CONTRIBUTIONS REGARDING THE USE OF OATS FLOUR AND BY-PRODUCTS OF MILK INDUSTRY TO OBTAIN BAKERY PRODUCTS

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ABSTRACT: The capitalization of cereals type oats flour and by- products of milk industry, become a national problem to obtain the dietetic bakery products.
The addition of oats flour in mixture with wheat flour type 650 and by- products of milk industry, contribute to obtain the dietetic bakery products with reduced gluten content.

KEYWORDS: by-products of milk industry, oats flour, and bakery.

1. INTRODUCTION

The extension of dietetic products with reduced gluten content becomes a primordial demand [1].

The use of oat flour can be considered a possible solution to dough obtaining [2].

We can use the oats flour in compatible proportion with wheat flour to obtain the dietetic bakery products with reduced gluten content and wealthy in cellulose fibers [3].

2. MATERIALS AND METHODS

To achieve this research, it was used a centered compound program by second degree with four independent variables produced in table no. 1.

Table 1.

Experimental conditions

Independent variables	X_i	Codified values					
		-2	-1	0	1	2	Δx
		Actual values					
Oats flour, (%) reported to mixture flour	X_1	0	3	6	9	12	3
By-products of milk industry , (%) reported to mixture flour	X_2	20	25	30	35	40	5
Duration of fermentation, (minutes)	X_3	56	58	60	62	64	2
Temperature of fermentation, (°C)	X_4	26	28	30	32	34	2

The raw materials was: wheat flour type 650; water and by-products of milk industry, 50 % reported to flour mixture; sodium chloride, 1.5 % reported to flour mixture; bakery dregs, 3 % reported to flour mixture; kneading duration is 10 minutes and the adding of sodium chloride and bakery dregs remains constantly in experimental program.

The oats flour adding from 3 % to 12 % influences positively the dough quality because of reduced gluten content.

By-products of milk industry have a wealthy content in proteins, lipids, and lactose [4].

The acidity degree was established with the titration method with NaOH 1 N. It was used the formula:

$$\text{Acidity} = \frac{V \times f}{5 \times 100} = 2 \times V \times f \quad \text{[acidity degree]} \qquad [1]$$

V = NaOH 1 N volume (mL);
f = the factor of NaOH solution [5].

The dough deformation (G) was established with formula:

$$G = \frac{D_f - D_i}{D_i} \times 100 \quad [\%], \qquad [2]$$

D_f = the final deformation of dough;
D_i = the initial deformation of dough [6].

To establish the humidity of dough (H) we dried 5 g dough in the following conditions: 155°C and 15 minutes.

The used formula is:

$$H = \frac{m_1 - m_2}{m_1 - m_0} \times 100 \quad [\%], \qquad [3]$$

m_1 = the weigh of plate with dough before drying, [g];
m_2 = the weigh of plate with dough after drying, [g];
m_0 = the weigh of plate, [g] [7].

The appearance was established with marks from 1 to 5, in increasing order.

It was used the regression equations particularized from general equation for interpretation of the research results (table no. 2).

