Effect of Pre-treatments on the Quality of Watermelon rind

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Effect of Pre-treatments on the Quality of Watermelon rind

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ABSTRACT-

Watermelon belongs to the family of Cucurbitaceae. Processing of watermelon generates considerable amount of wastes in the form of peels, rind and seeds. Every aspect of the fruit of watermelon has nutritional value, including the rind and the seeds. These wastes are also rich in phytochemicals and can be exploited to investigate its nutraceutical properties. Thus, the present study was designed to determine the effects of blanching on the overall quality of the watermelon rind. The rind was steam and water blanched for 1, 3 and 5 minutes. The samples were then analysed for their nutrient contents. Results demonstrated that blanching brought about considerable effects on the overall quality of the rind. Water blanching brought about drastic changes in the nutrient content in comparison to steam blanching. The moisture content of the steam blanched samples was found to decrease with an increase in blanching time (90.3%-89.0%) while that of the water blanched samples increased with an increase in the blanching time (90.3%-94.1%). Protein content of the water blanched samples reduced drastically from 0.18% to 0.08% while the reduction in steam blanching was not as drastic (0.18%-0.11%). Also, the loss in flavonoid content was drastic in water blanched samples as compared to steam blanched. There was significant nutrient loss in water blanching and thus steam blanching was considered as a preferred method for preserving the quality of watermelon rind.

Keywords: Watermelon rind, Water Blanching, Steam Blanching, Nutrient content, flavonoids

Introduction

Agrowaste the large volumes of solids waste, resulting from the production, preparation and consumption of fruit and vegetable. These wastes pose potential disposal and pollution problems along with loss of valuable biomass and nutrients. There is a potential for conversion of agro wastes into useful products or even as raw material for other industries. The utilization of wastes of fruit and vegetable processing as a source of functional ingredients is a promising field (Schieberet al., 2001).
Consumption of a large variety of fruits and vegetables is commonly practised all around the world, but it is only the pulp of the fruits that is consumed. The rind and the seeds are usually discarded. Consuming a diet rich in fruits and vegetables has shown to have significantly lower rates of occurrence of many types of cancers (Voorrips et al., 2000).

Fruits and vegetables are known to contain a variety of natural bioactive compounds (Pennington and Fisher, 2010) such as flavonoids, anthocyanins, vitamins C and E, phenolic compounds, dietary fibre, and carotenoids (Gonzalez-Aguilar et al., 2008).

One such medicinal plant is Citrullus lanatus. Citrullus lanatus plant is a herbaceous creeping plant of the cucurbitaceous family. Citrullus lanatus fruit is round with a light green to very dark green skin, variously patterned or stripped and red, yellow or orange flesh. The fruit has a smooth exterior rind (green, yellow and sometimes white). Consumption of watermelon generates a large amount of waste in the form of rind, peel and seeds.

The rind is an under-utilised waste generated after the consumption of the fruit. It contains citrulline which gives it antioxidant effects that protect the body from free-radical damage. The rind is used in preserves, jellies and conserves and to make pickles. The rind is also edible and is sometimes used as vegetable. (Johnson J.T et al., 2012)

Blanching is a specialised heat treatment to inactivate enzymes. Hot water and steam are the most commonly used heating media for blanching in the food industry. Time and temperature combination of blanching depends on the nature and the source of the material. The effect of blanching on vegetables consists of inhibition of enzymes such as peroxidases, lipoxygenases and proteases, thus stabilizing the nutritional values of the product. (OluMalomo et al., 2013)

Materials and methods

Collection of raw materials – Fresh watermelon with dark and light green stripes was chosen. Watermelons were collected from a local market and were used fresh.

Preparation of sample-The whole fruit was first washed, peel removed and the rind was separated from the flesh. The rind was then grated to reduce its size.

Pre-treatments

- Water Blanching - Approximately 1000mL of water was poured into a stainless steel vessel and heated at 100°C. Watermelon rind (200 g) were immersed in the boiling water at 100°C for 1, 3 and 5 min. The samples were drained on a stainless sieve until cold and then weighed.

