

RESEARCH REGARDING OF BAKING BAKERY PRODUCTS WITH BARLEY FLOUR

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ABSTRACT: To obtain bakery products with functional qualities must use: wheat flour type 800, 94 %; barley flour, 6%; fermentation duration of dough: 33-35 minutes; fermentation temperature of dough: 35°C; baking duration, 32-35 minute; baking temperature, 200-220 °C.

The transformation of dough in final product is the results of complex process: physical, chemical, biochemical and microbiological.

KEYWORDS: dough, barley flour, baking.

1. INTRODUCTION

The transformation of dough in final product is the results of complex process: physical, chemical, biochemical and microbiological.

The transformation of dough in final product is clearly by the crust obtaining, increasing volume, obtaining core and altering humidity.

The inferior layers of dough are wormed faster and outrun the 100 °C temperature in very short time, reaching the temperature of oven.

The exterior layers of dough lose the water and are transformed in crust. The crust obtaining has not the same speed in entire process. The thickness of crust increases, when the humidity of inferior layers goes to internal.

In the time of baking process the dough is altered continuing. First the dough firmness decreases to 57 °C and then increase. The dough elasticity increases begin with 60°C.

The biochemical process of dough: amylolise and proteolise are continuing in baking process.

2. Materials and methods

This program is based on the capitalization of barley flour for obtaining bakery dietetic products, especially for the people with gluten intolerance.

To achieve this research, it was used a centered compound program by second degree that has two independent variables:

- X_1 – baking temperature;
- X_2 – baking duration.

To realize the dough for baking process, was used the following recipe:

- o mixture of wheat flour type 800, 94% and barley flour, 6%;
- o water 50 % given mixture flour;
- o sodium chloride, 1.50 % given the flour mixture;
- o bakery dregs, 5 % given flour mixture;
- o kneading duration, 10 minutes;
- o fermentation duration, 35 minutes;
- o fermentation temperature, 36°C.

The independent parameters variation is presented in table no. 1.

Table no.1.

The independent parameters				
Independent values	X _i	Codified values		
		-1	0	1
Actual values				
Baking temperature, °C	X ₁	180	200	220
Baking duration, minute	X ₂	32	35	37

(*) reported to the total wheat flour

The experimental program is shown in table no. 2.

Table no. 2

Experimental program for dough baking								
Nr. crt.	Temperature, X_1 , °C		Duration, X_2 , minute		Acidity, degree	H/D	Core/crust	Core/bread
	Codi-fied	Real	Codi-fied	Real				
1	-1	180	-1	33	3,9	0,34	1,7	0,22
2	-1	180	0	36	4,1	0,42	1,9	0,38
3	-1	180	1	39	4,3	0,37	1,6	0,29
4	0	200	-1	33	4	0,47	2,1	0,42
5	0	200	0	36	4,2	0,48	2	0,30
6	0	200	1	39	4,5	0,39	2,4	0,35
7	1	220	-1	33	4	0,31	2	0,29
8	1	220	0	36	4,2	0,27	1,8	0,27
9	1	220	1	39	4,7	0,25	1,5	0,28

3. RESULTS AND DISCUSSIONS

To establish the recipe necessary to baking dough with barley flour was chosen as dependent variables the acidity, core/crust ratio and H/D ratio.

For interpretation of the research results was used the regression equations particularized from general equation:

$$y = b_0 + b_1X_1 + b_2X_2 + b_{12}X_1X_2 + b_{11}X_1^2 + b_{22}X_2^2 \quad [1]$$

The value of average deviation $\sigma = 0,15$ confirm the correctness of research.

Figures 1, 2, 3 and 4 present the variation of acidity degree of core, core/crust ratio, core/bread ratio and H/D ratio.

Table no.3.

The regression equations for dependent variables

Dependent parameters	Equations
Acidity degree, mL NOH 0,1 n/100g dough	$y_1 = 4,2 + 0,1x_1 + 0,26x_2 + 0,075x_1x_2 - 0,27x_1^2 - 0,071x_2^2$
H/D ratio	$y_2 = 0,36 - 0,05x_1 - 0,01x_2 + 0,034x_1x_2 - 0,12x_1^2 - 0,0014x_2^2$
Core/Crust ratio	$y_3 = 1,8 + 0,016x_1 - 0,05x_2 - 0,11x_1x_2 - 0,41x_1^2 - 0,0065x_2^2$

The parameters that influence the quality of final product are the temperature and duration of baking, for dough with 6% barley flour.

Core acidity is maxim for dough with 6% barley flour, when the baking duration is 35-37 minutes and baking temperature is 180-200°C (fig. 1).

