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ANALYSIS OF THICKNESS OF ECOLOGICAL MATERIAL, ORIENTATED POLYPROPYLENE FOR THE PACKAGING OF DRIED FRUIT

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ABSTRACT

Rational choice and the use of appropriate packaging materials and types of packaging influence the preservation of the qualitative characteristics of the product as well as on the sustainability of the packaged content [1]. Based on testing the thicknesses of different types of materials, it is possible to make the right choice for packaging certain food products. One of the important properties of packaging materials is its thickness. The thickness determines the physical - mechanical as well as the protective properties of the packaging material, and the uniformity of the thickness is important for the passage of material on the packers and the correctness of the formation of packaging units. Quality control of five types of packaging materials was carried out exclusively by measuring their thickness. The results of measurements are shown in this paper. Reducing the thickness, and therefore the mass per unit, is achieved by using these modern polymer materials. In this way, we achieve the savings of packaging material, which is justified from the economic point of view, but also from the ecological point of view.

1. INTRODUCTION

1.1. Packaging

Packaging is the medium which accepts the product and protects it until use [2]. Packaging with the product form a single unit, which is presented to the customer, meaning that it is an integral part of it, protects it and impartially recommends, thereby providing the necessary information on the content and makes using it satisfaction [3]. The task of the packaging is that in all conditions of packaging and storage, protects product from mechanical, chemical-physical, microbiological and biological changes resulting from the operation of environmental factors and storage time [4]. Presented package is partially made of plastic material and combined packaging materials [5]. Under the quality formation of packaging units means that all connections to the primary packaging are well closed, and shall not

remain open or pores that allow the undefined free exchange of the atmosphere around contents from the external environment.

1.2. Dried fruits

Dried fruit is dried in semi-industrial dryer-type (IVERAK), using alternately in drying of hot air for drying. The technological process of production of dried fruit consists of:

1. Calibration.
2. Cleaning.
3. Washing.
4. Cutting.
5. Treatment with sulphur dioxide.
6. Drying.
7. Packing.

Industrial indirect mini dryer (IVERAK), that was used in this study is intended to: Drying parcel fruit or vegetables. Capacity is 1000-1300 kg depending on the product in the forests. The drying time of the product depends on the product and ranges from 50 ^{0}C to 80 ^{0}C.
The temperature during drying is constantly controlled. The two-way fan ensures the uniqueness of the division in the tunnel and the uniform drying of the products in all stages. The fan is time- and temperature-programmed with system located in the control panel. The dryer is constructed of solid fuel. Tunnel of dryer is built of polyurethane. The dimensions of the tunnel are: length 5.1 m, width 2 m, height 2 m. Air circulation is determined by the fan installed on the upper side of the dryer.

2. EXPERIMENTAL RESULTS AND DISCUSSION

One of the important properties of packaging materials is its thickness. Thickness determines the physic -mechanical properties of the packaging material and uniformity of thickness is essential for mobility materials to packaging machine and regularity of the formation of packaging units. Changes in the contents of measuring thickness of individual packing material were observed after a certain period of time, as follows:15 days, 30 days, 90 days, and 120 days, during storage at room temperature and exposed to daylight. Results are given as the average of measurements made on four samples of the contents of the packaging unit or bags for each position. Packaging unit which made of plastic and the combined materials are formed with heat- seal. Thickness of the sample is made with a method according to JUS G.S2.733 with precise electronic gauge MICRO 2000. Measurements were made at eight positions on each sample.

3. RESULTS AND DISCUSSION

The paper used four types of packaging material, which were investigated on the impact of packaging on the quality changes of packaged dried fruits. The bags are made of the following materials:

1. Monomaterial, Polyethylene (PE) of thickness 95 μm.

2. Monomaterial, oriented polypropylene (OPP) thickness of 20 μm.

3. Combined packaging material, oriented polypropylene (OPP) / Polyethylene (PE) thickness 20/50 μm.

4. Composite packaging materials, polyethylene (PE) thickness of 20/50 μm.

5. Combined packaging materials, Polyester (PET) / oriented polypropylene metalized (RIP) met / Polyethylene (PE) 12/38/30 μm. The results of tests of thickness of the packaging material PE (95) μm shown in the Table 1.

