INFLUENCE OF DIFFERENT PRETREATMENTS ON THE COLOUR OF DRIED PEARS

UTICAJ RAZLIČITIH PRETRETAMANA NA BOJU SUŠENE KRUŠKE

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ABSTRACT

As a physical property, colour is an important indicator of the product quality. The purpose of this paper is to examine the effects of different pretreatments on the pear colour alteration during and after combined drying. Combined drying entails both osmotic and convective drying. The osmotic drying was done in a sucrose solution with the temperature of 50 °C and the concentration of 50 °Bx. The duration of osmotic drying was 120 minutes. The convective drying was performed by the air temperature of 50 °C during the period of 23 hours. The following protective agents were used: sulphur dioxide, ascorbic acid, citric acid, boiling water, and a solution of alcohol vinegar and water. The most significant change in the value of internal colour L* parameter was recorded in the blanched samples. After the convective drying, notable changes in this parameter were not recorded. All the samples showed an increase in the value of b* parameter following the convective drying. After the osmotic drying, the most significant change in the value of external colour L* parameter was also recorded in the blanched samples. However, in contrast with the internal pear colour, the changes in the external colour L* parameter following the convective drying were more significant. The slightest changes of all colour parameters were recorded in the samples treated with sulphur dioxide.

Keywords: pear, combined drying, colour.

INTRODUCTION

Drying is one of the oldest methods of food preservation which prolongs the storage life. The most evident changes during fruit drying are recorded in colour, shape, and volume. Furthermore, other physical and chemical properties are changed as well. Some fruit species such as pears are prone to significant colour alteration during drying. As a physical property, colour is a significant indicator of the product quality. The application of suitable pretreatments and drying methods enables a decrease in the product colour alteration. Enzymatic browning, caused mainly by the action of polyphenol oxidase (PPO), is a major effector limiting the shelf life of minimally processed fruits (Lamikanra, 2002). Ascorbic acid as a reducing agent has for long been applied in combination with organic acids or calcium salts to prevent enzymatic browning and maintain firmness of fruits (Lamikanra, 2002; Wang et al., 2007). Recently, Gomez et al. (2010) found that the application of an anti-browning pretreatment containing 1% (w/v) ascorbic acid – 0.1% (w/v) calcium chloride helped in maintaining the original colour of apple and pear slices after UV-C light exposure respectively. Storage air temperature in drying areas tends to be high during and several weeks after the fruit-drying season. Mahmutoglu et al., (1996) showed that the sulphur dioxide content of unpacked dried apricots, even when stored at the relatively low temperatures of 5 and 13 °C, declined considerably. Increases in temperature speed up the loss of sulphur dioxide and its degree of binding, which makes it ineffective in retarding product deterioration (Bolin and Jackson, 1985). The purpose of this research is to determine the effects of various commercial means of protection on the pear colour alteration during drying and storing. Certain means of protection were utilised with respect to the organic production of dried pears, where to eliminate use of sulfur dioxide.

MATERIALS AND METHOD

Pears of the Williams variety obtained from area near Fruska gora mountain orchards were used in the experiment. The moisture content of fresh pears was 83.22%. The pears were kept in a cold storage facility due to the fact that the fruits were harvested prior to reaching physiological and consumable maturity. Such fruits are characterized by a green-like colour of the epidermis. Fruit quarters were used in the experiment. The pretreatments applied for the colour preservation of pear samples are shown in Table 1. The sample preparation was done in a fast manner in order to avoid long exposure to the air.

The osmotic drying was conducted in a solution of sucrose and water with the concentration of 50 °Bx and the temperature of 50 °C. The duration of osmotic drying was 120 minutes. It was done in a self-designed osmotic dryer (Babić et al., 2005). The convective drying was performed by the air temperature of 50 °C during the period of 23 hours. An experimental convective dryer “IVA – 2” was utilised for the convective drying (Pavkov,
et al., 2009). The colour of flash (mesocarp) and peel (epicarp) pear was measured. The $L^*$, $a^*$, and $b^*$ values of fresh pears were set as reference values for determining the colour change parameters during and after drying. The colorimeter CR-400 (Konica Minolta, Japan) was used for the measurements. Standard illuminant C and 2° standard observer were chosen.

