EVALUATION OF GELLING PROPERTIES OF PECTIN FROM LOCAL GUAVA AND ORANGE FRUITS

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Abstract
Pectin was extracted from two local fruits namely orange and guava. The fruits were peeled, pulped and subjected to extraction process to yield reasonable amount of pectin. Pectin was extracted from guava and the pulp of orange fruits using standard extraction procedure for both fruits. Percentage yield of pectin from the pulp of local orange fruit (5.68%) was higher than that obtained from local guava (4.80%). Jam made from the two pectin samples showed that the sample pectins gel with sugar and acid at optimum pH of 3.22 and 3.26 while that of commercial pectin gel at pH 3.16 respectively. Pineapple jams were produced with the extracted pectin and commercial pectin and the jams were analyzed for pH, degree of methylation and gel strength. There was no significant difference observed at p≤0.05 between the pineapple jams produced from orange pectin and that from commercial pectin in colour, flavor and overall acceptability except taste. However, pineapple Jam (Sample C) using the guava pectin was observed to be significantly different at p<0.05 and was observed to have superior mean scores by pancompared to Jam produced from orange pectin (Sample A) and commercial pectin (Sample C) in all the sensory parameters measured and therefore was rated the best.

Keywords: Pectin, jam, orange, guava

Introduction
Pectin is widely used in the food industry, principally in the preparation of gels. Food gels based on pectin have been known for over 500 years (Abid et al., 2009). Pectin as originally defined, is a water soluble mixture of pectinic acids or partially neutralized pectinic acids capable of undergoing gel formation. Pectins are usually found in the flesh, skins and seeds of most fruits such as orange or lemon peel, guava et c (Masmoudi et al., 2010). Pectins are important emulsifying, gelling, stabilizing and thickening agents used in the preparation of numerous food products (Singh et al., 2009).

In Nigeria, the utilization of pectin has increased recently. This is due to increase in consumption of fruit preserves and jellies in the country, due to urbanization and changing ways of life of some of the rural dwellers. Most of the pectins utilized in Nigeria are imported, leading to a considerable drain on the foreign exchange reserves.

There is therefore the need to look inwards to source pectin locally in order to stop the drain on foreign exchange and at the same time meet the pectin demands of our local industries. A number of our local fruits have the potential to produce pectin with good gelling properties, but information in the potential of these fruits is scanty.

The major objective of this study is to extract pectin from two local fruits orange (Citrus sinensis) and guava (Psidium guajana) and to evaluate the pectins for their gelling properties.

Materials and methods
Raw materials procurement and processing
Orange (Citrus sinensis), Guava (Psidium guajana), sugar and commercial pectin were purchased from Jimeta market, Yola, Adamawa state, Nigeria. Equipments were sourced from the Food science laboratory of Modibbo Adama University of Technology, Yola, Adamawa state, Nigeria. All the reagents used were of analytical grade.

Extraction technique
Guava and orange were thoroughly washed, lightly peeled, seeds removed and orange fruit was pulped and both fruits were weighed. Pectins were extracted using standard procedure described by (Abid et al., 2009). The amount of pectin extracted from the orange and guava (Table 1) were used in the ingredient formulation (Table 2) for the production of pineapple jam. Three samples of pineapple jam were prepared using pectin from three different sources: From orange (Sample A), from guava (Sample B) and commercial source (Sample C). Laboratory production of the pineapple jam (Fig 2) followed the procedure described by Ihekoronye and Ngoddy (1985).
Table 1: Extraction of pectin from local orange and guava fruits

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Wt of pulp fruit(g)</th>
<th>Slurry obtained(ml)</th>
<th>Wt of pectin extracted(g)</th>
<th>%yield Pectin extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>278.00±5.77</td>
<td>400.00±0.57b</td>
<td>15.80±0.80ab</td>
<td>5.68±0.16a</td>
</tr>
<tr>
<td>Guava</td>
<td>278.00±5.29</td>
<td>580.00±0.54a</td>
<td>13.50±0.70b</td>
<td>4.80±0.50b</td>
</tr>
</tbody>
</table>

Table 2: Ingredient formulation for the production of pineapple jam.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineapple Fruit</td>
<td>490g</td>
</tr>
<tr>
<td>Sugar</td>
<td>294g</td>
</tr>
<tr>
<td>Pectin (from orange/guava/commercial)</td>
<td>2.94g</td>
</tr>
<tr>
<td>Citric acid</td>
<td>2.52g</td>
</tr>
</tbody>
</table>

**Analytical methods**

Three samples of pineapple jams were produced using pectin from orange pulp, guava and commercial pectin designated as Sample A, Sample B and Sample C respectively. Jams produced were analyzed for pH, degree of methylation and gel strength. The pH of samples were determined at 30°C using digital pH meter as described by Jindal *et al.* (2013) pH values of the samples were digitally displayed on the pH meter. Gel strength and degree of methylation were carried out according to the method described by Vithanage *et al.* (2010).

**Sensory evaluation**

The sensory evaluation of the samples was carried out by the method described by Ihekoro and Ngoddy (1985) for consumer acceptance and preference using 7-point Hedonic scale by 10 untrained judges. The results obtained from the sensory evaluation were tested at 5% level of confidence.

