THE FLOUR-GRAPHIC TECHNIQUE TO STUDY THE TIME EVOLUTION OF THE RESISTANCE TO EXTENSION OF BREAD DOUGH WITH POTATO VARIETY LAURA

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Abstract: Rheological characteristics were studied of brown flour type 1250, from Romanian wheat. The effect of hydrotermally treated potato on the rheological properties of flour dough was investigated. Haubelt Flourgraph E6 was used to determine water absorption in dough investigated with Haubelt Flourgraph E7. Flourgraph E7 resistance to extension significantly increased with the addition of potato pulp in time. The maxim value obtained at 90 minutes for sample control. The values of resistance to extension were best correlated with the percentage replacement of flour with potato at 45, 90 and 135 minutes. The brown flour additives, premix additive because the correlation is not so good.

Keyword: dough, rheological properties, wheat brown flour, potato pulp.

1. INTRODUCTION

Rheological properties of the dough samples were determined by the manufactured with the Brabender farinograph and extensigraph [1,2], alveograph [3-5] and Flourgraph E6 and E7 [6].

One of the oldest and most widely used test methods to measure materials properties is the uniaxial tensile test. Normally, the force and extension are divided by the original sample dimensions to obtained stress and strain, and allows removal of the sample geometry as a variable, but for doughs undergoing large extensional deformation, the actual change in dimensions must be measured or calculated [7, 8].

Studies of the fundamental uniaxial extensional rheological properties of dough have been carried out by many workers, for correlation between extensigraph parameters and bread quality characteristics [9] sodium caseinate, casein hydrolysate [10] ingredient effects: flour supplemented cross-linked [11], rice, corn and soy flour [12], product enriched by rice-oil [13], germinated and non germinated soybean [14], and eggs enzyme [15].

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The absorption of the flour determined by the Brabender farinograph compared with the one tested using the Haubelt Flourgraph E6 is higher for white flour additives and for brown flour additives. Hydration capacity values obtained on these two devices are in a close correlations R^2=0.9995 for brown flour additives. This demonstrates that the flour can be characterized as well by the two devices [16].

Will be used an experimental model for the application of the flourgraphic technique to the study of the mixture of flour and hydro thermally processed potato. The higher the amount of flour replaced by another material, the higher the moisture content of the mixture. The higher the replacement percentage, the lower the amount of flour and the higher the amount of potato pulp [17].

In a research of dough rheological properties of brown flour type 1250 with additives, studied with the Haubelt Flourgraph E7 and Brabender Extensograph we thus demonstrated that the equipment used can give values that similarly characterize the behavior of dough, if the same method of determination is used [18]. The potato pulp containing non-starch polysaccharide (cellulose, pectin and hemicellulose polymers), starch, pectin, minerals, fat, nutri-functional fibers, monosaccharides like galactose, acid uronic and latter indicating galacturonic and hence presence of pectin [19, 20].

Addition of exogenous α-amylase enzyme for standardizing the practice of flours does the transformation of catalytic action fermentescibile. Xylanases hydrolyze soluble pentozani. Cisteina corrects a very tenacious and strong gluten. Ascorbic acid is used for processing low-gluten flours. The latter are used in combination when the flour is medium quality characteristics [21].

The height of the diagram is a measure of the resistance of the test piece to extension. The maximum height occurs at different extensions for different samples [7].

The intend of this study is to examine the evolution of the resistance to extension in time relaxing of a basic wheat flour-water-salt (control) and the influence of adding different levels of potato pasta. Several flour types were used: brown flour (F1), brown flour type 1250, additives (F2) and one variety of potatoes, Laura. All the results were related to a control sample and four readings were proposed: 5%, 10%, 20%. The E7 Flourgraph was used to characterize the rheological behavior of the dough with potato. The resistance to extension of the doughs, made out of wheat flour mixed with potato pulp, were compared, and the relations between them were discussed.

