Full Length Research Paper

Biochemical changes in watermelon and pineapple juice blend during storage

Akande E. A* and Ojekemi O. R.

Department of Food Science and Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.

Accepted 28 October, 2013

A water melon: pineapple juice has been produced in a ratio 9:1 respectively. However, its biochemical changes on storage to establish its keeping quality is yet to be establish and so this research work is on the biochemical changes accompanying water melon-pineapple juice blends during storage for establishing the storage life. Samples of water melon- pineapple juice in 9:1 ratio respectively were produced using standard methods. The produced juice blends were subjected to chemical, microbiological and sensory evaluation at one week interval for six weeks storage time. The chemical analysis showed that, there is a gradual and minimal decrease in the specific gravity (78 - 80%), total sugar / brix (68 - 78%) and total titratable acidity (16 - 20%) of the juice along the storage period. This consequently indicates that the biochemical reactions that could lead to spoilage of the juice are at the minimum. The ascorbic acid and the pH values of the juice are almost constant throughout the storage period. The microbial analysis showed that the counts in total plate, coliform, yeast and mould were 5.2 x 10², 4.2 x 10³, 1.0 x 10⁵ and 4.7 x 10⁵, respectively which are values with acceptable change along the storage period. For the sensory evaluation, there were significant differences in all the quality attributes (colour, flavor, taste, and overall acceptability) starting from week 2. These changes though with very close mean difference, were noticed from week 2 till the fifth week of the storage period. From all the analysis, it can be observed that the juice blend (water melon and pineapple) at 9: 1 ratio respectively can be kept conveniently for five (5) weeks.

**Key words:** Blend, biochemical, juice, pineapple, storage.

INTRODUCTION

Fruit is a structural part of plant that contains seeds, normally fleshy, sweet and edible in the raw states, which include: oranges, grapes, strawberries, juniper berries, pineapple, and water melon etc. (Mauseth, 2003). They are ripe ovaries or carpels that contains seed (McGee, 2004). Fruits contain various phytochemical compounds that are similar in composition to vegetables. All contain a high percentage of water averaging 85%. Fat, protein and carbohydrate (cellulose and starch) are present in small amount (Ihekoronye and Ngoddy, 1985). Most fruits are eaten as desserts and they can be processed into liquid product which includes fruit juices, wines and other preserves like; marmalade, jams, jellies etc. Fruit products are marketed canned, bottled or packaged in tetra-packets.

Spoilage of fruits usually occurs during storage, transportation and while waiting to be processed. It has been recognize for many years that fruits continue undergoing biochemical changes even after harvest until spoilage occurs by microorganisms. This contributes to high post- harvest losses (Akande, 1995). An effective method of fruit preservation should retain the original characteristics of fruit as convenient as possible. The main methods of fruit preservation includes; Modified Atmosphere Storage (MAS), Controlled Atmosphere Storage (CAS), use of preservatives, use of irradiation, use of heat, chilling and processing all of which extend the shelf life of fresh fruit produce (George, 1999).

In processing, fruits are converted into more stable products through unit operations, such as cleaning, soaking size reduction, peeling, mixing, and heat

*Corresponding author. Email: felemma@yahoo.com OR eaakande@lautech.edu.ng.
treatment (Potter, 2003). Juice is a liquid that is naturally contained in fruit or vegetable tissue. It is one of the most popular drinks to go with breakfast in the morning (Franke et al., 2005). 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. This usually gives a better quality juice nutritionally and organoleptically. Akinosun (2010), has successfully produce juice from blend of watermelon and pineapple at ratio 90 to 10% respectively. However, there has not been work on the biochemical changes accompanying its storage so as to establish the shelf life of the product. Hence, the aim of this work is to investigate the biochemical changes accompanying water melon–pineapple blend during six weeks storage.

**METHODS**

Samples of water melon- pineapple juice at ratio 9: 1 respectively were produced using standard methods (Figure 1). The produced juice blends were subjected to chemical, microbiological and sensory analysis at intervals of one week to six weeks in order to find the maximum storage period

**Chemical analysis**

The chemical composition determined include: pH, titratable acidity, sugar (Brix), specific gravity and ascorbic acid. They were all determined using standard methods as recorded in (AOAC, 2000). For the microbiological analysis, the total plate count, coliform 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). The total coliform count was determined by measuring 1 ml of each blend from 10^{-2} and 10^{-4} dilution into sterile petri-dishes sterilized and cooled. Then the Macconkey agar was aseptically poured using pour plate method. The mixture was allowed to solidify, the plate was inverted and incubate at 37°C for 24 h, after which the colonies was counted. (Adegoke, 2004). The total yeast and mould count were determined by serial dilution of 1 ml of each sample and aseptically inoculated and then poured into sterilized plates containing acidified Potato Dextrose Agar (PDA) using a sterilize pipette. The plate was incubated at room temperature 37°C for 48 h. All count was done using a start scientific colony counter. The sensory evaluation was carried out for each sample of blended juice. An organoleptic study was carried out to evaluate the acceptability of the samples at the end of each week using 9 Point Hedonic scale (Ihekonronye and Ngoddy, 1985).