- Steam Blanching - Steam blanching was conducted by suspending 200 g of watermelon rind above 1000mL of boiling water for 1, 3 and 5 min in a stainless steel steamer with a lid. The samples were drained on a stainless sieve until cold and then weighed.

Determination of Proximate Analysis:

The proximate analysis of the watermelon rind was carried out by standard AOAC 2002 method.
-Determination of Ash Content

The inorganic matter left over after the organic matter has been completely destroyed is represented by ash content. 2g of the sample was kept in muffle furnace at 525°C for 4-6 hours. Weight of ash was determined using the formula,

\[
\text{Ash content(%) = } \left( \frac{\text{Weight of ash(g)}}{\text{Weight of sample(g)}} \right) \times 100
\]

-Determination of Fat Content

2g of dried sample was weighed and taken in a thimble and extraction was carried out for 4 hours in soxhlet apparatus. After extraction, the solvent (n-hexane) was completely evaporated and the residue is weighed.

\[
\text{Fat(%) = } \left( \frac{\text{Weight of fat(g)}}{\text{Weight of sample(g)}} \right) \times 100
\]

-Determination of Moisture content

The moisture content was determined using the air oven method. The samples were dried in the oven at 105 °C. The moisture content of the samples was calculated as:

\[
\text{Moisture Content(Wb%)} = \left( \frac{\text{Initial weight(g)} - \text{Final weight(g)}}{\text{Initial weight(g)}} \right) \times 100
\]

-Determination of Carbohydrate Content

The carbohydrate content of the samples was determined using Anthrone method. The carbohydrate content of the samples is determined from the standard glucose plot. The carbohydrate content is calculated as:

\[
\text{Total Carbohydrate(%) = } \left( \frac{\text{mg of glucose x 100}}{\text{volume of test sample (ml)}} \right)
\]

-Determination of Protein Content

The protein content of the samples was determined using Lowry’s method. BSA (Bovine serum Albumin) is used as standard and the protein content of samples is determined from standard plot. The protein content is calculated as:

\[
\text{Total amount of protein(%) = (concentration (µg/ml)) x (total volume of extract (ml))}
\]

-Determination of Flavonoid content

The flavonoid content of watermelon rind was determined by the method described by R.Sahu and J.Saxena 2013. Aluminium chloride method was used for determination of flavonoid. In this method Quercetin was used as standard and flavonoid contents were measured as quercetin equivalent. 1ml of standard or extract solution (20, 40, 60, 80,100
mg/l) was taken into 10ml volumetric flask, containing 4ml of distilled water. 0.3ml of 5% NaNO₂ was added to the flask. After 5min, 0.3ml 10% AlCl₃ was added to the mixture. After 6minutes, 2ml of 1M NaOH was added and the volume was made up to 10ml with distilled water. The absorbance was noted at 510nm using UV-Visible spectrophotometer.

Results and discussion

The nutritional composition of watermelon rind was evaluated on the basis of blanching time and the results are tabulated in table 1 and 2. Blanching time was found to significantly influence the nutrient content of watermelon rind such as the carbohydrate, protein, fat. Blanching treatment did not have a significant effect on the ash content of the samples.

### Table 1-Nutrient composition in Steam blanching

<table>
<thead>
<tr>
<th>Sample</th>
<th>Carbohydrates (%)</th>
<th>Protein (%)</th>
<th>Fat (%)</th>
<th>Ash (%)</th>
<th>Moisture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>4.72±0.14</td>
<td>0.18±0.06</td>
<td>0.10±0.03</td>
<td>3.54±0.11</td>
<td>90.3±1.3</td>
</tr>
<tr>
<td>1 minute</td>
<td>4.61±0.1</td>
<td>0.16±0.00</td>
<td>0.09±0.01</td>
<td>3.52±0.05</td>
<td>89.8±0.06</td>
</tr>
<tr>
<td>3 minutes</td>
<td>4.52±0.07</td>
<td>0.13±0.01</td>
<td>0.07±0.01</td>
<td>3.49±0.08</td>
<td>89.5±0.09</td>
</tr>
<tr>
<td>5 minutes</td>
<td>4.31±0.13</td>
<td>0.11±0.01</td>
<td>0.06±0.01</td>
<td>3.48±0.03</td>
<td>89.0±0.1</td>
</tr>
</tbody>
</table>

