Impact of Drying Pretreatments on the Quality Characteristics of Indian Cherry Fruit Pulp

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ABSTRACT

The present research has been conducted to study the effect of different dehydration pre-treatments on the proximate chemical composition, drying curve, dehydraion and rehydration characteristics, colour and sensory properties of Indian cherry (Cordia dichotoma) fruit pulp. The obtained results revealed that the fresh Indian cherry fruit pulp contained 78.97±2.04% moisture, 16.43±0.94% carbohydrate, 0.98±0.11% crude protein, 1.49±0.62% crude fiber, 1.03±0.27% fat and 0.56±0.02% ash. For dried samples, slight variations were observed between the proximate chemical compositions of all samples which have different treatments. The pretreatments performed in this search are an important parameter that affects drying time. Where, Samples dipped in a citric + ascorbic acid solutions prior to drying had a shorter drying time (7.5 hrs) compared to citric acid as well as blanching (8 hrs) and finally control samples (8.5 hrs). The maximum dehydration ratio was 4.70 for dried samples treated with citric + ascorbic acids. Also, dehydrated fruit pulp treated with citric + ascorbic acids had the highest dehydration ratio recording 3.51 followed by those treated with ascorbic acid (3.32), citric acid (3.31), blanching (3.26) and finally control sample (3.10). Rehydrated products contained clearly lower moisture content than fresh samples, it ranged between 65.34±1.98% for control sample to 69.87±1.01% for sample treated with citric + ascorbic acids. The Indian cherry fruit pulp colour treated with citric + ascorbic acids had the lightest colour as measured by the HunterLab color analyzer and as appears from the photos of studied samples, while control samples had the darkest colour comparing with all dried products. It could be referred that the dipping of Indian cherry fruit pulp in a 2% citric + 2% ascorbic acid solution before dehydration greatly increase the sensory attributes of the resulted dried products.

Keywords: Indian cherry, pretreatment dehydration, chemical and sensory properties

INTRODUCTION

Indian cherry (Cordia dichotoma Forst, Synonym: Lisura or Lasora) is a small to moderate size plant of family Boraginaceae. Cordia dichotoma is one of the traditional medicinally important deciduous plants available all over India and other warmer regions. The fruit of Cordia dichotoma is a green-yellow shining globose or ovoid drupe seated in a saucer-like enlarged calyx. It turns dark on ripening and the pulp gets viscid and produces a sticky, jelly-like mass called Cordia dichotoma gum (Basu et al., 1984). The whole plant of Cordia dichotoma is edible and is used as food. Plant parts such as leaves, fruit, bark and seed have been reported for possessing anti-diabetic, antiulcer, anti-inflammatory, immune modulator and analgesic activity. (Agnihotri et al., 1987; Jamkhande et al., 2013 and Pawar et al., 2018). Cordia dichotoma fruit is a delicious fruit particularly admired by children. The fruit is slimy, juicy and helps in the curing of mouth ulcers, strengthening of teeth and gums. It is also used as an ingredient in preparations to relieve urinary tract infection (Rapisarda et al., 1992 and Patil et al., 2010). Cordia dichotoma fruits contain 74.87-82.46 % moisture, 1.98-2.8% protein, 1.6-2.0% fat, 13.0-17.0% carbohydrate and 2.0-2.91% ash. Cordia dichotoma fruits is a rich source of vitamin C, calcium, phosphorus, potassium, magnesium and iron (Duhar et al., 1992; Valvi and Rathod, 2011 and Toliba, 2012).