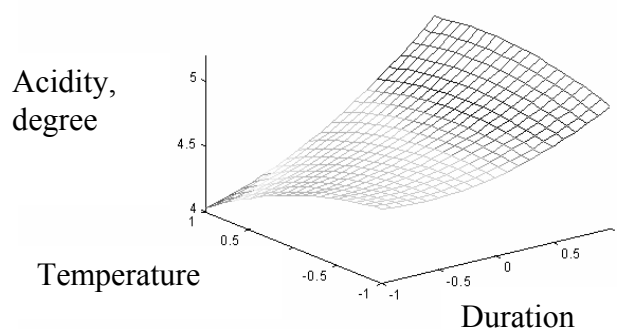


Fig. no. 1. Acidity variation of bread with barley flour, after baking process, depending on baking temperature and baking duration

When the baking temperature increase from 180°C up to 220 °C, the core acidity decrease to 4 degree.

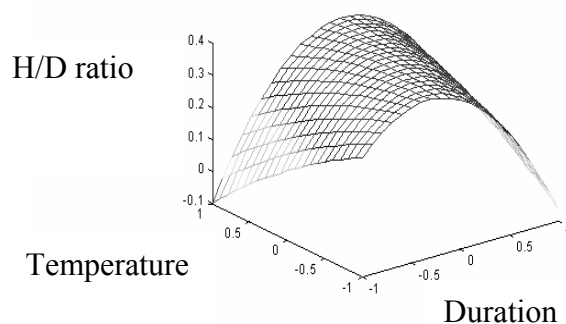


Fig. no.2. H/D ratio variation of bread with barley flour, after baking process, depending on baking temperature and baking duration

The H/D ratio is minim when the baking temperature is 220°C and is maxim when the baking temperature is 180-220 °C and the baking duration is 32-35 minutes (fig. 3).

The same values of temperature and duration of baking process influence the core/crust ratio positively.

The core/crust ratio decreases when the temperature and duration of baking increases. A temperature of 220°C will influence the core negatively (fig. 4).

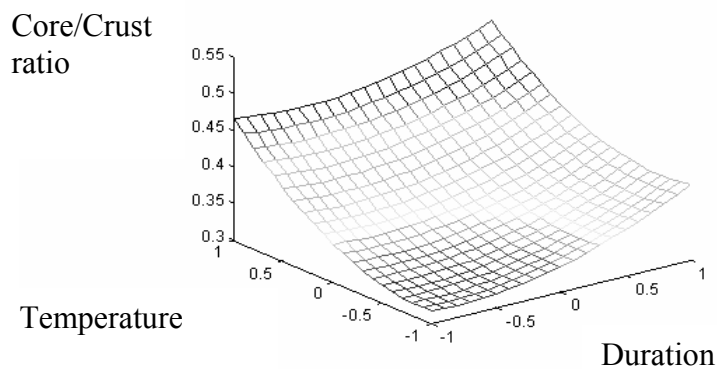


Fig. no. 3. Core/Crust ratio variation of bread with barley flour, after baking process, depending on baking temperature and baking duration

The core/bread ratio has maximal value when the independent parameters: baking temperature and baking duration are 180°C and 34 minutes.

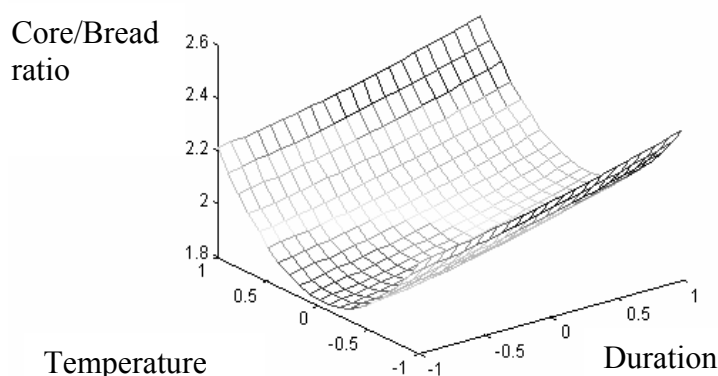


Fig. no. 4. Core/Bread ratio variation of bread with barley flour, after baking process, depending on baking temperature and baking duration

The optimal values of acidity, H/D ratio and core/crust ratio are established according with the reckonings (table no.4):

Table no. 4

Optimal values of independent parameters				
Independent variables	X_i	Acidity, Y_1 , degree acidity(1 mL NaOH n/10 / 100 g product)	H/D , Y_2 , %	Core/crust, Y_3 , %
Optimal baking duration (minutes)	X_1	34,87	33,95	31,37
Optimal baking temperature (°C)	X_2	212	197,4	200,38

4. CONCLUSIONS

The barley flour can be considered a necessary solution to obtain dietetic bakery products, with increased fibers content for the people with gluten intolerance.

It is necessary to apply a baking program according to the following recipe, to obtaining bakery products with functional qualities:

- ❖ wheat flour type 800, 94 %;
- ❖ barley flour, 6%;
- ❖ fermentation duration of dough: 33-35 minutes;
- ❖ fermentation temperature of dough: 35 °C;
- ❖ baking duration, 32-35 minute;

❖ baking temperature, 200-220 °C.

A mixture of wheat and barley flour, in quantities established by the research, allows obtaining dietetic bakery products, with reduced gluten content, reached in fibers and vitamins B and PP.

The impact studies of people response of this dietetic product with reduced gluten content are necessary.

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