A Study on the Shelf Life of Minimally Processed Apple with Edible Coatings

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Abstract

In this experiment the effect of edible coating (apricot gum) was used to extend the shelf life of apple slices. The edible coating was applied at different concentrations i.e. 0.5, 1, 2 and 3%. Physicochemical characteristics of edible coated apple slices were analyzed at different time intervals. The analysis was carried out for 12 days with an interval of 4 days. Results showed that the treatments and storage intervals had significant (p<0.05) effect on both moisture and total soluble solids of apple slices. Moisture content was decreased from 78.66% to 73.11% whereas Total Soluble Solids (TSS) were increased from 8 to 10 °Brix during 12 days storage of apple slices.

Keywords: Apple, edible Coatings, Storage, Physicochemical Characteristics

1. Introduction

Apple belongs to *Malus domestica* species of rose family (Potter et al, 2007). It is the most widely civilized tree fruit that is used for humans (Javanmard, 2010). The tree originated in Western Asia. Apple has been consumed for thousands of years in Asia and Europe (Coart et al, 2006). Apples have been presented as a superior dish in traditional and religious cultures. Apple is a climacteric fruit which is well-liked however, commercially significant fresh-cut apple turns brown fast occasionally in few seconds (Jiang & Joyce, 2002). The troubles with apple slices are weight loss, firmness loss and spoilage by microbes. Among many other ingredients, milk proteins and apricot gums could be more effective for maintaining the superiority of fresh-cut apples exclusive of disturbing the sensory properties (McHugh & Senesi, 2000 and Robertson et al, 2007).

The USDA and FDA definitions for “minimally-processed” fruits and vegetables entail that fresh-cut (pre-cut) commodities have been freshly-cut, washed, packaged and maintained with refrigeration. Fresh-cut products can be in a raw form whereas processed (physically deformed); products may be treated with some additives or preservatives (FDA, 1998). Today’s customer is challenging for foods that have need of minimal process such as fresh-cut fruits and vegetable. This is essential because of demanding life styles, an increase in health perception and increased purchase power of the customer (Baldwin et al, 1995). In this regard, restaurants are the most important user of minimally processed fruits and vegetables (Ponce et al, 2008). The reason for their utilization is to condense the manpower and manage the waste (Xu et al, 2003). Minimally processed foods are vastly nutritious and extremely delicate. Edible coatings have a lot of return to mankind. For instance, they control microbial growth, safeguard the colour, texture and moisture and can efficiently expand the shelf life of the product (Chen & Dubinsky, 2003). *Cytospora* canker or gummosis is an extremely destructive disease of stone fruits (i.e. peaches, sweet cherries, apricots, and plums). The canker is caused by the *Cytospora* fungus that infects the tree bark. On 3-year-old or older peach trees, it has been estimated that at least one-third have cankers present on the trunks, scaffold limbs, and/or the fruiting wood. The usual symptom is the ambergum, or gummosis, which oozes from the infected area (Biggs et al, 1994).
The aim of this experiment was to determine the effect of edible coating on the shelf life of apple slices at different concentrations during storage.

2. Material and Methods

The research work was carried out in PCSIR Labs complex Lahore, Pakistan. Edible coating was collected from different apricots plants of Gilgit-Baltistan, Pakistan.

2.1. Preparation of Apple Slices and Edible Coating Solutions

Apples were purchased from a local market, cleaned, sorted to remove damaged fruits and foreign materials. The apples with similar size, shape, and colour were selected. The apples were stored in a room temperature and rinsed comprehensively with tap water to remove any surface dust or any impurity. Apples were then cut through stainless steel knife in equal slices of 1.5 cm in length to minimize browning. These pieces were dipped in the coating solution as soon as they were cut. The slices were placed on a tray for 10 minutes, after removed from the coating solution, to drain the existing water. In order to ease the process, each whole apple was used for each quality parameter and each coating treatment. Took 0.5% (1.25g), 1.0% (2.5g), 2.0% (5.0g) and 3.0% (7.5g) of apricot gum weighing in balance and dissolved in distilled water and volume is made up to 250 ml in measuring flask for every treatment.

2.2. Physicochemical Analysis of Apple Slices

Total soluble solids were determined at ambient temperature using electric refractometer and moisture content using modification of vacuum oven method as recommended by AOAC (2000).

