness were slitghtly different (sample 1 55 Fj, sample 2 60 Fj, respectelively). The values viscosity peak determined by amilograph were almost the same (sample 1 285 Aj, sample 315 Aj, respectelively). Development dough stability wich were gained by mixolab was 6 min i 4 S for sample 1 and 4 min i 38 s for sample 2. Protein weakening for the both samples had lasted 18 min. However, protein breakdown sample 2 was faster than (-0.060 Nm/min) sample 1 (-0.026 Nm/min). Amylolyse sample 1 had lasted about 12 min and sample 2 10 min, while starch gelatinization sample 1 (0.408 Nm/min) was higher than starch gelatinization sample 2 (0.334 Nm/min). The table 2 represents the values of rheological parametres for both samples measured by extensograph, alveograph and reofermentometer. The deformity work obtained by alveograph for sample 1 was in conformity with energy measured by extensograph (159 10^{-4} J, 58 cm^2, repectively).

Table 1.
The values of rheological parametres sample 1 and sample 2 measured by farinograph, amilograph and mixolab

	Sample 1	**Sample 2**
FARINOGRAPH		
Water absorption (%)	56.7	57.0
Douhg development (min)	2.0	2.0
Dough stability (min)	4.5	4.0
Dough level of softness (Fj)	55	60
Quality number	70.7	69.9
Quality level	A2	B1
AMILOGRAPH		
Viscosity peak values (Aj)	285	315
MIXOLAB		
C_1, development (min:s)	6:04	4:38
C_2, Protein reduction (min:s)	18:10	18:06
C_3, Starch gelatinization (min:s)	24:31	25:44
C_4, Amylase activity (min:s)	36:15	35:06
C_5, Starch gelling (min:s)	45:02	45:03
α, Protein breakdown (Nm/min)	-0.026	-0.060
B, Gelatinization (Nm/min)	0.408	0.334
γ, Cooking stability rate (Nm/min)	-0.074	-0.070

Table 2.
The values of rheological parametres sample 1 and sample 2 measured by extensograph, alveograph and reofermentometer

	Sample 1	**Sample 2**
EXTENSOGRAPH		
Energy (cm^2)	58	26
Resistance (Ej)	200	100
Exstensibility (mm)	156	163
Ratio (eesistance / exstensibility)	1.28	0.61
ALVEOGRAPH		
P, dough tenacity (mmH_2O)	57	47
L, curve lenhght (mm)	90	87
G, puffing value	21,1	20.8
W, deformity work (10^{-4} J)	159	115
Ratio P/L	0.64	0.54
REOFERMENTOMETER		
Hm, maximum dough height at T1	58.9	54.9
T2 - T'2, dough tolerance during fermentation (h:min:s)	0:58:30	0:34:30
Total volume (ml)	1186	1112
Volume of retention (ml)	1032	978
Volume of CO_2 lost (ml)	154	134
T_x, Porousity begining (h:min:s)	1:25:30	1:52:30
Retention coefficient (%)	87.0	88.0

Gained value of de-formity work was higher than 150 10^{-4} J – grade which French breeder use to deter-mine wheat varieties of high bread-making quality (Oury et al., 1999). The deformity work obtained by alveograph for sample 2 was also in conformity with energy measured by extensograph (115 10^{-4} J, 26 cm^2, repectively). Gained value of de-formity work was smaler than 120 10^{-4} J – grade which French breeder use to determine wheat varieties of average bread-making quality (Oury et al., 1999).

Reofermentometer curves showed that retention coefficient of sample 1 was 87%, while sample 2 88%, which means that dough sample 1 keeped 87% total produced CO_2 after fermentation and dough sample 2 88%. Total dough volume of sample 1 was 1186 ml, and maximum dough height was 58.9 mm. Dough tolerance during fermentation of sample 1 was 58 min and 30 s, whereas porousity started after 1 hour 25, minute and 30 seconds.

Sample 2 had total volume 1112 ml, while maximum dough height was 54.9 mm. Dough tolerance during fermentation of sample 2 was 34 min and 30 s, whereas porousity started after 1 hour 52 minute and 30 seconds.

Reofermentometer could be used in baking industry for panctual determination fermentation finish by using device.

CONCLUSION

Develompent of new rheological methods represent more punctual way for determination technological wheat quality and wheat flour quality which is main product milling industry. In that way the wheat quality will be examinated as same as EU (alveograph was not use oftenly in Serbia for examitnation wheat quality). Some devices as reofermentometer and mixolab could be succsesfuly used in baking industry to avoid mistakes in determination the end of process fermentation and eliminate human factor, so as provide possibility of making the whole technological process. However, for obtaining grades and desired values of quality parameters for new assays, more severe scientific work is necessary to do. In that way the new methods will have precise definition, whereas maximum advantage it will be achieved.

ACKNOWLEDGEMENTS

This research is a part of the funded by Ministry of Science and Technological Development, Republic of Serbia (Project No. 20139).

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