### Table 2-Nutrient composition in Water blanching

<table>
<thead>
<tr>
<th>Sample</th>
<th>Carbohydrates (%)</th>
<th>Protein (%)</th>
<th>Fat (%)</th>
<th>Ash (%)</th>
<th>Moisture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>4.72±0.14</td>
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<td>0.10±0.03</td>
<td>3.54±0.11</td>
<td>90.3±1.3</td>
</tr>
<tr>
<td>1 minute</td>
<td>4.59±0.3</td>
<td>0.14±0.01</td>
<td>0.07±0.01</td>
<td>3.50±0.17</td>
<td>91.6±0.7</td>
</tr>
<tr>
<td>3 minutes</td>
<td>4.32±0.2</td>
<td>0.11±0.01</td>
<td>0.04±0.01</td>
<td>3.48±0.11</td>
<td>93.7±0.8</td>
</tr>
<tr>
<td>5 minutes</td>
<td>4.17±0.09</td>
<td>0.08±0.01</td>
<td>0.02±0.01</td>
<td>3.47±0.13</td>
<td>94.1±0.9</td>
</tr>
</tbody>
</table>

The moisture content of the watermelon rind was found to reduce as the blanching time increased in case of steam blanching, while with water blanching the moisture content of the samples increased with an increase in the blanching time. Similar results were obtained by Fouad A. Ahmed and Rehab F. M. Ali, 2013 in the Bioactive Compounds and Antioxidant Activity of Fresh and Processed White Cauliflower.

The reduction in the protein content can be attributed to the heat sensitive nature of proteins. Since blanching is a hydrothermal treatment, prolonged blanching times brought about greater denaturation of the native protein structure which accounts for the loss in proteins. The degradation of proteins was found to be greater in water blanching in comparison to steam blanching. Similar results were obtained by L.S. Badwaik et al., 2015 in the influence of blanching on the nutrient content of bamboo shoot.
There was also a slight reduction in the fat content with increased blanching times which may be due to the melting and subsequent oxidation of fats when subjected to hydrothermal treatments such as blanching. However, the loss in fat content was found to be greater in water blanching as compared to steam blanching. This may be due to greater surface area of the sample being exposed to the blanching medium in case of water blanching and the subsequent transfer of the fat into water. Similar results were obtained by Zhang et al., 2011 in the effect of blanching on the nutrient content of bamboo shoots.

Sugars like glucose, fructose and sucrose are sensitive to heat treatments and thus there was a significant reduction in the carbohydrate content of the watermelon rind samples. Water blanching brought about increased loss in comparison to steam blanching, due to loss of the soluble sugars into the blanching medium. Similar results were obtained by Song et al., 2003.

Flavonoid content

![Flavonoid Content of Blanched Watermelon Rind](image)

Figure 1 – Flavonoid Content of Blanched Watermelon Rind

Flavonoids are phytochemicals that account for anti-oxidant activity. Figure 1 shows the effect of blanching on the flavonoid content of watermelon rind. Fresh watermelon rind was found to have 8.31mg QE/100g of dry weight. Total flavonoids were found to decrease with blanching treatment. This reduction can be attributed to the heat sensitive nature of phytochemicals when subjected to hydrothermal treatments like blanching. The reduction was more drastic in water blanching in comparison to steam blanching. Steam blanching at 1min was found to retain most of the flavonoids with 8.3 mg/100g. But as the blanching time increased there was subsequent reduction in the flavonoid content. A similar reduction in the flavonoid content was observed by Y.Porter 2012 in the flavonoid content of broccoli.
Conclusion

As shown in this study, both water and steam blanching affect the nutrient composition as well as flavonoid content of the watermelon rind. However, steam blanching for 1 minute caused considerably lesser losses in nutrients and also preserved the flavonoid content of watermelon rind. Thus steam blanching is a preferred method for the preservation of watermelon rind and its utilisation for the production of beverages and pickles.

References