2. MATERIALS AND METHODS

2.1. Materials

Brown wheat flour type 1250 (u=13.9%; Gl_u=29.8%; ID = 8 mm; I_{GL}=47.4; FN = 290-300s; TTA =4 degree, ash 1.1 %), Brown wheat flour type 1250 additives (u=12.9%; Gl_u=29.8%; ID = 8 mm; I_{GL}= 44.4; FN = 280s; TTA =3.3 degree, ash 1.25%) producer *Mill Cibin Sibiu, Romania*, Method of analysis: Gl wet, AACC METHOD 38-10 Hand Wasing Method; ID-STAS 89-90- STAS 6283; Ash ICC STANDARD 105/2; Acidity STAS 90-88; „Falling Number”ISO 3093-97, ICC STANDARD No.107/1-1995; Hydration degree ISO 5530/1/1999 ICC No 115/1-Haubelt 2010. Umidity–termoanalyzer, Potato Laura variety, u = 73.5% Producer: *Potato Research and Development Station Târgu Secuiesc Romania,* Method of analysis: the determination of moisture with the gravimetrical method, using a thermobalance.

2.2. Preparing the potatoes

The potato paste (PP) is obtained by hydro thermally processing the unpeeled raw potato for 30 minutes at water boiling temperature, then cooling it, peeling, and mashing it by passing it through the ϕ2 mm mesh sieve with HV4 mixer.

2.3. Rheological measurement

First time, flour and potato pasta humidity were determined with termoanalyser (AND ML-50). The analytical balance type WPS 210/C/1Partner was used for weigh measurements. Dough samples for the rheological test were prepared without adding any yeast but adding sodium chloride 2% to the formulation to avoid interference

of bubble formation. The effect of different quantity of potato pasta on stretching dough properties was investigated by Haubelt Flourgraph E6 and E7 (Berlin, Germania). From the Haubelt Flourgraph E6, E7 curves [8, 22], the water absorption (the percentage of water requirement to yield a dough consistency of 500 HE) at the end of mixing was estimated. From the Flourgraph E7 curves, the resistance to extension and the evolution in time were compared.

3. RESULT AND DISCUSSISION

As shown in Figure 1, the use of Haubelt Flourgraph E7 [8, 22] in the study of tensile behavior of the dough has proven to be a good choice. By using the additive premix, the flour quality has improved. The values of all measured variables increased.

The height of the flourgram is a measure of the resistance of the test piece to extension. The maximum height occurs at different extensions for different samples (Figure 2).