**Results and Discussion**

The chemical constituent of the juice samples produced are as presented in Figure 2. These include; the pH, total titratable acidity, sugar level, specific gravity and the ascorbic acid. pH is a measure of the acidity or alkalinity of medium which is usually expressed as the hydrogen ion concentration. Solutions are described as acidic if the hydrogen ion concentration is less than 7 and it can be classified as basic when the pH is greater than 7.0. Most beverages or juice has their pH ranges between 3.5 and 5.5 (Pearson, 1995). As shown in the Figure 2, the pH of watermelon and pineapple juice stored for 6 weeks changes with storage time, the pH dropped from 4.46 to 2.92. The decrease in pH might be due to the possible biochemical reactions leading to formation of ethanol that may lead into decrease in pH. The decrease in pH which indicates increase in the acidity can assist in increasing the shelf life of the watermelon and pineapple juice. This means that the blends will have the tendency to keep the juice better.

The total titratable acidity (TTA) measures the ionic strength of a solution, this determines the rate of chemical reaction. The total titratable acidity as shown in Figure 2 showed that the value is near constant along the storage time. This infers that the chemical reactions in the medium are bound to be slow throughout the storage period. 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 trend of the total sugar reduction is as shown in Figure 2. It decreases with the storage period. The reduction in values showed that the chemical reactions that should have consumed the sugar or reduce the concentration is at minimum e.g. alcohol production.

The specific gravity is the ratio of the density of substance to the density of a reference substance (Robbert et al., 1991). The specific gravity as showed in Figure 2 ranged between 1.00 – 1.03. This indicates the tendency of the chemical reactions taking place within the storage period i.e. to below.

Ascorbic acid is a naturally occurring organic compound with antioxidant properties. It is white solid, but when impure, can appear yellowish. The ascorbic acid content of watermelon and pineapple juice during the storage time was also near constant values as show in Figure 2. This indicates that there is little biochemical changes during the storage period.

Microbial examinations are usually used as monitoring indices of food spoilage. The result of the microbial
Figure 1. Flow chart for watermelon-pineapple juice (90% : 10%)
Figure 2. Changes in chemical composition of the juice during storage.

Figure 3. Trends in microbial load of the juice.

The analysis of watermelon and pineapple juices during storage is as shown in Figure 3. The organisms analyzed for are total plate count, coliform count, yeast count and mould count. All the colonies were counted in unit per milliliter (cfu / ml). For week zero, the total plate count of $5.2 \times 10^6$ was recorded. This value steadily increases till six (6) weeks of storage to $3.8 \times 10^7$. These values are within the safe limit for juices, as they have not exceeded the standard values of $1.0 \times 10^{10}$ as recorded in Ihekoro and Ngoddy (1985). This indicates that biochemical changes would have occurred during storage period which has lead to reduction in the pH of the medium implying a high acidic medium that might have suppressed the microbial replication. The coliform count which is an index of faecal contamination showed very low coliform population till the fifth (5) weeks of storage. The low count of this organism was probably as a result of proper hygienic condition observed in the processing of juices and absence of faecal contaminations. Yeast and mould count were $1.0 \times 10^6$ and $4.7 \times 10^6$ respectively and these values increases gradually until the six (6) weeks of the storage period to $2.9 \times 10^7$ and $2.6 \times 10^7$ respectively. The reduction in the acidic medium might favour the replication of these organisms and so increase in population. However, the values are all still below the save limit of $1.03 \times 10^{10}$ population.

Table 1 showed 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, flavor, taste and overall acceptability. In the
Table 1. Sensory Evaluation of the watermelon and pineapple juice during storage.

<table>
<thead>
<tr>
<th>Storage Period (Weeks)</th>
<th>Quality Attributes</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td></td>
<td>6.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.78&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.44&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>5.22&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.44&lt;sup&gt;d&lt;/sup&gt;</td>
<td>4.45&lt;sup*e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Flavour</td>
<td></td>
<td>6.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.11&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.22&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5.56&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>4.56&lt;sup&gt;cd&lt;/sup&gt;</td>
</tr>
<tr>
<td>Taste</td>
<td></td>
<td>6.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.22&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.22&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.89&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.00&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3.11&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3.14&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td></td>
<td>6.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.56&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.11&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.11&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.11&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.11&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note: Mean sensory score not followed by the same alphabet implies no significant difference between the samples.

Table 1. Sensory Evaluation of the watermelon and pineapple juice during storage.

In the case of color, there was no significant difference between the samples in week 0 and 1. The color changed in week 2 to 5 as shown in the Table 1. The color change within the storage period may be due to the microbiological and chemical reactions that might have occurred. Flavour is a combination of various sensations derived from foods. Flavour was constant for the first three weeks and the changes were noticed in the fourth week. This indicates that the juice may still be permitted for consumption till the end of the storage period. For taste, changes were noticed and the value reduced drastically, the change in taste may be attributed to the increase in the microbial load. On the overall acceptability, the watermelon and pineapple juice was well accepted till the fifth weeks after which it decreases in the sixth weeks.

Conclusion

Production of juice blend from watermelon and pineapple at 90 to 10%, respectively, was able to keep very well for at least five (5) weeks considering all the attributes assessed, so it can be concluded that the juice is safe for consumption until the fifth week and so its shelf life is five (5) weeks.

REFERENCES


Akinosun FF (2010). Production and quality evaluation of juice from blend of watermelon and pineapple fruits. Department of Food Science and Technology, Ladoke Akintola University of Technology, Ogbomoso.