Scheme of Study

\[ \text{T}_0 \] Control
\[ \text{T}_1 \] 0.5% Apricot plant gum
\[ \text{T}_2 \] 1% Apricot plant gum
\[ \text{T}_3 \] 2% Apricot plant gum
\[ \text{T}_4 \] 3% Apricot plant gum

3. Results and Discussion

3.1. Percent Moisture

During 12 days storage, significant decrease of moisture from 78.66% to 73.11% was observed in coated apple slices (Table 1). Maximum decrease of moisture was observed in sample \( \text{T}_0 \) (72.05%) followed by \( \text{T}_1 \) (73.14%) respectively. Whereas, minimum decrease of moisture was recorded in sample \( \text{T}_4 \) (81.33%) followed by the sample \( \text{T}_3 \) (77.28%) respectively. These readings are correlated with Rashidi et al (2009) who analyzed that moisture level is significantly decreased in storage period and the moisture level during storage were 85.78%, 84.88%, 83.44%, 82.40%, 80.01% and 79.48% in apple slices. The decrease of moisture during storage could be due to biochemical reactions and physiological changes of food items.

3.2. Total Soluble Solids (TSS)

During 12 days storage, significant increase in mean values of Total Soluble Solids (TSS) from 8 °Brix to 10 °Brix was observed in processed apple (Table 2). Maximum increase of TSS was observed in sample \( \text{T}_1 \) (10.75 °Brix) which is followed by \( \text{T}_3 \) (9.75 °Brix) respectively. The minimum increase in mean values of TSS was recorded in sample \( \text{T}_0 \) (7.08 °Brix) which is followed by the sample \( \text{T}_4 \) (8.75 °Brix) respectively. There was an increase and decreases in TSS with the passage of time with different rates in different treatments which may be due to many physiological and biochemical changes. The increase of TSS might be due to the formation of water soluble pectin from protopectin during storage. Rashidi et al (2009) also reported that during storage the TSS is increased and decreased gradually and the reason he pointed out is the same as we assumed in our study.

Table 1. Effect of Edible Coatings on the Overall Moisture Content of Apple

<table>
<thead>
<tr>
<th>Stages</th>
<th>Samples</th>
<th>0 Day</th>
<th>4th Day</th>
<th>8th Day</th>
<th>12th Day</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>75.91</td>
<td>73.4</td>
<td>70.89</td>
<td>68</td>
<td>72.05</td>
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<tr>
<td>T1</td>
<td>76.92</td>
<td>74.45</td>
<td>71.94</td>
<td>69.25</td>
<td>73.14</td>
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</tr>
<tr>
<td>T2</td>
<td>78.4</td>
<td>77.1</td>
<td>75.8</td>
<td>73.2</td>
<td>76.13</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>79.77</td>
<td>78.0</td>
<td>76.23</td>
<td>75.1</td>
<td>77.28</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>82.3</td>
<td>82.0</td>
<td>81.0</td>
<td>80.0</td>
<td>81.33</td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td>78.66</td>
<td>76.99</td>
<td>75.172</td>
<td>73.11</td>
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</tr>
</tbody>
</table>

Table 2. Effect of Edible Coatings on the Overall TSS of Apple

<table>
<thead>
<tr>
<th>Stages</th>
<th>Sample</th>
<th>0 Day</th>
<th>4th Day</th>
<th>8th Day</th>
<th>12th Day</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>6</td>
<td>7</td>
<td>8.3</td>
<td>7</td>
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<tr>
<td>T1</td>
<td>10</td>
<td>11</td>
<td>10</td>
<td>12</td>
<td>10.75</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>11</td>
<td>9.50</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>9</td>
<td>9.75</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>7</td>
<td>9</td>
<td>8</td>
<td>11</td>
<td>8.75</td>
<td></td>
</tr>
<tr>
<td>Means</td>
<td>8</td>
<td>9.41</td>
<td>9.26</td>
<td>10</td>
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</tbody>
</table>

4. Conclusion
This experiment authenticate that edible coatings can increase the shelf life of apples particularly when apples are cut into slices. Apricot gum is the most important edible coating material and has the positive effect to increase the shelf life of apple. These results further indicate that uses of more concentration of edible coating increase more shelf life.

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References