Dehydration of fruits is an important means of preservation. The main attribute of this method is the decrease in the water activity in the product by decreasing its water content, inhibiting the development of microorganisms, and decreasing spoilage reactions, thus prolonging the shelf life of the product (Doymaz, 2014 and Pisalkar et al., 2014). Out of various methods available to extend the shelf life of perishable crops, dehydration is one of the easy and less expensive processes, and it is a complex process involving transient heat and mass transfer and various factors should be taken into account. Hot air is one of the most common methods for food dehydration (Prakash et al., 2004 and Al-Amin et al., 2015). Pretreatment affects the nutritional, sensorial and functional properties of the dried food without changing its integrity. It also improves the texture as well as stability of the pigment during dehydration and the storage of dehydrated product (Raoul-Wack, 1994; Rastogi et al., 2002 and Al-Amin et al., 2015). Many reports have been carried out regarding the process for rehydration and cooking of fruits and vegetables (Krokida and Marinos-Kouris, 2003; Singh et al., 2007 and Al-Amin et al., 2015). In addition, colour is a vital fruit quality characteristic which occurs in the interaction among light, observed object and observer (Yam and Papadakis 2004 and Nowicka et al., 2015). Colour changes are mostly related to browning interactions that occur during dehydration of fruits and vegetables. Several studies about pretreatments of fruit in order to minimize negative effects carrying out during dehydration and reconstitution (Guerrero-Beltran et al. 2005; Doymaz, 2006). The browning of fruits and vegetables during drying appears due to both enzymatic and non-enzymatic reactions (Vadivambal and Jayas 2007).

However, less information is available on the dehydration and rehydration characteristics of Indian cherry fruit pulp. That is why, the present study has been conducted for studying the effect of different drying pretreatments on the proximate chemical composition, drying curve, dehydration and rehydration characteristics, colour and sensory properties of Indian cherry (Cordia dichotoma) fruit pulp.

MATERIALS AND METHODS

Materials:
Ripe Indian cherry (Cordia dichotoma Forst) fruits were collected from a private farm in Kafr-Saqr, Sharqia Governorate, Egypt during summer 2017. The fruits were carefully washed using tap water at ambient temperature 22±2°C.
All chemicals as analytical grade were purchased from Elgomhorya Company Branch, Zagazig City, Egypt.

**Methods:**

**Dehydration experiment of Indian cherry fruit pulp:**

Indian cherry fruit pulp was manually separated by removing the nonedible parts (stone and sticky pulp). The fruit pulps were divided into five parts and coded T1, T2, T3, T4 and T5, respectively. The first, third, fourth and fifth parts were separately soaked in distilled water, 2% citric acid solution, 2% ascorbic acid solution and 2% citric acid solution, respectively.

**Dehydration and rehydration ratio and coefficient of reconstitution determination:**

Dehydration is a process of refreshing the dried material in water however, dehydration prowess was conducted the optimum conditions which described by Al-Amin et al. (2015). Both control and treated samples of Cordia dicotoma fruit pulp were reconstituted as follows: each sample was pre-soaked in water for 45 min and then 2g of pre-soaked sample was boiled with 150 ml water for 30 min. After boiling, the liquid portion was drained off and excess water was removed by filter paper. The rehydrated materials were removed from the filter paper and weights were recorded separately and the following parameters were calculated.

- **Dehydration ratio** = Weight of prepared material before drying / Weight of dehydrated material.
- **Rehydration ratio** = Weight of rehydrated sample / Weight of dehydrated sample.
- **Coefficient of reconstitution** = Rehydration ratio / Dehydration ratio.

**Sensory evaluation:**

The sensory evaluation test of the four dried Indian cherry fruit pulps were conducted with ten consumers of varied ages and gender, who were students, professors and employees of Food Science Department, Faculty of Agriculture, Zagazig University as described by Dever et al. (1996). A nine-point structured hedonic scale (1= disliked extremely and 9= liked extremely) was used in the acceptance test to evaluate the colour, taste, flavour, texture, appearance and overall acceptability of the dried fruit samples and the means were calculated with the standard deviations.

