THE IMPACT OF DIFFERENT DRYING METHODS ON PEARS QUALITY

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Abstract: Processed pears present a worldwide consumed product. This paperwork presents an impact analysis of different dehydrating methods on pears quality indices. There was made a comparative appreciation of dried by different methods pears, as by organoleptic method as well as using CIELAB instrumental method.

Keywords: pears, dehydration, convection, microwaves (SHF), quality, etc.

Introduction

The pear tree is a Rosaceae Family falling leaves tree, which can reach 10 – 20 m and its fruit being the pear. Its longevity is about 65 years, in some cases reaching to 400 years. The pear tree roots are deep and woody, the trunk is straight with a grey cracked bark, the tree has 10 cm long oval leafs, with an green contour. Pear tree flowers have white ore rose 1,5 cm long petals, and its fruits are comestible.

It grows within temperate and moist climate regions, resists cold but the heat and the drought prevents its fruits to grow. The best climate is characterized by cold but not frosty winters and moderate springs and summers. Blooms at 7°C and resists up to -18°C, at winter rest the tree can handle even a -40°C frost.

Another advantage of the pear tree is that its fruits aren't just good for using as row food, but as well using them in different type of delicacy. Conference pears are remarkably good handling thermal treatment.

These fruits haven't necessary to be immediately treated. In some cool place the pears can be preserved up to several weeks and in the fridge even up to several months.

As study object we chose the pear Conference (cultivated autumn variety), which has a pleasant aroma and a flavor. As lot of other autumn varieties, those are good to be eaten sometime after being reaped. In this period the fruit gains its sweet taste and a pleasant succulence. That fruit is radically transformed just by putting it in the fridge or some other cool place. At cold that pear becomes very succulent and flavorful. The interior is beige-rosy and tasty. The fruit is quite big, weighing from 150 g to 200 g, has an elongate form, a dense yellow-greenish texture, sometimes with some maroon spots. Those spots are the symptom of a disease which shows that the pears weren't treated right. Conference pear is the most suitable to be consumed in dehydrated form as it contains lot of nutriments, fibers, antioxidants and a lot of vitamins (A, K, B_2, B_6, E and C) and minerals (Ca, Mg, Cu, K and pectins) [1].

The cultivation of Conference pears trees is advised to be done on a vast area. The large crowned tree occupies a lot of space. Many experts sustain that's much better to buy the Conference pears variety trees than several different varieties of smaller trees. In that case there will be a greater harvest with less worries as well as the possibility to store the pears for up to three months. That way the producer will be stocked with fresh juice fruits for almost the whole winter.

Conference pears tree doesn't require any special treatment. This variety is quite resistant to most of pears diseases; it's tolerant to heat and not exigent to the soil type.

Materials and methods

To dry the pears one used different methods: convective, microwaves (SHF) and combined one (convective + microwaves (SHF)). The combined method was tested ad different temperatures: 60°C, 70°C, 80°C, 90°C, and 100°C.

Using the microwave (SHF) method one dried the product at 57%, 73%, 83% and 100% of the magnetron power. The last method, the combined one, was tested at t = 60°C and 73% of the magnetron power. We made by different methods an organoleptic analysis of the row pear, as well as of the dried ones by different methods, and all of them were rated. One presented the spectral methods graphical CIELAB presentation of dehydrated by different methods pears. We determined as well the dry pear polyphenol-oxidase enzyme. For that reason we used some chemical reagents: Distilled water – ГОСТ-6709-72, Oxalic acid 1% – ГОСТ-6032-2004, 0,001 n solution – ГОСТ-6015-34, Sodium salt – ГОСТ-13830-97, Phosphoric acid H_3PO_4 – ГОСТ-10678-76, 1% amidin solution – ГОСТ-7699-78.

Results and discussions

The drying process is consists of two periods. The first period is featured by a constant drying velocity, the second one – the velocity decreases. Before first period begins, we got a product heating phase. In the first period there is water evaporation from the material's surface (external diffusion) as well as high process intensity. Beside this the drying velocity here is proportional to the driving force likewise the material's surface is proportional to the thermic agent. One performed different methods drying scenarios afterwards drawing drying charts that allowed us to estimate: mass decreasing and drying velocity dynamics.