Table 1: The thickness of the packaging material PE (95) μm

Position	Samples					
	1	2	3	4	5	
1	91	90	95	90	94	
2	92	91	95	91	92	
3	95	91	92	90	90	
4	95	91	91	92	91	
5	97	95	91	95	91	
6	92	96	91	95	98	
7	97	98	92	92	93	
8	93	95	91	93	97	
X	94	96	92	92	93	X93.40
S	0.7557	1.2755	0.2224	0.3069	0.9408	S0.7017
Kv	0.0080	0.0132	0.0024	0.0033	0.0101	Kv0.0074

The results obtained indicate that the packaging material PE has a satisfactory uniformity of the thickness of the packaging material. The results indicate a good technological process of material production. Uniformity of the thicknesses of packaging materials provides good mobility materials to the packing machines and quality formation of packaging units.
The results of tests of the packaging material thickness meth OPP (20) are shown in Table 2.

Table 2: The thickness of the packaging material meth OPP (20) μm

Position	Samples					
	1	2	3	4	5	
1	19	19	20	20	20	
2	19	19	20	20	21	
3	19	19	20	21	20	
4	19	20	20	21	20	
5	19	20	20	20	19	
6	19	20	20	20	20	
7	20	21	21	21	21	
8	20	20	20	21	20	
X	19	20	20	20	20	X19.80
S	0.0944	0.2361	0.0472	0.1889	0.1417	S0.1416
Kv	0.0049	0.0118	0.0023	0.0094	0.0070	Kv0.0070

The values obtained indicate a slight deviation of thickness OPP meth for packaging material and provides good graft material to the packing machine and the formation of high-quality packaging units. The results indicate a good technological process in materials production. The results of tests the thickness of the packaging material OPP met /PE (20/50) microns are shown in Table 3.

Table 3: Thickness of packaging material OPP met / PE (20/50) μm.

Position	Samples					
	1	2	3	4	5	
1	69	69	71	71	70	
2	70	70	71	71	70	
3	65	72	70	71	71	
4	62	71	72	70	73	
5	63	72	69	70	71	
6	66	73	71	70	72	
7	69	69	70	70	70	
8	72	75	66	70	70	
X	67	71	70	70	71	X69.80
S	1.1338	0.6140	0.4723	0.1416	0.3306	S0.1416
Kv	0.0169	0.0086	0.0067	0.0020	0.0046	Kv0.0070

The values obtained indicate a small deviation of thickness OPP met / PE of packaging materials. This small deviation results can be explained by the uneven distribution of the adhesive at combined OPP met and PE materials. The results of tests the thickness of the packaging material 12/38/50 (PET / OPP met / PE) are shown in microns in Table 4.

Table 4: The thickness of the packaging material 12/38/50 (PET / OPP met / PE) μm

Position	Samples					
	1	2	3	4	5	
1	78	78	79	79	78	
2	78	79	79	80	78	
3	79	80	80	78	80	
4	79	79	78	78	80	
5	79	79	79	81	79	
6	78	79	77	80	79	
7	79	80	79	79	80	
8	79	79	79	80	79	
X	79	79	79	79	79	X79.00
S	0.1794	0.0885	0.2054	0.3306	0.1307	S0.1869
Kv	0.0022	0.0011	0.0026	0.0041	0.0016	Kv0.0023

The results do not show large variations in the thickness of the packaging material. Slight variations than the stated values of mono materials from combination indicate on a good combination with a uniformly applied adhesive.

4. CONSCLUSION

At the end of 120 days of storage was just concluded with the packaging material, 12/38/50 (PET / OPP met / PE) μm, that there was an appearance of mold. What leads us to the conclusion that in the three other packaging materials there has been no change, and they can be used as appropriate materials for the protection of dried fruit. Test results of testing thickness indicate that there are not major deviations from the nominal values given in the documentation of these materials. Tested quality of the material was evaluated as good in accordance with the technical characteristics which is characteristic for the manufacturing technology of this material.

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