DEVELOPMENT AND CHEMICAL ANALYSIS OF WATERMELON BLENDS WITH BEETROOT JUICE DURING STORAGE

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ABSTRACT

The watermelon juice (Citrulluslanatus) and beetroot juice (Beta vulgaris) were formulated to a blend in different proportion (in v/v) as T1 (80:20), T2 (75:25), T3 (70:30), T4 (65:35) and T0 (100:00) respectively. The standard sample (T0) was made without blending these two juices (100% standard watermelon juice). Physico-chemical and sensory analysis were evaluated. Marginal changes in pH, total soluble solids, acidity and vitamin C. The results of the analysis of Vitamin C content (mg/100 ml of juice) gave 125.26 in standard watermelon juice, 106.89 in T1, 102.31 in T2, 97.68 in T3, 93.12 in T4 respectively. The acidity increased (0.25-0.33) and pH of the juice decreased progressively during the storage period. This may be due to the fermentation and presence of lactic acid reducing micro- organism. The mean overall acceptability scores up to 8 for T2 samples in it up to 25% beetroot juice were incorporated. Microbial analysis (total plate count and yeast and mould count) was carried out from zero day to 30 days with 10 days interval and shows that microbial activity was steadily increases till 30 days of storage to 13 x 10³ increased. Heat pasteurization (80°C for 3 min.) was more effective for inactivating the microbial flora. However the shelf life of juice was established within 30 days.

Keywords: Beetroot Juice, Watermelon Juice, Blends, Physicochemical, Sensory and Microbial Analysis, Self Life.

1. INTRODUCTION

The fruits and vegetables are rich in functional components like minerals, vitamins, dietary fiber, antioxidants, and do not contain any dairy allergens that might prevent usage by certain segments of the population (Luckow and Delahunty, 2004). Fruit juices are liquid, non-alcoholic products with a different degree of clarity and viscosity, obtained through pressing or breaking up the fruits with or without sugar or carbon dioxide addition (Costescu et al. 2006). It is one of the most popular drinks to go with breakfast in the morning (Frankeet al. 2005). In processing, fruits are converted into more stable products through unit operations, such as cleaning, soaking size reduction, peeling, mixing, and heat treatment (Potter, 2003).

Watermelon (Citrulluslanatus) belongs to the family Cucurbitaceae and native to tropical Africa. This fruit contain a thick rind (exocarp) and fleshy center (mesocarp and endocarp). It is a popular thirst-quencher during summer days. Watermelon juice is a very rich source of carotenoid called lycopene. The lycopene content of watermelon is higher than many other fruits and vegetables. Lycopene is proven to be an effective oxygen radical scavenger as well as protective agent against heart diseases and various types of cancers. Lycopene synergistically inhibits low-density lipoprotein oxidation in combination with vitamin E, garlic, and glabridin (Fazeli et al. 2007). Watermelon juice before is great for hydration, high in nutrition and very low in calories which is helpful for losing weight in order to satisfy the consumers need.

The beetroot (Beta vulgaris) is the taproot portion of the beet plant. Beetroot is an excellent source of folate and a good source of manganese, and contains betaines which may function to reduce the concentration of homocysteine, a homolog of the naturally occurring amino acid cysteine. High circulating levels of homocysteine may be harmful to blood vessels and thus contribute to the development of heart diseases, strokes and peripheral vascular diseases (A.D.A.M. Inc. ed 2002). Haveland et al. (1981) attributed the biological activity of beetroot juice, including its antioxidant and antimutagenic properties because of the colorant compounds present in the root of beetroots, that is, betacyanins (betanin, isobetanin, and other related compounds).

Fruit juice blends can be produced from various fruits in order to combine all the basic nutrients present in these different fruits for use when combined. It can improve the vitamin and mineral content depending on the kind and quality of fruits and vegetables used (De Carvalho et al. 2007). Sandhu and Sindhu (1992), Deka and Sethi (2001) reported that two or more fruits juice/pulp may be blended in various proportions for the preparation of nectar, RTS beverages etc. The blending of juice may also improve aroma, taste and the nutritional quality of the juices. Moreover, one could think of a new product development through blending in the form of a natural health drink, which may also be served as an appetizer. So far, no more work has been carried out on mixed fruit juice and spiced beverage. The aim of this research is therefore to develop the various blends of watermelon juice with beetroot juice and determine their chemical characteristics.
2. MATERIALS AND METHODS

Freshly harvested, fully ripened watermelon and fully matured beetroot fruits used for the preparation of the juices and their blends were obtained from a local fruit market in Allahabad, and were brought to the Food Process Engineering laboratory, SHIATS, Allahabad, India.

