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Planning the experiment of treated melon slices during the drying

Abstract

The analysis of planning the experiment of treated melon slices during the drying will help in decision of such matters as: creation of large powered equipments and effective methods of drying, automation of control and regulation of drying process.

Keywords: melon, osmotic drying, pulp thickness, concentration Mode

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Introduction

The drying process of melons treated with sugar syrup studied using methods of optimal planning of full factorial experiment,[1,2] which is described by the following equation:

$$y = b_0 + \sum_{i=1}^{n} b_i x_i + \sum_{i,j=1}^{n} b_{ij} x_i x_j$$

The plan of the experiment (Table 1) is based on the basis of three factors in their natural dimensions (X1- concentration syrup within 70% and 50%-plus-minus x2-product thickness 30mm and 10mm, plus or minus, x3-drying method IR and convective convective plus minus.) in terms of dimensionless variables (x1, x2, x3).

The implementation of the plan prepared by the data presented in curves drying kinetics, melons, depending on the concentration (Figure 1), the thickness of the layer (Figure 2), the processing method. According to the results of experiments obtained by drying curves for different melon thermal effects (IR convection, convective).

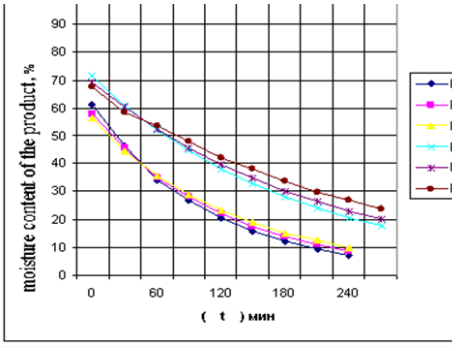

Figure 1: Where 1,2,3 ranks chopped pulp, 4,5,6 rows 2 cm thickness.

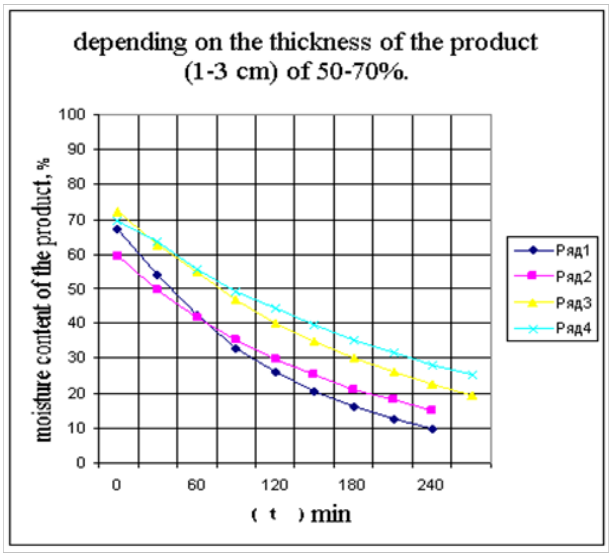

Figure 2 The number of the pulp treated with 1.3 to 50% syrup, 2.4 pulp is treated in a series of 70% syrup.

Drying curves consist of a constant speed period and falling rate drying period. Changing moisture in the first period is given by:

$$W_{\dot{p}}^{c} = W^{c} - N \cdot \tau_1$$

$$\text{Here } N = \frac{W_i^c - W_p}{\tau_1}$$

For the second drying period we have:

$$W_k^c = W_1^c \exp\left(-K\tau_2\right)$$

Table 1 The plan of full factorial experiment in syrup

№	X_1	X_2	X_3	$W_{н.ср}^{c}$	$W_{кр.ср}^{c}$	t_1 (min)	$N_{ср}$	t_2 (min)	$К_{ср.}$
1	+	+	+	62.4	47	75	0.3	285	0.075
2	+	+	-	69.4	58	60	0.19	420	0.075
3	+	-	+	59.5	50	30	0.32	300	0.118
4	+	-	-	59.5	52	45	0.17	435	0.084
5	-	+	+	72.26	62	30	0.34	330	0.128
6	-	+	-	72.26	58	75	0.19	405	0.094
7	-	-	+	68.8	54	30	0.49	300	0.147
8	-	-	-	68.8	58	45	0.24	435	0.108

Results and discussion

Changes in humidity melon pulp in a sugar syrup is determined by the formula:

$$W_{KP} = 54.87 - 3.12 \cdot x_1 + 1.37 \cdot x_2 - 2.37 \cdot x_3 - 0.625 x_1 x_2 - 2.87 x_1 x_3 - 0.375 x_2 x_3 - 2.12 x_1 x_2 x_3$$

Regression equations ratio drying melons during constant speed in the form

$$N = 0.28 - 0.035x_1 - 0.025x_2 + 0.0825x_3 + 0.025x_1x_2 - 0.0175x_1x_3 - 0.0175x_2x_3 + 0.0075x_1x_2x_3 =$$
$$= 0.28 - 0.035x_1 - 0.025x_2\left(1 - x_1\right) - 0.0175x_3\left(x_1 + x_2\right) + 0.0$$

Straighten the curves obtained in the semi-logarithmic anamorphosis to determine the coefficient falling drying rate:

$$K = \frac{In\left(W_n^c - W_p^c\right) - In\left(W_k^c - W_p^c\right)}{\tau_2}$$

$$K=0.283-0.0584X_1-0.0476X_2+0.0435X_3+0.0166X_1X_2-0.0116X_1X_3-0.0214X_2X_3+0.0008X_1X_2X_3$$

Conclusion

As a result, the planning of the experiment processed melon slices on drying obtained regression equation in times of permanent and falling rates of drying that allows us to choose the most appropriate methods for solving these problems.

Acknowledgements

None.

Conflict of interest

The author declares no conflict of interest.

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