$$y = b_0 \pm b_i x_i \pm b_{ij} x_i x_j \pm b_{ii} x_i^2, \qquad [4]$$

Table 2

Regression equations for dependent variables for dough fermentation

Dependent variable, y_i	Regression equation
Acidity degree, ml NaOH N/1	$Y = 3.75 + 0.08\ x_1 + 0.095\ x_2 + 0.12\ x_3 + 0.14\ x_4 + 0.031\ x_1x_2 + 0.018\ x_1x_3 + 0.018\ x_1x_4 - 0.043\ x_2x_3 - 0.043\ x_2x_4 - 0.078\ x^2_1 - 0.103\ x_2^2 - 0.028\ x_3^2 - 0.21\ x_4^2$
Dough deformation, %	$Y = 24.7 - 0.91\ x_1 + 0.58\ x_2 + 0.083\ x_3 + 2.25\ x_4 - 0.125\ x_1x_4 + 0.25\ x_2x_3 - 0.625\ x_3x_4 - 1.11\ x_1^2 - 1.11\ x_2^2 - 0.74\ x_4^2$
Final temperature of fermentation, °C	$Y = 31.42 + 0.16\ x_1 - 0.16\ x_2 + 0.24\ x_3 + 1.04\ x_4 - 0.125\ x_1x_2 + 0.093\ x_1x_3 - 0.25\ x_1x_4 + 0.25\ x_2x_3 + 0.25\ x_1^2 + 0.007\ x_2^2 + 0.07\ x_3^2 - 0.05\ x_4^2$
Humidity, %	$Y = 46.14 - 0.79\ x_1 - 0.54\ x_2 - 0.54\ x_3 + 0.70\ x_4 - 0.18\ x_1x_2 + 0.18\ x_1x_3 + 0.25\ x_1x_4 - 0.18\ x_2x_4 + 0.031\ x^2_1 - 0.34\ x_2^2 + 0.031\ x_3^2$
Appearance, marks by 1 to 5	$Y = 3.42 - 0.29\ x_1 - 0.25\ x_3 + 0.083\ x_4 - 0.37\ x_1x_2 + 0.125\ x_1x_3 - 0.125\ x_1x_4 - 0.25\ x_2x_4 - 0.0625\ x_3x_4 - 0.105\ x^2_1 + 0.11\ x_2^2 + 002\ x_4^2$

3. RESULTS AND DISCUSSIONS

For establishment of experimental program influence about the dough quality was chosen the graphical representation, presented in figures: 1, 2, 3, 4, 5, 6.

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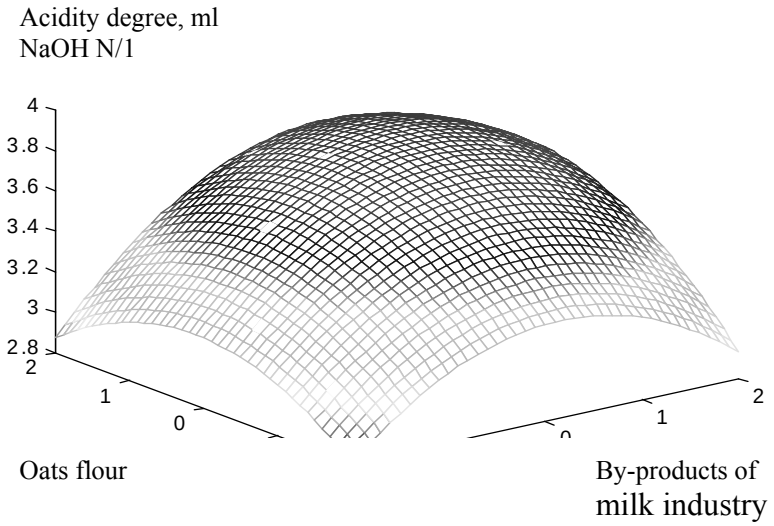

Fig. no. 1. Acidity degree variation of dough made of wheat flour and oats flour mixture and by-products of milk industry, when the temperature and duration are constantly in central domain (30 °C, 60 minutes)