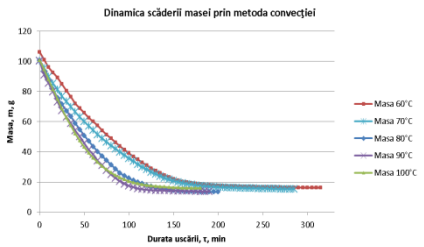

Fig. 1. Convection method mass decreassing dynamics

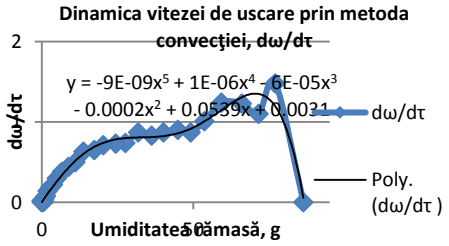

Fig. 2. Convection method drying velocity dynamics

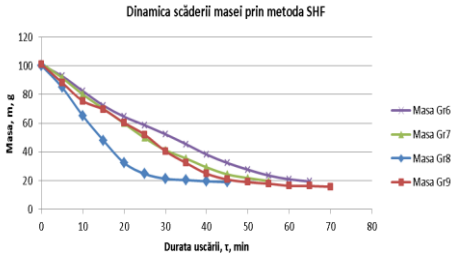

Fig. 3. Different gradation SHF method mass decreassing dynamics.

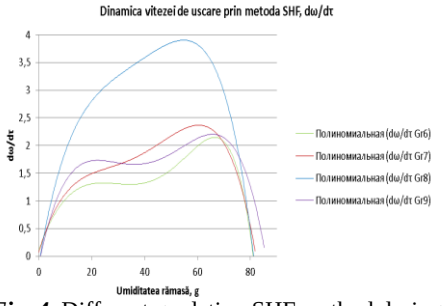

Fig. 4. Different gradation SHF method drying velocity dynamics

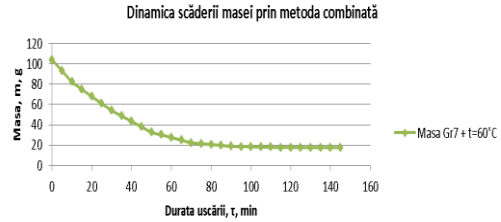

Fig. 5. Combined method mass decreassing dynamics

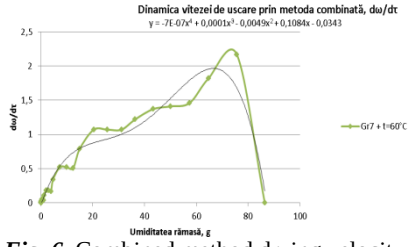

Fig. 6. Combined method drying velocity dynamics

The combined method was introduced as a solution to reduce the disadvantages of two forming it component-methods: convective one and using SHF fields (super high frequency fields). For this experiment to go we chose the most convenient regimes from both component-methods: drying agent temperature *t = 60°C* and magnetron regime *73% m.p.* (magnetron power). As a result we got a both sides convenient product: good as quality (conserving most useful components, by reducing high temperature effect) and economically profitable (SHF action decreases processing duration). The drying duration was twice as short comparing to convective method at same *t = 60°C* (*315 min* to *145 min*), likewise the electromagnetic field action was reduced.

We rated the analyzed row and dried pears by different methods of organoleptic analysis. The tasting committee, consisting of eight people, calculated the average mark of the test.

From the table one can observe that all samples data are different and correspond to: Sample I – fresh row pear; Sample II – hot air dried pear; Sample III – SHF dried pear; Sample IV – combined method dried pear.

Table 1. Dried to row material pears organoleptic comparative analysis

Fresh pear – Sample I		**Dried pear – Sample II, III, IV**		**Rating**
Organoleptic index	**Comments**	**Organoleptic index**	**Comments**	
1) Texture	No foreign matter particles found, the surface is smooth.	**1) Texture**	No foreign matter particles found, the surface is rough. Sample IV is slightly burnt.	Sample I = 5,0 Sample II = 3,8 Sample III = 4,5 Sample IV = 3,7
2) Color	Specific to the variety.	**2) Color**	Sample II has an attractive color however the rest of the samples have a burnt-brown color.	Sample I = 4,9 Sample II = 5 Sample III = 3,5 Sample IV = 3,8
3) Flavor	Pears specific flavor.	**3) Flavor**	Samples II and III have a sweet-caramelized flavor. Sample IV is less pronounced.	Sample I = 5,0 Sample II = 4,6 Sample III = 4,1 Sample IV = 4,1
4) Taste	Specific to the pears.	**4) Taste**	Sweet-caramelized taste for Sample II and III. Sample IV has a less pronounced taste.	Sample I = 5,0 Sample II = 4,8 Sample III = 4,1 Sample IV = 3,6

After finishing the organoleptic analysis, and drawing the table, we determined the most appropriate method for pears drying – the convective regime (using hot air). Sample II has accumulated the maximum rating of all – 4,5 points.

