

Method of Comparative Analysis of the Structure of Food

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Abstract

Pore size distribution has a large impact to determine the rational mode of drying the combined method of investigation of hygroscopic properties and the binding energy of moisture. Hence introduction of modern methods of treatment and non-traditional methods of drying fruits to produce new products that require research and mathematical description of the hygroscopic properties. The method of comparative analyses applied in this study gives the opportunity to determine diameters of pores activity of water and other parameters in dried products.

Keywords: Uzbekistan; Agriculture; Melon; Activity of water

Introduction

Food products are so complex a system as in nature, and structure that they have different types of communications moisture [1-6]. At various stages of dehydration products plays a major role or that kind of moisture.

Much of the fruit and vegetable crops subjected to drying are wet colloidal capillary- porous systems. Pore size distribution has a large impact to determine the rational mode of drying the combined method of investigation of hygroscopic properties and the binding energy of moisture [6]. Nature of the sorption and desorption isotherms depends on the type of moisture due to the material. In the hygroscopic region of connection of moisture depends on the relationship of structure and properties of materials.

Results and Discussion

There were discussed hygroscopic properties of different types of products by a number of scientists. Currently, however, introduction of modern methods of treatment and non-traditional methods of drying fruits to produce new products that require research and mathematical description of the hygroscopic properties.

In order to determine the equilibrium moisture content of fruit crops: melon varieties: - "Shakar-Palak", "Ala-puchak"-experimental studies designed and manufactured in a climate chamber. The results of these studies, the desorption isotherm melon fruits at different temperatures ($t = 25 - 50^{\circ}\text{C}$) and relative humidity (20-80%), are presented in Table 1 and Figure 1.

In connection with the penetration of syrup solution in the capillaries of melon flesh, determination and dissolution of the effective pore diameter of great importance. The specific surface of the remote water film is formed in the early part of the capillary condensation is determined by the method of: 4

$$S = \frac{1}{G_u} \int_{U_n}^{U_s} \Delta r \cdot du \quad (1)$$

G- The surface tension of liquid, H/M;

U- Amount of moisture in the material at saturation $p/p_c=1$;

U- Amount of moisture in the beginning of the section of capillary condensation

L- The binding energy or differential operation dehydration product, $\kappa\text{Дж}/\text{кг.вл.}$

$$L = -RT \ln \phi \quad (2)$$

R- Universal gas constant, $\text{Дж}/\text{КМоль}\%$

According to the formula defined by the effective diameter of pores

$$d = \frac{4GV_m}{RT \ln \left(\frac{P_n}{P_h} \right)} \quad (3)$$

G- the surface tension of melon juice which depends on sugar, MH/M ;

V- molar volume of water contained in the product, $\text{м}^3/\text{моль}$;

In order to determine the pore size by comparing different varieties of melons. Choose a melon pulp, and other varieties of the same surface wetting handle under the same conditions in the same concentration of sugar syrup. After processing in sugar syrup is binning of products within 5-10 minutes.

Calculations of the parameters listed in Table 2.

Melon	t°C	Relative humidity air,%						
		20	30	40	50	60	70	80
Without Treatment	25	10,1	12	15,8	18,1	22,6	26,7	35
With Treatment in sugar syrup	25	11,8	12,5	18,1	22,4	25	32,1	38,8
Without Treatment	50	4,8	5	6,1	8,1	12	17	25
With Treatment in Sugar Syrup	50	5,1	6,8	8	12,1	15,6	22	28,5

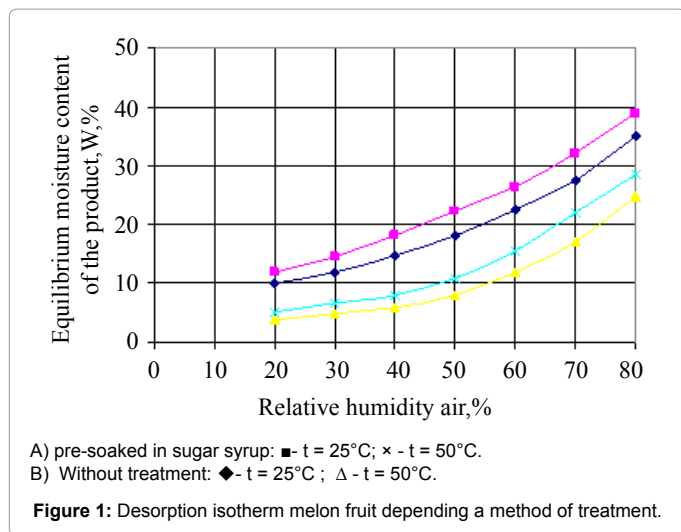
Table 1: Desorption isotherm melon processed in sugar syrup.