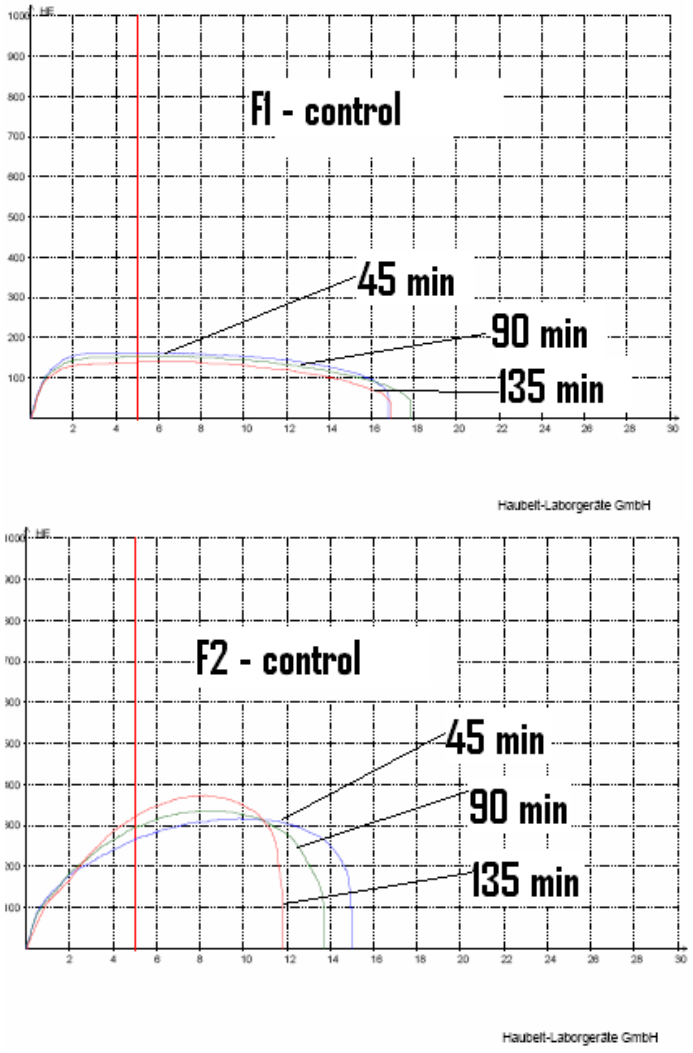

Fig. 1. Evolution of flourgraphic E7 curves profile of dough made of brown flour (F1) and brown flour with additives (F2).

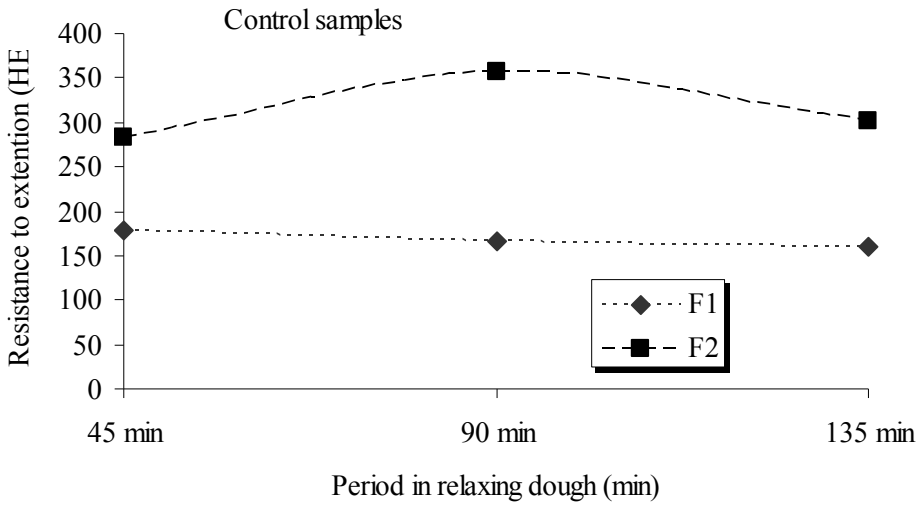

Fig. 2. Evolution the resistance to extension in time for resting at control samples F1 and F2.