Table 2. Dried samples rating

Sample I (fresh pear)	**4,9puncte**
Sample II (dried with hot air)	**4,5puncte**
Sample III (dried with SHF)	**3,1puncte**
Sample IV (dried by combined method)	**3,8puncte**

After a short discussion with the tasting committee all of its members gave the maximum point to Sample II, making the most suitable method for drying vegetal matter the convective method. As quality aspect it is so, but this method can't be called an economically favorable one. The final price (including electricity bills) will be higher as against to other drying methods.

For colors specter appreciation one studied sample's drying temperature, this is 90°C. Afterwards the convection dried pear image was transferred to pixels color tracking soft that showed us matter's characteristic data. We could observe that temperature's action augments by percentage colors' intensity. Table 3 informs us about temperature influence on color intensity.

Table 3. Color intensity depending on temperature

Spectral color representation depending on drying temperature – convection		
Red	75,66%	
Blue	35%	
Luminosity	21,12%	
Blue-Yellow	24,04%	**b**
Green-Red	4,47%	**a**
Luminosity	41,75%	**L**

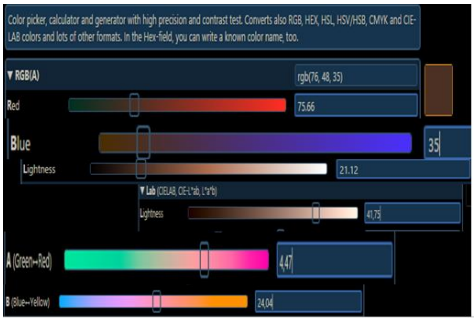

Fig. 7. CIELAB program data

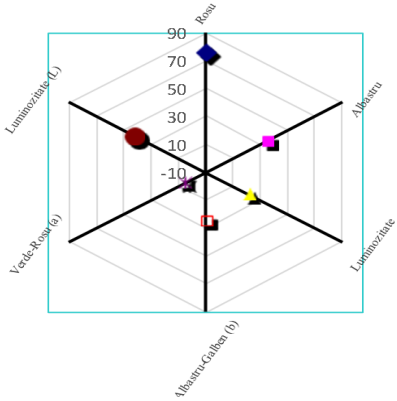

Fig. 8. Color spectral representation depending on temperature (convective method)

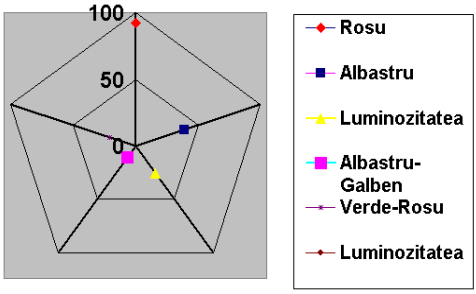

Fig. 9. Color spectral representation depending on magnetron's power (method SHF)

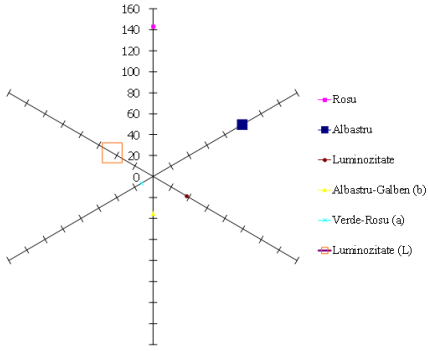

Fig. 10. Color spectral representation depending on magnetron's power and temperature (combined method)

After drying the pears by different means and using the CIELAB program we gathered data that doesn't fit into the admissible limits. The product showed a less clear luminosity after convective and SHF drying methods. Red color indicates that magnetron's power is too high for drying such product as pears; it requires a less

powerful regime, as well as the convective regime requires a lower temperature for the drying agent.

Conclusion

1. There were researched and analyzed vegetal products' different modern drying methods as convective, SHF and combined dryings.
2. There were analyzed the drying charts that showed that from drying duration, polyphenols content and antioxidants activity points of view, for convective drying the most optimal temperature regime would be $t = 60°C$ (3 h 10 min) and for SHF drying the recommended magnetron power is – *20% m.p.* (1 h 10 min).
3. There were presented organoleptic CIELAB researches of dried by different means pears.

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