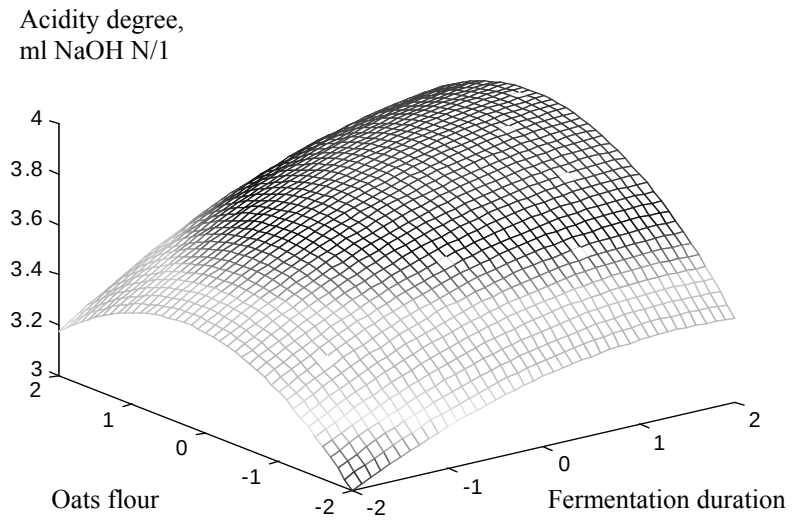

Fig. no. 2. Acidity degree variation of dough made of wheat flour and oats flour mixture and by-products of milk industry, when the by-products of milk industry adding and temperature are constantly in central domain (30 %, 30°C)

The oats flour adding, with reduced gluten content influences the acidity degree and the dough increase (figures 1, 2).

The improvement of dough quality is possible through the judicious selection of fermentation duration and temperature (figures 3, 4).

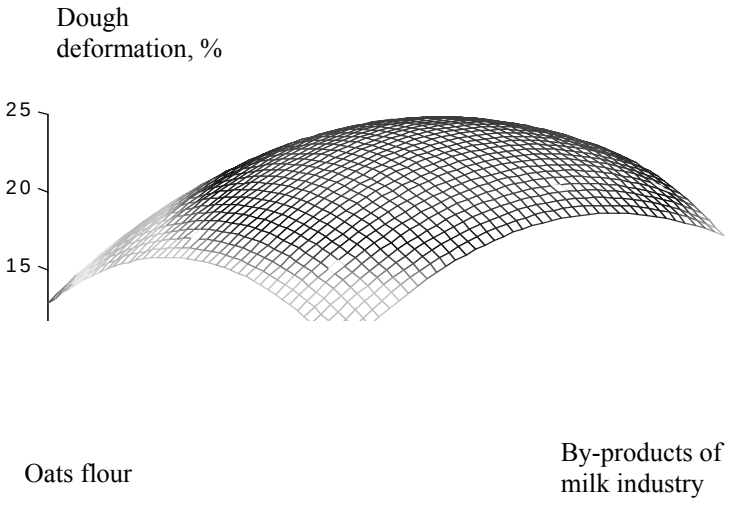

Fig. no. 3. Dough deformation variation of dough made of wheat flour and oats flour mixture and by-products of milk industry, when the temperature and duration are constantly in central domain (30 °C, 60 minutes)

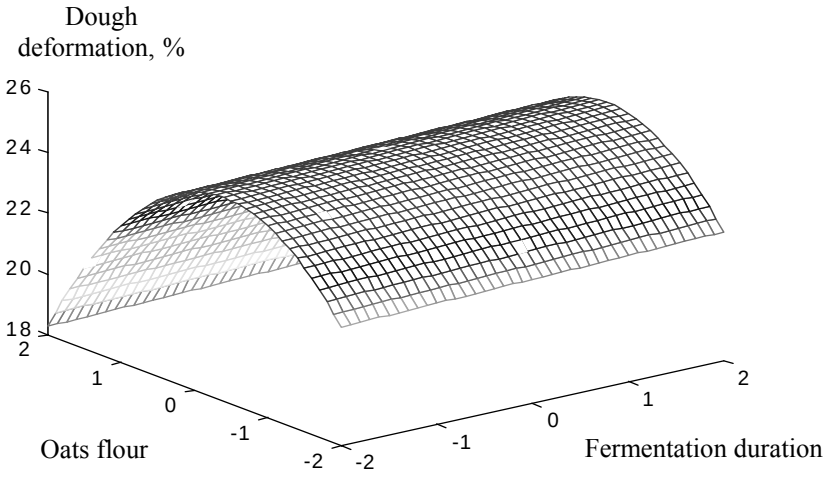

Fig. no. 4. Dough deformation variation of dough made of wheat flour and oats flour mixture and by-products of milk industry, when the by-products of milk industry adding and temperature are constantly in central domain (30 %, 30 °C)

The by-products of milk industry adding, with increased content of proteins, improve the technological results: humidity, final temperature of dough and appreciation (figures 5, 6).

