Changes in the Composition of the Pulp, Alpha-Amylase Activity and Titratable Acidity During the Controlled Rotting of Egusi Fruits (Colocynthis Citrullus L.) for the Harvesting of the Seeds

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Abstract

The laboratory rotting of Egusi Fruits was completed in 120 hours. At this stage pulp became soft and the seeds were extracted easily with the fingers. The changes in the composition of the pulp, alpha-amylase activity and titratable acidity during the controlled rotting of egusi fruit (Colocynthis Citrullus L.) for the harvesting of the seeds showed that moisture content (MC) increased from 82.04% at 0 hour of rotting to 85.00% at 120 hours of rotting. The titratable acidity increased from 0.10mg lactic acid/g, wet matter (WM) at 0 hour to 0.70mg lactic acid/g, at 120 hours.

Keywords: Rotting, Egusi, Pulp, Composition, Alpha-amylase, titratable acidity.

Introduction

Egusi (Colocynthis Citrullus L.) is a creeping annual plant belonging to the melon (Cucubitaceae) family. Many varieties are widely cultivated in the whole of West African sub-region including Nigeria, solely for their seeds. The fruit pulp has a bitter taste and the whole fruit is discarded after the extraction of the seeds. Egusi has been much confused with other members of the family especially water melon (Oyolu, 1977). He suggested the adoption of the common name egusi and the botanical name (Colocynthis citrullus) for all varieties of egusi to remove this confusion. However, the distinction between egusi melon and the popular water melon (Citrullus vulgaris) whose fruit pulp is softening of the pulp and hence facilitating the easy removal of the seeds from the fruits with fingers.

Materials and Methods

Sample collection

Seventy mature healthy egusi fruits of ‘serewe’ variety of various sizes were collected from farmers in Ogoja, Cross River State, Abakaliki in Ebonyi State, Enugu and Nsukka in Enugu State, Nigeria, in two batches of thirty-five (35) fruits each. They were washed with tap water immediately they were brought to the laboratory and stored in the refrigerator at 4°C for not more than 7 days before they were used in the experiment.

Laboratory Rotting of Egusi Fruits

Rotting was carried out in three (3) batches,
using fifteen (15) egusi fruits per batch. Four deep approximately equidistant cuts were made on each egusi fruit with a sharp sterile knife in such a manner that the parts were not allowed to fall apart. The cut parts usually became separated during sampling and they were held with clean elastic bands. Two uncut fruits were used as control for each batch. The fruits were heaped on a laboratory bench, covered with cellophane materials and allowed to rot at room temperature (Ca 28°C) until rotting was completed.

The degree in all the experiments was determined, subjectively by the ease with which the seeds could be removed from the pulp.

**RESULTS AND DISCUSSION**

Laboratory rotting of egusi fruits was completed in 120 hours. At this stage, the pulp became soft and the seeds were easily extracted with fingers. The results of the changes in the composition of the pulp, alpha-amylase activity and titratable acidity during the controlled rotting of egusi fruits are shown on Table 1. The composition of egusi fruits at the beginning of rotting (0 hour) showed that the moisture content was 82.04%, carbohydrate 10.76%, crude fats 6.85% and crude protein 0.39%. The data reported by Purseglove (1991) indicated that the composition of egusi fruits by percent wet matter (%WM) differs considerably from the values of some related edible members of the family. The moisture content of egusi fruit at 0 hour (82.04%) is less than the value for wax or white gourd (*Benincasa hispida* Thumb) which is 96%, water melon (*Citrullus lanatus* Thumb) 93.3% and melon (*Cucumis Melon L*) 92.1%. The carbohydrate and fat contents of 10.76% and 6.85% respectively are higher than the values for those edible ones. The carbohydrate content of wax gourd, water melon and melon are 3.2, 5.3 and 6.2% respectively while the fat contents are melon 0.3%, wax gourd and water melon 0.1% each. The protein content of egusi pulp (0.39%) is fairly close to wax gourd (0.4%), water melon and melon 0.5% each. Protein level increased gradually from 0.39% at 0 hour to 0.88% at 72 hours. At 96 hours it has increased to 4.38%, and then fall to 1.14% at 120 hours. The changes could be attributed to microbial activities. Bacterial counts increased rapidly during the period from 24 hours, reached a peak at 72 hours and declined after 96 hours (Obeta and Abriba, 1994). The increase in protein level therefore corresponded to the period of rapid bacterial growth and activities which were accompanied by increase in pH and temperature. The level of water soluble carbohydrate gradually decreased from 10.76%, at 0 hour to 0.35% at 120 hours. The rapid decrease in carbohydrate also corresponded to the period of large bacterial population and was accompanied by increase in protein level (Obeta and Abriba, 1994). This suggests a possible synthesis of proteins from carbohydrates. Bacteria are known to synthesize proteins from the products of carbohydrate metabolism (Rose, 1968). Moisture content also increased during the same period due to bacterial activities because in bacterial utilization of organic materials as energy sources, water is directly or indirectly produced as end products (Rose, 1968). The decrease in fat content between 0 hour and 120 hours is very small. This could be due to the inability of the participating microorganism to utilize egusi fruit fats or their preference for other substances in the fruit. Odunfa (1983) reported a very low lipase activity during the fermentation of boiled egusi seeds for the production of ‘ogiri’. Between 0 hours and 24 hours, the level of reducing sugars decreased from 1.25mg/g to 0.60mg/g, then increased to 1.01mg/g at 48 hours, thereafter, there was a continuous decrease to the end of rotting. A similar observation has been reported by Odunfa (1983) during the fermentation of boiled egusi seeds. He attributed the initial decrease in reducing sugars to an initial bacterial populations which preferentially utilized the sugars. Considering the short period involved (24) hours, it is possible that bacterial which entered egusi...
### TABLE 1: CHANGES IN THE COMPOSITION OF THE PULP, ALPHA-AMYLASE ACTIVITY AND TITRATABLE ACIDITY DURING THE CONTROLLED ROTTING OF EGUSI FRUITS

