Extraction of Pectin from Different Fruit Wastes due to the Quality Upgradation of Jellies Preparation – Review

Antony Allwyn Sundar Raj* and Thottiam Vasudevan Ranganathan
Department of Food Processing and Engineering, Karunya University, Coimbatore–641 114, Tamilnadu, India

Abstract

Pectin—a polysaccharide present in fruit cell walls can be extracted from fruit wastes obtained after processing. With the increase in production of processed fruit products, the amount of fruit wastes generated is increasing enormously. The pectin could be utilized for preparing jelly. Most of the jellies made using pectin from fruit wastes were found to have good quality. Those jellies with defects were in different corrective measures to upgrade their quality.

Keywords: Jelly quality; Jelly preparation; Gel formation; Pectin extraction

Introduction

Fruit wastes, which are highly perishable and seasonal, is a problem to the processing industries and pollution monitoring agencies. Suitable methods have to be adopted to utilize them for the conversion into value-added products [1]. By-product recovery from fruit wastes can improve the overall economics of processing units. Besides this, the problem of environmental pollution also can be reduced considerably.

A valuable byproduct that can be obtained from fruit wastes is pectin. Pectin designates that water soluble pectinic acid (colloidal polygalacturonic acids) of varying methyl ester content and degree of neutralization, which are capable of forming gels with sugar, and acids, under suitable condition [2]. It is used in pharmaceutical preparation as filler, as an agglutinated in blood therapy and also to glaze candied fruits.

Pectin exists in varying amounts in fruit cell walls and has important nutritional and technological properties, mainly because of its ability to form gels [3]. The pectin is used in manufacture of jams, jellies, marmalades, preserves etc. It is also useful as a thickening agent for sauces, ketchups, flavoured syrups and as a texturising agent in fruit-flavoured milk deserts. Besides, it finds numerous applications in pharmaceutical preparations, pastes, cosmetics etc. But, the single largest use of pectin is in the manufacture of jellies. About 80 to 90% of the seven million kg of commercial pectin in the world is used to make jelly and similar products.

Extraction of pectin from different fruit waste

The different fruit wastes selected for pectin extraction and preparation of jelly were nutmeg rind, passion fruit rind, pumello peel, banana peel and citrus peel. Pectin was extracted from these fruit wastes using standard treatments [4].

The suitability of pectins for different purposes is determined by their characters viz., anhydouronic acid content, methoxyl content, degree of esterification and acetyl value. Hence, it is an unavoidable aspect that every pectin should be described properly for its biochemical characters.

To analyze the biochemical characters, pectin was extracted from different wastes by boiling them with water and acids as specified in Table 1. The biochemical characters analyzed were anhydouronic acid (%), methoxyl content (%), gel grade and acetyl value (%), using standard procedures [5]. The results are given in Table 2.

Jelly was prepared by boiling the pectin extract with sugar (sugar is added at the rate of 3/4th the quantity of pectin extract) and citric acid (2.5 g per kg of pectin extract) till a gel consistency is reached. The end point was judged by sheet test (jelly was taken in a spoon and allowed to fall. When it started falling like a sheet, cooking was stopped). Another criterion taken was the T.S.S. (The mass was boiled till 72°C Brix was obtained). The jellies thus prepared were evaluated for their qualities by visual means as well as organoleptically. The qualities of different jellies were compared with that of guava jelly, which was taken as the standard [5]. The results are given in Table 3.

Upgradation of jelly quality through special treatments

Based on the results of quality evaluation of jelly prepared from

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*Corresponding author: Antony Allwyn Sundar Raj, Research Scholar, Department of Food Processing and Engineering, Karunya University, Coimbatore–641 114, Tamilnadu, India, E-mail: asrthegreat@gmail.com

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different fruit wastes, special treatments/ method of preparation were tried for the following fruit wastes to improve their quality by correcting the defects identified. The results are given in Table 4.

Conclusion

Gel grade is the weight of sugar with which one part by weight of pectin will, under suitable conditions, form a satisfactory jelly. This is the most important character that determines the value of pectin in international market. As the methoxyl content increases the spreading quality and sugar binding capacity of pectin increase.

In the present study, the gel grade of pectins with methoxyl content in the range of 8 to 11%. Pectin from pumello peel was found to vary from 200 to 213. Highest gel grade was obtained for lime peel pectin-213. These results are in collaboration with Sudhakar et al. [6].

It can be inferred that they possess good are spreading and sugar binding capacity. Pectins from passion fruit rind with methoxyl content 4.96% recorded low gel grade-73. Gel grade was in the range of 100 to 200 for those having methoxyl content in between 7 and 8%.

The jellies prepared out of pectin extracts from different fruit wastes were analysed for their setting property, consistency, syneresis, colour, crystallisation and cloudiness in comparison with standard guava jelly. The treatments, which could overcome the defects noticed with different jellies, are given in Table 5.

Rate of setting and setting time

Almost all jellies except that of passion fruit rind, lime peel and pumello peel exhibited slow setting, whereas passion fruit rind and lime peel jellies exhibited very fast setting nature and achieved proper set within 20 minutes. Pumello peel attained fast setting.