The fruits were washed thoroughly in running water. The seeds from peeled watermelon were removed manually. The pulps were ground separately and the juice extracted using a laboratory electric juice extractor. The extracted juice were filtered through double muslin cloth. Beetroots were peeled with the help of stainless steel laboratory knife, they were sliced and ground with addition of distilled water 1:1 (v/w) and filtered through double muslin cloth to get fresh juice and immediately stored at refrigerated temperature further use.

The one standard (100% watermelon) and four blends of watermelon juice and beetroot juice were developed in different ratio as 80:20 (T1), 75:25 (T2), 70:30 (T3) and 65:35 (T4) respectively. Each blend was prepared to give about 12% total soluble solid with addition of sugar. Finally 350 ppm sodium benzoate was as preservative then juice mixed properly and then mixture was filtered through muslin cloth. The product was pasteurized at 80°C for 3 min. (Mestrey et al., 2011) and stored at refrigerated temperature for 30 days.

Note

T0 = 100% watermelon juice + beetroot juice 0%.
T1 = watermelon juice 80% + beetroot juice 20%.
T2 = watermelon juice 75% + beetroot juice 25%.
T3 = watermelon juice 70% + beetroot juice 30%.
T4 = watermelon juice 65% + beetroot juice 35%.

2.1 PHYSICO-CHEMICAL ANALYSIS OF THE WATERMELON JUICE AND THEIR BLENDS WITH BEETROOT JUICE

2.1.1 Physico-Chemical analysis:

The chemical composition determined include: pH, titratable acidity, sugar (Brix) and ascorbic acid.

Total acidity (as % citric acid) and vitamin C were determined by titrimetric method (Ranganna 1986).

TSS was determined directly with a refractometer ATAGO (0-32° Brix).

Values for pH were determined using standard methods as recorded in AOAC, (2000). All estimations were carried out in triplicate at 10 days interval and the mean values reported.

2.1.2 Sensory analysis:

A panel of 10 semi-trained members carried out the overall acceptance test based on color, taste, aroma, appearance, flavour for the juice using 9-point Hedonic scale, where 9 is "like extremely" and 1 is "dislike extremely” as described by Amerine et al, 1965.

2.1.3 Shelf life analysis:

The all samples were packed in PET bottle and stored in refrigeration temperature for 30 days has evaluated.

2.1.4 Microbiological analysis:

The total plate count and total yeast and mould counts were determined. For the total plate count, 1 ml of each blend from 10−2 and 10−4 dilution was taken into petri dishes, it was then sterilized and cooled. Nutrient agar was poured into the samples aseptically using the pour plate method. The mixtures were allowed to solidify the plate was inverted and incubated at 37°C for 48 h. Colonies was counted and recorded as colony units 1 ml (Adegoke, 2004).

2.1.5 Statistical analysis:

Statistical analysis: Analyzed by one-way analysis of variance (ANOVA) and analysis were carried using Microsoft Excel data analysis.

3. RESULTS AND DISCUSSION

3.1 SENSORY EVALUATION

The sensory evaluation of the blends prepared from watermelon juice and beetroot juice are shown in following figure 1 that show the mean sensory score and the significant difference among quality attributes of the blended juice. The evaluations were done on all the data for color, taste, aroma, flavor and overall acceptability. The best results were obtained for the watermelon and beetroot juice blends of 75:25 (V/V) proportion with 12° brix TSS.

3.2 PHYSICO-CHEMICAL ANALYSIS

a. Titrable Acidity

The total titratable acidity measures the ionic strength of a solution, this determines the rate of chemical reaction. The addition of beetroot juice to watermelon juice reduced the titratable acidity while pH value increased. Acidity values for all the samples increases linearly during the storage period of 24 days, as shown in Table 3.1. It was observed that maximum acidity (0.34%) was recorded in T1 sample. The minimum increase (0.30%) in acidity was showed in T4 sample.

Table 3.1 Changes in titratable acidity during storage day

<table>
<thead>
<tr>
<th>Treatment</th>
<th>0 days</th>
<th>10 days</th>
<th>20 days</th>
<th>30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>0.30</td>
<td>0.31</td>
<td>0.35</td>
<td>0.38</td>
</tr>
<tr>
<td>T1</td>
<td>0.26</td>
<td>0.29</td>
<td>0.32</td>
<td>0.34</td>
</tr>
<tr>
<td>T2</td>
<td>0.25</td>
<td>0.28</td>
<td>0.31</td>
<td>0.32</td>
</tr>
<tr>
<td>T3</td>
<td>0.24</td>
<td>0.26</td>
<td>0.30</td>
<td>0.31</td>
</tr>
</tbody>
</table>
b. pH