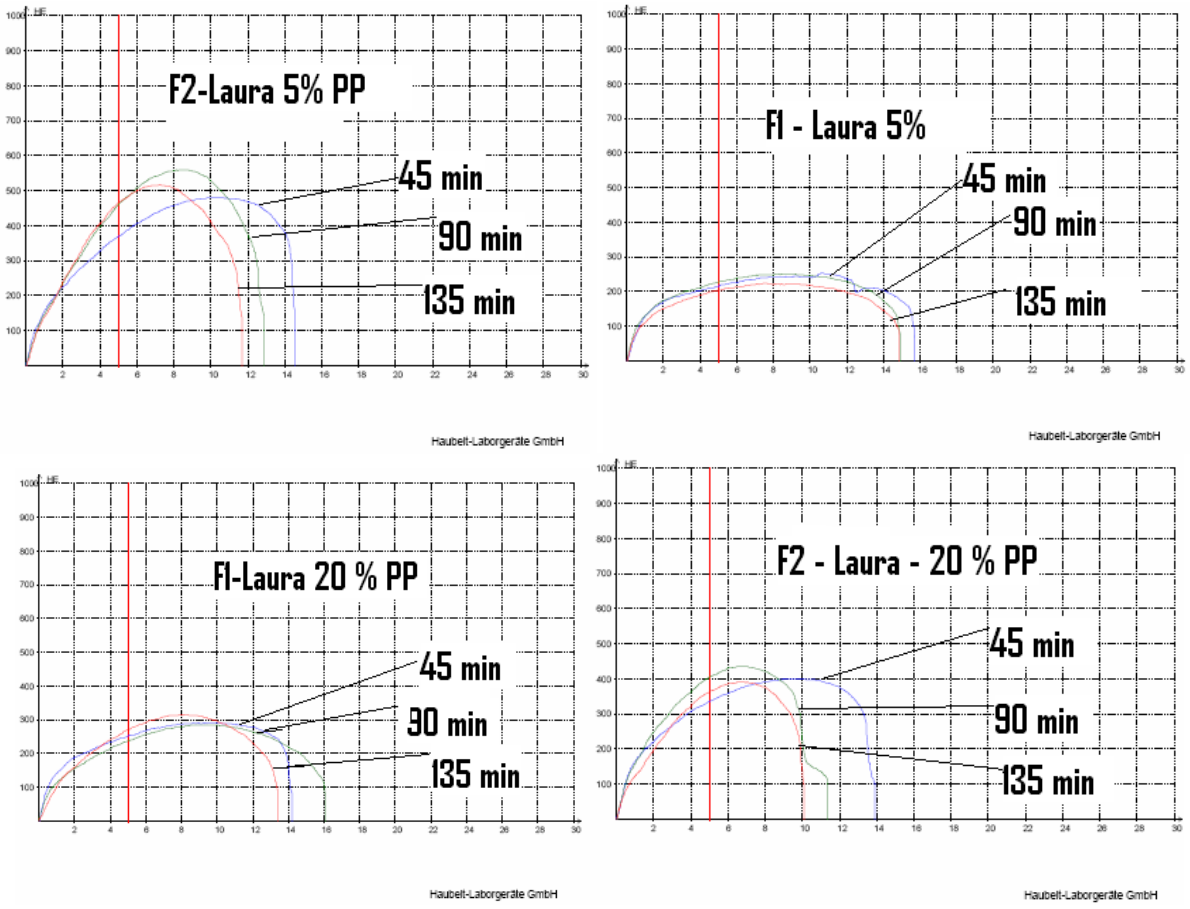

Fig. 3. Evolution of flourgraphic E7 curbs profile of dough made of wheat brown flour and brown flour additives which is replaced with potato pasta Laura variety in percentage 5% and 20%.