**Results and Discussion**

**Proximate chemical composition of fresh and dried Indian cherry fruit pulp:**

Proximate composition of fresh and dried Indian cherry fruit pulp are presented in Table 1. The fresh fruit pulp contained 78.97±2.04% moisture, 16.43±0.94% carbohydrate, 0.98±0.11 crude protein, 1.49±0.62% crude fiber, 0.93±0.27% fat and 0.56±0.02% ash. These results are in agreement with those reported by Duhan et al. (1992), Valvi and Rathod (2011) and Toliba (2012). For dried samples, slight variations were observed between the proximate chemical compositions of all samples which have different treatments. Where, the moisture content ranged between 12.54±0.31 to 12.85±0.36%, Carbohydrate 66.34±0.89 to 68.28±1.25%, Crude protein 3.87±0.88 to 4.07±0.47%, Crude fiber 6.19±0.64 to 6.31±0.84%, fat 4.20±0.22 to 4.27±0.12% and Ash 2.19±0.29 to 2.34±0.24%.
Drying process of Indian cherry fruit pulp:

Dehydration experiment was performed to evaluate the effects of pre-treatments on dehydration and rehydration properties of Indian cherry fruit pulp as well as the colour attributes of the dried products using a hot air cabinet dryer at 65°C.

Drying curves of Indian cherry fruit pulp treated with citric acid, ascorbic acid, citric + ascorbic acids or blanching as well as control sample were expressed as a relationship between the moisture ratio and the drying time (Figure 2).

It is clear that moisture ratio decrease continuously with the drying time for all treatments. The falling-rate period was mostly observed in all fruit samples. On the other hand, the pre-treatments performed in this search are an important parameter that affects drying time (Figure 2).

Figure 2. Drying curves of Indian cherry fruit pulps treated with water (control), blanching, citric, ascorbic, and citric + ascorbic acids (T5).

Table 2. Rehydration characteristics of Indian cherry fruit pulps.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dehydration ratio</th>
<th>Rehydration ratio</th>
<th>Co-efficient of reconstitution</th>
<th>Moisture content of rehydrated product</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>4.45</td>
<td>3.10</td>
<td>0.69</td>
<td>65.34±1.98</td>
</tr>
<tr>
<td>T2</td>
<td>4.51</td>
<td>3.26</td>
<td>0.72</td>
<td>66.98±0.86</td>
</tr>
<tr>
<td>T3</td>
<td>4.57</td>
<td>3.31</td>
<td>0.72</td>
<td>67.03±1.38</td>
</tr>
<tr>
<td>T4</td>
<td>4.54</td>
<td>3.32</td>
<td>0.73</td>
<td>67.87±0.99</td>
</tr>
<tr>
<td>T5</td>
<td>4.70</td>
<td>3.51</td>
<td>0.75</td>
<td>69.87±1.01</td>
</tr>
</tbody>
</table>

T1, T2, T3, T4 and T5 were fruit pulps treated with water (control), blanching, citric, ascorbic, and citric + ascorbic acids, respectively.

Colour values of dried Indian cherry fruit pulps:

Color is one of the most important features determining a product quality. It is a parameter determining the first impression, and thus, it shapes the purchase desire of the consumers (Wojdylo et al. 2014, Nowicka et al. 2015). Colour attributes (lightness, L*; redness, a* and yellowness, b*) of dried Indian cherry fruit pulps treated with different pre-treatments and control were determined and the obtained results are shown in Table 3.

It could be mentioned that the all treatments have a clear effect on the colour of the final product. The T5 had the lightest colour as measured by the HunterLab color analyzer and as shown in the photos presented in Figure 3, while T1 had the darkest colour comparing with all dried products. However, L value ranged between 15.71±2.34 to 22.76±1.45, a value 3.03±0.43 to 5.57±1.86 and b value 8.27±0.73 to 11.80±0.56 for all treated as well as control samples. Similar trends in colour changes were noticed by Nowicka et al. (2015) who studied the color parameters of dried sour cherries as affected by osmo dehydration pre-treatment process. The improvement of colour for T5 may
be due to the synergistic effect of citric and ascorbic acids as anti-browning.