pH is one of the main quality characteristics that describes the stability of bioactive compounds in fruit juice (Sanchez-Moreno et al., 2006). From the Table 3.2 it is cleared that pH of all samples decreased day by day. The table shows that gradual decrease in pH indicates that the acidity of products increases.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>0 days</th>
<th>10 days</th>
<th>20 days</th>
<th>30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>5.2</td>
<td>4.9</td>
<td>4.72</td>
<td>4.62</td>
</tr>
<tr>
<td>T1</td>
<td>5.42</td>
<td>5.1</td>
<td>4.86</td>
<td>4.77</td>
</tr>
<tr>
<td>T2</td>
<td>5.48</td>
<td>5.16</td>
<td>4.98</td>
<td>4.86</td>
</tr>
<tr>
<td>T3</td>
<td>5.5</td>
<td>5.22</td>
<td>5.07</td>
<td>4.91</td>
</tr>
<tr>
<td>T4</td>
<td>5.62</td>
<td>5.36</td>
<td>5.18</td>
<td>5.00</td>
</tr>
<tr>
<td>Overall mean</td>
<td>5.44</td>
<td>5.14</td>
<td>4.96</td>
<td>4.83</td>
</tr>
</tbody>
</table>

It was observed that the maximum pH (5.00) was recorded in the sample T4. Most beverages or juice has their pH ranges between 3.5 and 5.5 (Pearson, 1995). The decrease in pH was due to increase in titrable acidity which affects the organoleptic quality of juice as discussed by Bhardwaj et al., 2005

c. Total Soluble Solids

The Total sugar (Brix) is the sugar content of an aqueous solution. One degree brix is 1 g of sucrose in 100 g of solution and represents the strength of the solution as percentage by weight (Robbert et al., 1991). The TSS of all the blends was maintained 12 °brix. The TSS increased with gradual passage of storage time, which might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides. Awsi Jan (2012) found an increasing trend in total soluble solids during storage at ambient and low temperature in lime - aonla and mango-pineapple spiced RTS beverages.

d. Ascorbic acid

The vitamin C values obtained for watermelon and beetroot juice blends T0, T1, T2, T3 and T4 as 106.89, 102.31, 97.68 and 93.12 mg/100ml of juice respectively as show in Table 3.3. The watermelon were found to contain the highest amount of vitamin C (125.26mg/100ml of juice), more than three times the beetroot juice. The addition of beetroot juice to watermelon juice reduced the vitamin C content. The ascorbic acid (vitamin C) content of the juice decreased during storage with the advancement of storage period, which was probably due to the fact that ascorbic acid being sensitive to oxygen, light and heat was easily oxidized in presence of oxygen by both enzymatic and non-enzymatic catalyst (Mapson, 1970). Maximum ascorbic acid (93.08mg/100 ml juice) was recorded in watermelon juice blended with beetroot juice in ratio 80:20(v/v).

e. Microbial Analysis

Microbial examinations are usually used as monitoring indices of food spoilage. The result of the microbial analysis of watermelon and beetroot juice and their blends during storage is as shown in figure 2 and figure 3. All the colonies were counted in unit per milliliter (cfu / ml). The total microbial count for all the samples on the nutrient agar and potato dextrose agar media was very low on first day, indicating that the pasteurization of the samples was effective and the product was safe for consumption. But on storage for 30 days there was slight growth in the bacterial and yeast mould growth. This value steadily increased till 30 days of storage to 13 x 10^2. These values were within the safe limit for juices, as they have not exceeded the standard values of 1.0 x 10^10 as recorded in Ilhekoronye (1985).
4. CONCLUSION

The present study showed that blending of fruit juices could enhance their nutritional quality and development of new products. It was concluded that the best sensory evaluation score results were obtained for the watermelon and beetroot juice blends of 75:25 (V/V) proportion with 12° brix TSS, containing vitamin C (102.31mg/100 ml of juice). The developed blends and standard watermelon were had higher than the 60mg/day recommended daily allowance of vitamin C needed by an adult male (U S Food and Nutrition Board; Paouling L,1970). The microbial values were within the safe limit, as they had not exceeded the standard values of $1.0 \times 10^{10}$, so the product was microbiologically safe.

**Figure 1**: The sensory analyses of blended watermelon juice and beetroot juice

**Figure 2**: The total bacterial count in blended watermelon juice and beetroot juice during storage day.

**Figure 3**: The total yeast and moulds count in blended watermelon juice and beetroot juice during storage day

**REFERENCE**


**BIOGRAPHY**

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