<table>
<thead>
<tr>
<th>Period of Laboratory Rotting (h)</th>
<th>0</th>
<th>24</th>
<th>48</th>
<th>72</th>
<th>96</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture % WM</td>
<td>82.40 ± 1.00</td>
<td>82.10 ± 1.00</td>
<td>83.01 ± 0.10</td>
<td>83.10 ± 0.10</td>
<td>84.90 ± 0.05</td>
<td>85.00 ± 0.05</td>
</tr>
<tr>
<td>Crude protein % (Nx 6.25) WM</td>
<td>0.39 ± 0.05</td>
<td>0.42 ± 0.04</td>
<td>0.44 ± 0.20</td>
<td>0.88 ± 0.01</td>
<td>4.38 ± 0.10</td>
<td>1.14 ± 0.04</td>
</tr>
<tr>
<td>Crude fat % WM</td>
<td>6.85 ± 0.20</td>
<td>6.83 ± 0.10</td>
<td>6.81 ± 0.02</td>
<td>6.80 ± 0.05</td>
<td>6.75 ± 0.05</td>
<td>6.72 ± 0.01</td>
</tr>
<tr>
<td>Water soluble CHO % WM</td>
<td>10.76 ± 0.10</td>
<td>9.78 ± 0.05</td>
<td>7.50 ± 0.01</td>
<td>3.25 ± 0.50</td>
<td>1.75 ± 0.03</td>
<td>0.35 ± 0.02</td>
</tr>
<tr>
<td>Reducing sugars (mg g⁻¹ WM)</td>
<td>1.25 ± 0.01</td>
<td>0.60 ± 0.05</td>
<td>1.01 ± 0.01</td>
<td>0.40 ± 0.02</td>
<td>0.25 ± 0.03</td>
<td>0.25 ± 0.02</td>
</tr>
<tr>
<td>Titratable acidity (mg lactic acid g⁻¹ WM)</td>
<td>0.10. ± 0.01</td>
<td>0.20 ± 0.10</td>
<td>0.20 ± 0.10</td>
<td>0.30 ± 0.05</td>
<td>0.50 ± 0.05</td>
<td>0.70 ± 0.02</td>
</tr>
<tr>
<td>Alpha-amylase activity (mg g⁻¹ WM)</td>
<td>ND</td>
<td>0.02 ± 0.10</td>
<td>0.80 ± 0.50</td>
<td>0.05 ± 0.10</td>
<td>0.30 ± 0.02</td>
<td>0.02 ± 0.01</td>
</tr>
<tr>
<td>pH</td>
<td>5.20 ± 0.05</td>
<td>5.30 ± 0.10</td>
<td>5.50 ± 0.05</td>
<td>6.20 ± 0.05</td>
<td>6.50 ± 0.10</td>
<td>6.70 ± 0.10</td>
</tr>
<tr>
<td>Temperature</td>
<td>28.0 ± 0.10</td>
<td>28.5 ± 0.20</td>
<td>29.0 ± 0.50</td>
<td>29.0 ± 0.50</td>
<td>30.0 ± 0.25</td>
<td>30.0 ± 0.25</td>
</tr>
</tbody>
</table>

**NOTE:**
- WM = Wet matter
- ND = Not detectable
- Ambient temperature = 28°C.
- ± = Standard deviation.
- CHO = Carbohydrate
fruits by chanced inoculation were undergoing a sort of long lag phase which involved spore germination, increase in sizes of cells and syntheses of inducible enzymes compatible with the nature of the substrate. During this period, they would preferentially utilize reducing sugars which are readily absorbable and metabolisable. It will then be possible to explain the increase in reducing sugars after 24 hours as a result of the acquired ability of bacteria to utilize other carbohydrates, while the decrease between 72 hours and 96 hour could be due to bacterial population (Obeta and Abriba, 1994).

The steady increase in titratable acidity could be due to the activities of the participating bacteria especially *Lactobacillus* and *Leuconostoc* species which produce large amounts of acid from sugars (Fields et al 1981). Acid production has some marked effects on the activities of microorganisms. The activities of alpha-amylase became detectable at 24 hours. It increased by 4 folds at 48 hours and there after declined till the end. This observation differs from the work of Odunfa (1983) in which alpha-amylase activity increased after 50 hours to 120 hours during the fermentation of boiled egusi seeds. The decline in alpha-amylase activity after 48 hours could be as a result of low level of utilization of starchy materials in the egusi seeds or preferential utilization of water soluble carbohydrates and reducing sugars. This work has therefore been able to establish the changes in the composition of the pulp, alpha-amylase activity and titratable acidity brought about as a result of rotting, resulting in the softening of egusi pulp and therefore facilitating the easy removal of the seeds from the fruits.

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REFERENCES