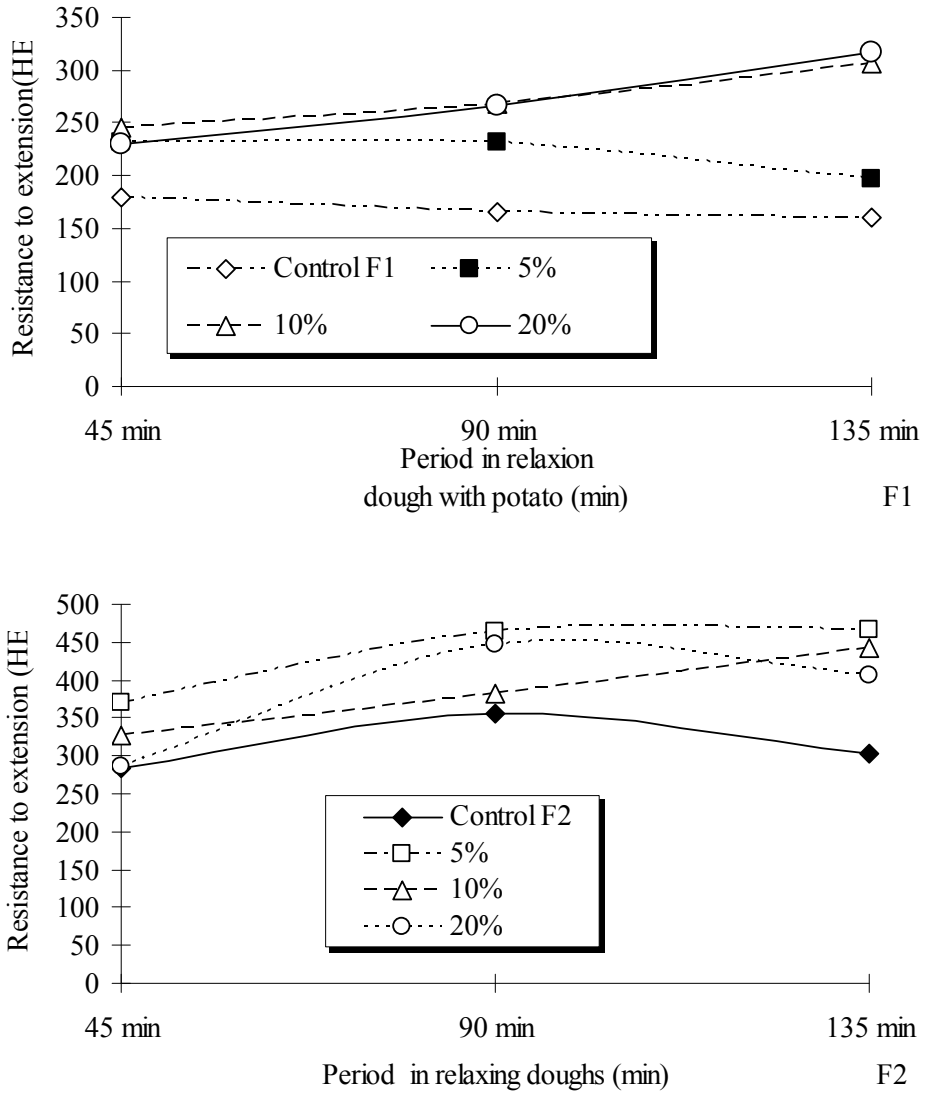

Fig. 4. Extension resistance value compared after 45, 90 and 135 minutes obtained for dough prepared of brown flour and brown flour additives and Laura potato variety, hydrotermally treated potato, which have replaced flour in proportion of 5%, 10% and 20%.

Extension resistance is lower for flour dough of flour F1 compared to F2 due to simultaneous action of ascorbic acid and L-cysteine. The maximum value for F1 is obtained after 45 minutes on control. So it has characteristics of a medium quality flour, 356 [HE] maximum value F2 flour was obtained in 90 minutes of rest. F1 is to increase 98.8% (Figure 2). The recorder curve, the flourgram, can be interpreted as a curve of stretching force versus a function of extension (Figure 3).

Influence of the replacement percentage of potato flour could be demonstrated during this study. Although he used the same values for potato resistance to extension was different. The resistance to extension increases with the increase rate of replacement of potato flour. Figure 4 for F1 shows that the parameter values obtained for a replacement rate of 10% - 20% are in the upper tier of control sample. Maximum was obtained for 20% working version, 317 (HE after 135 minutes of rest). It thus enhances resistance to extension of the dough. The dough of flour and potato variety F2 Laura maximum value is obtained for the working version of 5% after 135 minutes on control (Figure 4).