Consistency

Desirable consistency was obtained for jelly made from pectin extracts of banana peel, nutmeg rind and lime peel. Jelly from pumello peel and passion fruit rind extracts were of firm consistency. By this, the firmness of passion fruit rind jelly could also overcome. According to [5], a jelly will become syrupy, if it contain low amount of pectin, which is not sufficient enough to bind the sugar.

Cloudiness

Cloudiness—the loss of transparent nature—was observed only for banana peel jelly, whereas other jellies were transparent. Jelly became cloudy when pulp gets mixed in the extract. So extraction was carried out by scraping off the pulp from peel as well as by reducing the time of extraction from 45 to 60 minutes to 25 minutes. The second treatment was found effective for extraction and the jelly prepared using such extracts were more transparent. Banana peel is very soft and it may not require boiling for long time to extract pectin. By organoleptic evaluation, it was found that the single most hindrance in acceptance of lime peel of pumello peel jelly was its bitterness. Probably, this could be due to the presence of limonin and naringin as reported by [7,8].

Several methods have been tried to reduce the bitterness of juice from citrus fruits. These include raising the pH of the juice [9], suppression of bitterness by addition of sweetening agents [10], addition of p-cyclodextrin monomer for forming inclusion complexes of limonin [1], conversion of bitter principles to non-bitter components in the juice by the action of immobilized bacteria [11] and treating the juice with adsorbent XAD-16 [12].

Properties of pectin in cell walls are sometimes modified by low levels of hydroxyl esterification with acetyl groups. The distribution of acetyl groups in pectin is unknown but in sugar beet, pear and apricot pectin, acetyl levels are reported to approach 4% [5].

<table>
<thead>
<tr>
<th>Fruit wastes</th>
<th>Citric acid%</th>
<th>Water: fruit waste ratio</th>
<th>Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutmeg rind</td>
<td>0.75</td>
<td>1.5</td>
<td>45</td>
</tr>
<tr>
<td>Banana peel</td>
<td>0.75</td>
<td>1.5</td>
<td>60</td>
</tr>
<tr>
<td>Pumello peel</td>
<td>0.50</td>
<td>1.5</td>
<td>45</td>
</tr>
<tr>
<td>Passion fruit rind</td>
<td>0.75</td>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>Lime peel</td>
<td>0.5</td>
<td>3</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 3: Preparation of jelly.

<table>
<thead>
<tr>
<th>Fruit waste</th>
<th>Special treatments tried</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana peel</td>
<td>(i) The peel was taken after scrubbing off the peel pulp portion from the peel</td>
<td>Removal of cloudiness</td>
</tr>
<tr>
<td></td>
<td>(ii) The extraction time was reduced to 25 minutes from 45 to 60 minutes</td>
<td></td>
</tr>
<tr>
<td>Pumello peel</td>
<td>(i) The chopped peel boiled in 1, 2, 3, 4 and 6% sodium chloride for 30 minutes and thoroughly washed with water before pectin extraction</td>
<td>De-bittering of pectin</td>
</tr>
<tr>
<td></td>
<td>(ii) Chopped peel boiled with sodium hydroxide at 0.175, 0.25, 0.5, 0.75, 1, 1.5 and 1.75% for 30 minutes and thoroughly washed with water before pectin extract</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(iv) Blended with pineapple pectin extract at the ratio of 1:1</td>
<td></td>
</tr>
<tr>
<td>Lime peel</td>
<td>Lime peel was treated with 1, 2 and 3% sodium chloride by boiling for 30 minutes and kept overnight. Before extracting pectin, thorough washing was given</td>
<td>De-bittering of pectin</td>
</tr>
<tr>
<td>Passion fruit rind</td>
<td>(i) Jelly was prepared using reduced quantities of sugar viz., pectin extract and sugar in the ratio 1:0.75</td>
<td>Removal of crystals</td>
</tr>
<tr>
<td></td>
<td>(ii) Blended with that of pineapple peel pectin extract at 1:1 ratio</td>
<td>To obtain gel consistency</td>
</tr>
</tbody>
</table>

Table 4: Details of special treatments tried.
Sugar beet pectin contains acetyl group. Perhaps other pectins may also contain this group. If acetyl group is present in pectin, it inhibits jelly formation.

Pumello is a potential under exploited fruit of South India. No much product diversification or preservation methods are undertaken in the fruit. However, the attempts for extracting pectin from pumello peel and its subsequent utilization for product preparation is first of its kind in this study. Peels were treated with sodium chloride, lime and sodium hydroxide at different concentrations with and without boiling for extracting pectin.

Completely de-bittered and highly acceptable jelly was obtained with pectin extracts of peels boiled in 6% sodium chloride for 30 minutes before pectin extraction. The de-bittering might be due to the inactivation of the enzyme, which is responsible for conversion of laminate-A ring lactone to limonine [13] at high temperature combined with high salt concentration.

The preparation of good quality jellies from fruit wastes is certainly becoming a matter of very much importance, as it benefits the mankind in various ways like food products, pharmaceutical and cosmetic purposes.

References