**Statistical analysis**

The general linear model (GLM) of SPSS Statistical package (version 16.0) was used for the statistical analysis of results. All the results obtained for the statistical analysis were subjected to analysis of variance (ANOVA) to determine differences within the samples (Snedicor and Cochran, 1987). Duncan Multiple Range Test (Duncan, 1995) was used to determine the differences with the variation at 95% confidence limit (p<0.05).

**Results and discussion**

The result of percentage yield of pectin extracted from local orange and guava fruit is presented in Table 2. The result showed that there were significant differences observed in the parameters investigated at p≤0.05. The results also showed that high percentage yield of pectin were obtained from the pulp of local orange fruit than the local guava. Liu, *et al.* (2006) reported 3.7% pectic substances on a dry weight basis and 4.8% on wet weight basis. This agrees with the findings of Abid, *et al.* (2009) on the determination of pectin yield from sour orange. It was observed that the pectin extracted from the local guava fruit and the pulp of local orange fruit was higher than the percentage of pectin reported by Abid *et al.*, 2009. Pulp obtained after extraction will normally serve as waste material.

The pH, degree of methylation at 83°C for Jams produced with local orange pectin, local guava pectin and commercial pectin is presented in Table 3 (see appendix). There was no significant difference at p≤0.05 observed in the pH values and degree of methylation at 88°C between the samples and that of commercial sample. The pH of sample A (3.22), sample B (3.26) and that of the commercial sample (3.16) were observed to be very close. These pH values fall within the acceptable level of 3.1-3.33 for Jam production reported by Liu, *et al.* (2006). This implies that the three pectins used for the production of these jams can be substituted for each other because they all form gel at almost the same pH.

As the result indicates, there was no significant difference at p≤0.05 in the degree of methylation at 88°C recorded for the two samples and that of commercial sample. It was observed that when the extracted pectin from orange and guava were used in the production of pineapple jam with the addition of appropriate sugar and citric acid, the pectins were found to form gel with sugar and acid at pH of 3.22 and 3.26 respectively at 88°C. The result showed that these pectins have high degree of methylation and are also rapid set pectin. Ihekoro and Ngoddy (1985) reported that the degree of methylation is important in determining the type of gel. It was further reported that a rapid set pectin has degree of methylation of 70% or higher and begins to set at about 87.7°C. Slow set pectin has a degree of methylation of 50%-70% and forms gel below 54.5°C. However, Jam produced with
commercial pectin (Sample C) had a higher gel consistency compared to that of sample A and sample B while the gel consistency for sample A and sample B were observed to be very close to each other.

The result of sensory evaluation of pineapple jam produced from orange pectin, guava pectin and commercial pectin showed that there was significant difference at $p \leq 0.05$ in all the parameters measured between guava jam and jam produced from orange pectin and commercial pectin. However, there was no significant difference observed at ($p \leq 0.05$) between the jam produced from the orange pectin and that of commercial jam produced from commercial pectin except for taste. Sample B recorded superior mean scores for all the sensory parameters measured and was rated higher by the panelists than Sample A and Sample C.

**Conclusion**

From the results of this study, it showed that high quality grade pectin can be obtained from our local fruits. Local orange fruit and guava fruit contain appreciable amount of pectin acceptable for jam production. The pectin extracted from the local guava and the pulp of orange fruits yielded a reasonable amount of cheap quality pectin when compared with that of commercial pectin because pectin used from the local guava and that from the pulp of the orange fruit which normally will go as a waste. Hence, the pectin produced from both fruits can serve the same purpose as the commercial pectin because they showed similar functional characteristic in the production of jam.

It may be inferred from this study that the pectin from the guava and the pulp of local orange fruits had similar gelling properties with commercial pectin and therefore could be used interchangeably in jam production.

**References**


Masmoudi, M., Besbes, S, Thabet, I, Blecker, C and Attia, H (2010). Pectin extraction from lemon by-product with acidified date juice: rheological properties and microstructure of pure and mixed pectin gels. *Food Science and Technology International* 16;105-114.


Table 3: pH and Degree of Methylation at 88°C of Pineapple Jam produced from Orange, Guava and Commercial pectin

<table>
<thead>
<tr>
<th>Sample</th>
<th>pH(ns)</th>
<th>Gel consistency</th>
<th>Degree of methylation at 88°C(ns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample A</td>
<td>3.22±0.11</td>
<td>Medium</td>
<td>70.00±0.61</td>
</tr>
<tr>
<td>Sample B</td>
<td>3.26±0.11</td>
<td>Medium</td>
<td>70.00±1.02</td>
</tr>
<tr>
<td>Sample C</td>
<td>3.16±0.08</td>
<td>High</td>
<td>70.00±0.64</td>
</tr>
</tbody>
</table>

Values are mean ± standard deviation of three determination. Values with different superscripts in a column are significantly different at p<0.05.

Table 4: Sensory evaluation of Pineapple Jam produced from orange and guava pectin

<table>
<thead>
<tr>
<th>Samples</th>
<th>Flavour</th>
<th>Colour</th>
<th>Taste</th>
<th>Overall Acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample A</td>
<td>5.17±0.20&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.00±0.27&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>5.10±0.15&lt;sup&gt;c&lt;/sup&gt;</td>
<td>5.50±0.21&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sample B</td>
<td>6.50±0.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.30±0.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.40±0.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.30±0.27&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sample C</td>
<td>4.80±0.17&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.50±0.27&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.70±0.17&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.40±0.17&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Values are mean ± standard deviation of three determination. Values with different superscripts in a column are significantly different at p<0.05.