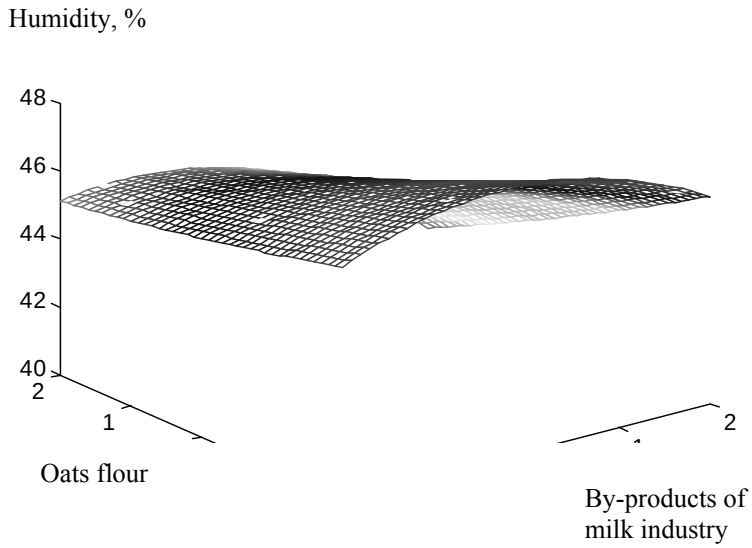

Fig. no. 5. Humidity variation of dough made of wheat flour and oats flour mixture and, by-products of milk industry, when duration and temperature are constantly in central domain (60 minutes, 30°C)

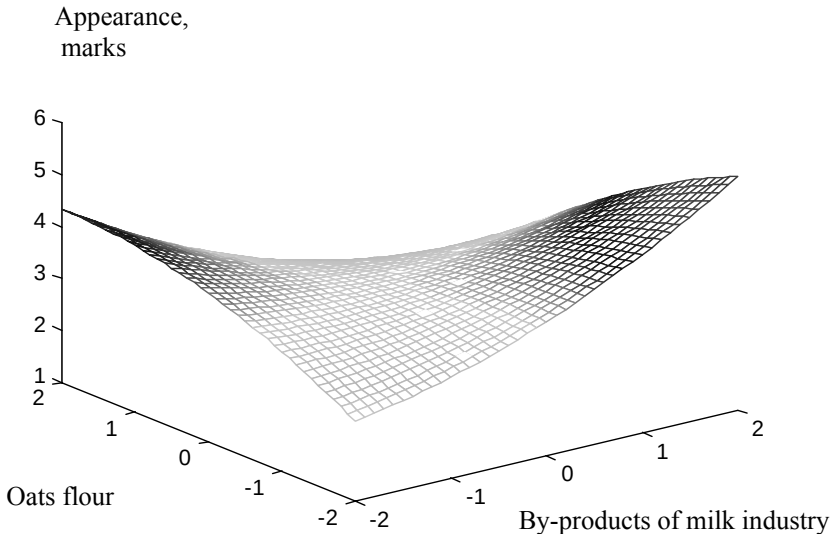

Fig. no. 6. Appearance variation of dough made of wheat flour and oats flour mixture and, by-products of milk industry, when the duration and temperature are constantly in central domain (60 minute, 30 °C)

An adding by 30 – 40 % by-products of milk industry has positive influence about fermentation process and the possibility to decrease the technological water consumption.

4. CONCLUSIONS

The research results permit the following conclusions:

- ✓ Oat flour adding in 6 – 9 % limits permits to obtain dough with improved functional specific features;
- ✓ The necessary technological conditions are represented through:
  - 91 – 94 % wheat flour type 650 adding;
  - duration of fermentation, 60 minutes;
  - sodium chloride 1.5 %;
  - bakery dregs 3 %;
  - 30 – 40 % by-products of milk industry adding reported to 50 % liquid adding.
- ✓ The extension of industrial level can influences positively the economical impact.

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