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Humidity	Desorption with Melon T=298 (Without Treatment)				Desorption with Melon T=323 (without treatment)			
	U, Mol/kg	V · 10 ⁻³ m ³ /kg	L, J/mole	D · 10 ⁻⁹ , m	U, Mol/kg	V · 10 ⁻³ m ³ /kg	L, J/mole	D · 10 ⁻⁹ , m
0,8	19,4	0,34	552	10,2	13,87	0,24	598,8	6,87
0,7	14,82	0,26	884	4,88	9,43	0,16	958,7	2,92
0,6	12,54	0,22	1268	2,88	6,6	0,11	1374	1,43
0,5	10,04	0,18	1717	1,7	4,44	0,07	1861	0,7
0,4	8,7	0,156	2269	1,11	3,3	0,05	2455	0,4
0,3	6,6	0,11	2983	0,64	2,7	0,04	3233	0,25
0,2	5,6	0,10	3989	0,4	2,1	0,037	4323	0,14

Table 2: Calculated data melon desorption.

Humidity in Chamber	Desorption Melon Stood in syrup at T= 298 K				Desorption Melon Stood in syrup at T= 323			
	U, Mol / kg	V · 10 ⁻³ m ³ /kg	L, J/mole	D · 10 ⁻⁹ , m	U, Mol / kg	V · 10 ⁻³ m ³ /kg	L, J/mole	D · 10 ⁻⁹ , m
0,8	21,35	0,38	552	11,5	15,81	0,28	598,8	7,68
0,7	17,8	0,32	884	5,97	12,21	0,21	958,7	3,71
0,6	13,87	0,24	1268	3,25	8,65	0,15	1374	1,83
0,5	12,43	0,223	1717	2,14	6,71	0,12	1861	1,05
0,4	10,04	0,18	2269	1,31	4,4	0,07	2455	0,52
0,3	6,93	0,12	2983	0,69	3,77	0,067	3233	0,33
0,2	6,5	0,117	3989	0,43	2,8	0,05	4323	0,16

Table 3: Calculated melon stood.

Then, after the drying process is the measurement of water activity in the two products using laboratory equipment of “rotronic Hygro Palm” with an accuracy of 0.5 - 100% and the temperature in the range from 0.5 to 50°C

Since we know the parameters of water activity in both products

and the pore diameter of one of the varieties of melons we turn to the formula for determining the activity of water depending on the structure of the product.

$$\alpha_w = e^{\frac{-2\gamma \cos \theta_m}{rRT}}$$

Or

$$r = \frac{-2\gamma \cos \theta \cdot v_m}{R \cdot T \cdot \ln \alpha_w}$$

γ - the surface tension of liquid; θ / - contact angle of liquid with the wall of the capillary; R - gas constant; r - radius of the capillary; v - molar volume of liquid

Assume that during the processing of sugar syrup melon pulp adsorption of one and the other varieties formed a superficial solution to Gibbs identical in composition, we can assume that the surface tension and contact angle in the products are the same. Hence the average pore radius of another kind.

$$r = \frac{r_{melon} \cdot a_{abri \cot}}{\dot{a}_{melon}}$$

In these calculations do not take into account the correction factor which depends on: the real values of surface tension, contact angle of liquid with the wall, the chemical potential in the product Table 3.

Conclusion

The method of comparative analyses gives the opportunity to determine diameters of pores activity of water and other parameters in dried products. Investigated the hygroscopic properties of the pulp after melon combined drying method in a wide range of moisture and temperature environment, their structural characteristics, the quantity of energy due to moisture.

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