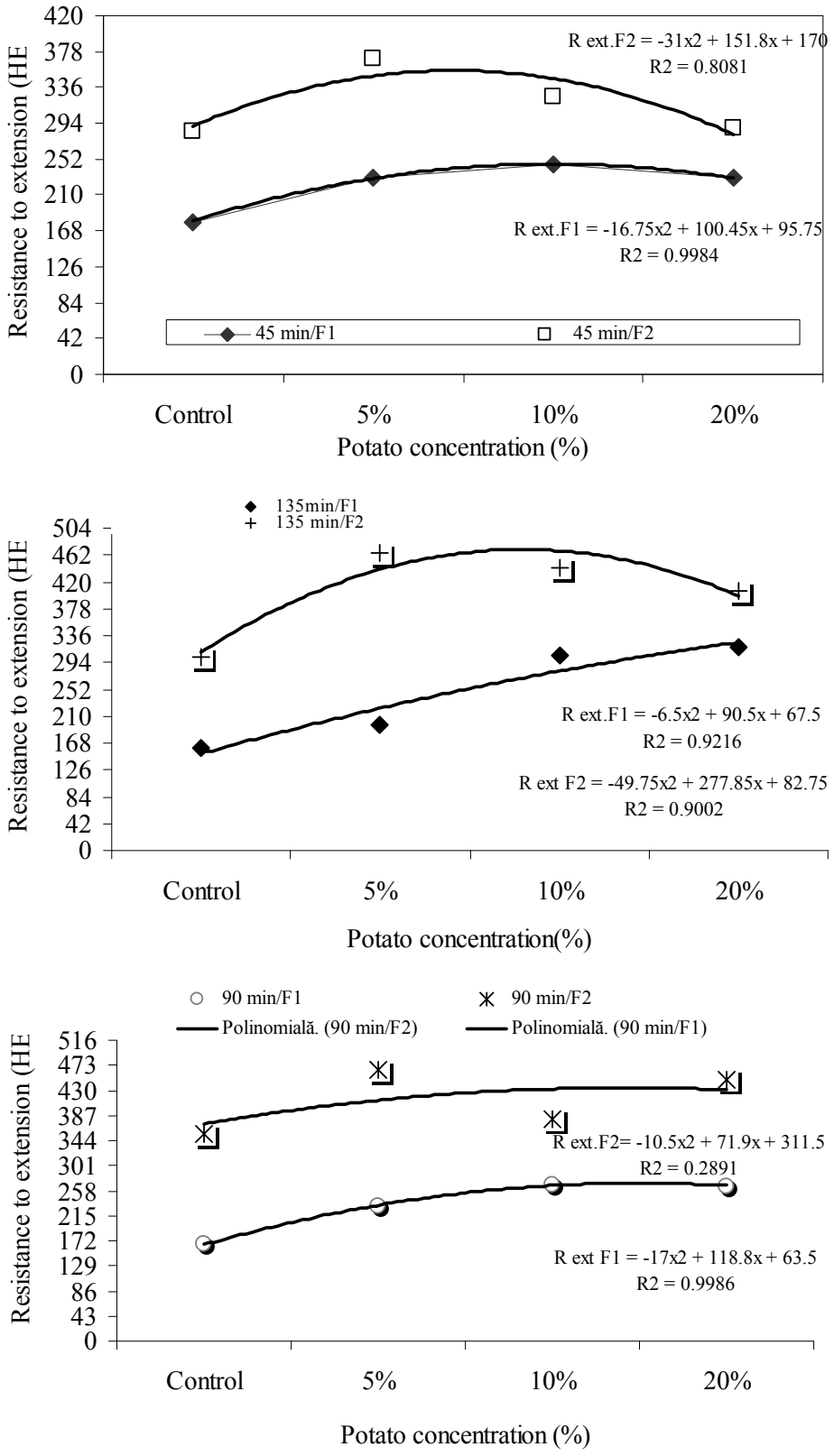

Fig. 5. Correlation between resistance to extension and the replacement percentage of flour with hydrothermally processed pulp for 45, 90 and 135 minutes.

To highlight the dependence of resistance to the percentage of replacement extension with potato flour was chosen for graphical representation number 5. It is seen from Figure 5 that the dependence of the percentage of meal replacement an additive F1 is polynomial. Demonstrated by the correlation index value R^2_{45min}= 0.9984, R^2_{90} min= 0.9986, $R^2_{135\ min}$ = 0.9216 that the degree of substitution of flour with potato pulp is an important influencing factor. During this study it was demonstrated that he has a higher weight than used in bread improvers. Resistance to extension of the dough of flour and potato Laura variety with additives F2 depend on the percentage of replacement of potato flour. The correlation is weaker compared with the version that was used in F1. Proof of correlation indices are: $R^2_{45\ min}$ = 0.8081, R^2_{135} min = 0.9002. When the items are its premix additive effect of resistance to extension rate dependence of replacing potato flour is accompanied by the effect of this action. The correlation is weaker $R^2_{90\ min}$ = 0.2881 (Figure 5).

4. CONCLUSION

Resistance to extension of the dough is a quality indicator influenced by the percentage of replacement of flour with the potato. If we replace the flour in a proportion of 20% with potato paste extension, the resistance increases during rest at constant temperature according to the quality of flour. The same potato variety behaves differently if the flour is mixed using different processes.

If additive premix contains flour, during dough processing enzymes act with its components and with hydrothermally processed potato pulp. Such the values of resistance to extension are no longer correlated only with percentage replacement of flour with potato.

5. REFERENCES

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