**Table 3. Colour values of dried Indian cherry fruit pulps**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>L*</th>
<th>a*</th>
<th>b*</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>15.71±2.34</td>
<td>5.57±1.86</td>
<td>8.27±0.73</td>
</tr>
<tr>
<td>T2</td>
<td>17.65±0.95</td>
<td>4.82±1.23</td>
<td>8.95±1.10</td>
</tr>
<tr>
<td>T3</td>
<td>19.29±1.76</td>
<td>3.85±1.69</td>
<td>9.69±1.11</td>
</tr>
<tr>
<td>T4</td>
<td>20.86±1.95</td>
<td>3.55±0.75</td>
<td>11.27±1.23</td>
</tr>
<tr>
<td>T5</td>
<td>22.76±1.45</td>
<td>3.03±0.43</td>
<td>11.80±0.56</td>
</tr>
</tbody>
</table>

T1, T2, T3, T4 and T5 were fruit pulps treated with water (control), blanching, citric, ascorbic, and citric + ascorbic acids, respectively.

**Sensory properties of dried Indian cherry fruit pulps:**

Sensory analysis is a powerful scientific tool that can be used to identify variations in sensory properties and measure product’s acceptability. Sensory properties of dried Indian cherry fruit pulp resulted from different pretreatments are presented in Table 4. It could be noticed that, T5 was more acceptable than T4, T3, T2 and T1 for all studied sensory properties. Where, the colour score ranged between 5.05±0.75 to 7.95±0.78, taste 4.81±0.78 to 7.54±0.68, flavour 6.04±0.90 to 7.86±0.66, texture 4.31±0.95 to 7.50±0.50, appearance 4.06±0.97 to 7.72±0.78 and overall acceptability 4.30±0.79 to 7.40±0.76. It could be referred that the dipping of Indian cherry fruit pulp in a 2% citric + 2% ascorbic acid solution before dehydration greatly increase the sensory attributes of the resulted products. Generally the drying pretreatments affects the sensory properties of the final products (Abd Elrashid and Nasar, 2000 and Al-Amin et al., 2015).

**Table 4. Sensory properties of dried Indian cherry fruit pulps**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Colour</th>
<th>Taste</th>
<th>Flavor</th>
<th>Texture</th>
<th>Appearance</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>5.05±0.75</td>
<td>4.81±0.78</td>
<td>6.04±0.90</td>
<td>4.31±0.95</td>
<td>4.06±0.97</td>
<td>4.30±0.79</td>
</tr>
<tr>
<td>T2</td>
<td>5.89±0.73</td>
<td>5.77±1.00</td>
<td>6.36±0.50</td>
<td>5.27±0.56</td>
<td>4.63±0.45</td>
<td>5.05±0.68</td>
</tr>
<tr>
<td>T3</td>
<td>6.55±0.72</td>
<td>6.63±0.67</td>
<td>6.84±0.92</td>
<td>6.77±0.60</td>
<td>5.63±0.50</td>
<td>5.91±0.66</td>
</tr>
<tr>
<td>T4</td>
<td>7.18±0.68</td>
<td>7.27±0.51</td>
<td>7.68±0.97</td>
<td>6.81±0.75</td>
<td>6.77±0.68</td>
<td>7.04±0.65</td>
</tr>
<tr>
<td>T5</td>
<td>7.95±0.78</td>
<td>7.54±0.68</td>
<td>7.86±0.66</td>
<td>7.50±0.50</td>
<td>7.72±0.78</td>
<td>7.40±0.76</td>
</tr>
<tr>
<td>L.S.D.</td>
<td>0.63</td>
<td>0.64</td>
<td>0.69</td>
<td>0.59</td>
<td>0.57</td>
<td>0.61</td>
</tr>
</tbody>
</table>

L.S.D. Least Significant Difference
T1, T2, T3, T4 and T5 were fruit pulps treated with water (control), blanching, citric, ascorbic, and citric + ascorbic acids, respectively.

**CONCLUSION**

From this study it could be concluded that, the pre-treatments of Indian cherry fruit pulp conducted before hot air drying at 65°C affects the proximate chemical composition, colour, dehydration and dehydration ratios and drying time of dried products. So, it could be recommended to soak Indian cherry fruit pulp in a 2% citric + 2% ascorbic acids solution for 5 min before dehydration process to improve the characteristics of the final product. Finally, more studies needed for formation a module for Indian cherry fruits drying.

**REFERENCES**