Table 1. Applied pretreatments for the pear colour protection

<table>
<thead>
<tr>
<th>Antioxidant agents</th>
<th>Application</th>
<th>Concentration</th>
<th>Treatment duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascorbic acid</td>
<td>Aqueous solution</td>
<td>2%</td>
<td>15 min</td>
</tr>
<tr>
<td>Citric acid</td>
<td>Aqueous solution</td>
<td>2%</td>
<td>15 min</td>
</tr>
<tr>
<td>Alcohol vinegar</td>
<td>Aqueous solution</td>
<td>4%</td>
<td>15 min</td>
</tr>
<tr>
<td>Sulphur dioxide</td>
<td>Gas</td>
<td>1 g/kg of fruits</td>
<td>150 min</td>
</tr>
<tr>
<td>Boiling water</td>
<td>Liquid</td>
<td>100 H2O</td>
<td>8 min</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

Figure 1 displays the value changes in the internal colour $L^*$ parameter of pears during drying and storing. After the blanching, a significant change in the value of $L^*$ parameter was recorded ranging from initial 80.45 to 59.29. Notable changes were not recorded during other pretreatments. A declining trend of the $L^*$ value continued throughout the drying of blanched samples.

The same results were obtained by Chafer et al., (2003). After the osmotic drying, a significant change in the value of $L^*$ parameter was recorded in the samples treated with an acetic acid solution. After the convective drying, slighter changes were recorded in all the samples (ranging from 1 to 4 $L^*$) in comparison with the values measured following the osmotic drying. The samples which were not subjected to any pretreatments indicated similar values of the $L^*$ parameter following the convective drying in comparison with the $L^*$ values of the samples treated with ascorbic acid, citric acid, and a vinegar solution. The slightest changes were recorded in the samples treated with sulphur dioxide. After a month of storage, the changes ranging from 5 to 10 $L^*$ were measured in all the samples, with the exception of the ones treated with sulphur dioxide. During the storage period, a decrease in the $L^*$ value was recorded in the samples treated with an acetic acid solution. Joubert et al., (2001) conclude that changes in the values of $L^*$, $a^*$ and $b^*$ parameters of the pear samples treated with sulphur dioxide during 46 weeks of the storage period are not statistically significant.

The value of internal colour $a^*$ parameter of the pear samples did not change significantly following the pretreatment and osmotic drying. After the convective drying, an increase in the value of internal colour $a^*$ parameter was recorded in all the samples. The slightest change was measured in the samples treated with sulphur dioxide (Figure 2). Notable changes in the value of internal colour $a^*$ parameter were not recorded during the storage period.

In comparison with the other samples, the blanched samples indicated a significant change in the $b^*$ parameter after the pre-
treatment and osmotic drying. Following the convective drying, a significant increase in the $b^*$ parameter was recorded in all the samples. The most significant change was noted in the samples treated with a vinegar solution. Such changes are desirable provided the $L^*$ parameter of the samples remains unchanged. Alternatively, fruit tissue browning would occur. Such instances were recorded in the blanched samples during the experiment (Figure 3).

In contrast with the internal fruit tissue, the epidermis may indicate more notable changes such as spots. Preserving the yellow colour of pear epidermis greatly affects the quality of final products. After the sulphurisation, the pear epidermis became brighter (lighter), whereas browning occurred following the blanching. During the other pretreatments, significant changes in the brightness (lightness) of the epidermis were not recorded. Significant changes in the value of $L^*$ parameter were recorded after the convective drying. The largest decrease in the value of $L^*$ parameter was recorded in the samples which were not subjected to any pretreatments. The most efficient protection of the epidermis brightness (lightness) was achieved by the application of sulphur dioxide (Figure 4). During the storage period, significant changes in the $L^*$ parameter were not recorded.

The pear samples which were blanched and treated with sulphur dioxide indicated a difference of 10 values regarding the $a^*$ parameter in comparison with fresh samples. The same values were recorded following the osmotic drying. All the other samples indicated slighter value differences. However, an increase in the value of $a^*$ parameter was measured in all the samples, especially the ones treated with citric acid.
CONCLUSION

The applied pretreatments for pear tissue colour preservation proved to be of different effectiveness. Significant changes in the internal colour parameters of pear samples were recorded after the convective drying. The slightest changes in the colour of internal fruit tissue were recorded in the samples treated with sulphur dioxide. All the pretreatments, with the exception of blanching and acetic acid solution treatment, indicated considerable effectiveness in preserving the colour of internal fruit tissue. Blanching proved to be a very unfavourable pretreatment for pear colour protection during drying. Significant changes in the sample colour occurred immediately following the pretreatment. Such trend was continued during drying and storing. Intensive colour alterations occurred in the epidermis of pear samples. The most effective method of pear epidermis colour protection was the application of sulphur dioxide. Other applied pretreatments were not effective enough in the protection of pear epidermis colour. The most unfavourable mean of protection was blanching. Further researches will be aimed at the examination of possible improvements of colour protection by means of ascorbic and citric acid. The effects of different concentrations of ascorbic and citric solutions, as well as other agents, will be researched. Moreover, the effects of various applied and new antioxidant agents should be examined.

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REFERENCES


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