Comparative studies of pectin yield from fruits using different acids
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ABSTRACT
Pectin was extracted from fruits such as orange, apple, guava and grapes using different acids. Hydrochloric acid, sulphuric acid and nitric acid were used for extraction of pectin from dried fruit pieces. The level of pectin differed in the fruits depending on the acids added during the process of extraction. Generally fruits are dried to determine the yield of pectin. Various drying methods were adopted in this study to extract pectin from above mentioned fruits. The resulting pectin content of fruits was compared with drying methods adopted.

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Introduction
Pectin is a structural heteropolysaccharide contained in the primary cell walls of terrestrial plants. It has a high water-holding capacity, due to its physical and chemical nature. Pectin is used as a gelling agent and thickening agent. It gives the jelly-like consistency to jams or fruit gels. Pectin is extracted from guava, apples, blackberries, gooseberries, cranberries, grapes, plums. It can also be used to stabilize protein drinks, such as yogurt, and as a fat substitute in baked goods. It is produced commercially as a white to light brown powder.

Commercially pectins are categorized according to their methoxy content and whether they form gels quickly or slowly. Roughly speaking pectin can be classified as high methoxy pectin (>50% esterified) and low methoxy pectin (<50%esterified).High methoxyl pectin (HM-pectin) has degree of esterification more than 50 % and low methoxyl pectin (LM-pectin) has degree of esterification less than 50%. (Braddock,1999).

The degree of amimation indicates the presence of carboxyl groups in the amide form. The main use of pectin is as a gelling agent, thickening agent and stabilizer in food. The classical application of pectin is to give a jelly-like consistency to jams or marmalades, which would otherwise be just sweet juices. For household use, pectin is an ingredient in gelling sugar (also known as 'Jam Sugar') where it is diluted to the right concentration with sugar and some citric acid to adjust pH. In some countries, pectin is also available as a solution or an extract, or as a blended powder, for home jam making. For conventional jams and marmalades that contain above 60% sugar and soluble fruit solids, high-ester pectin is used. With low-ester pectin and amided pectin less sugar is needed, so that diet products can be made. Typical levels of pectin used as a food additive are between 0.5 – 1.0% - this is about the same amount of pectin as in fresh fruit.

This study was carried out with the following objectives:
• Identification of sources of pectin.
• Extraction of pectin from different fruits using different methods (varying the acids).
• Comparison of the pectin yield from different methods.

Product and application development by the major pectin producers has over the years resulted in a large expansion of the opportunities and applicability of pectin. Figure 2 shows the application of pectin.

Figure 2: Applications of pectin

Figure 1: Structure of pectin

Methodology
Fruits selected for pectin extraction were orange, apple, guava and grapes based on a maturity indices viz., acidity, TSS, specific gravity, firmness and color. Before the processing of orange, apple, guava and grapes the fruits were washed with clean potable water to remove the dust particles. Ripe fruits were sorted from the under ripe fruits and cut into pieces or into slices
and were dried by sun drying method for complete removal of moisture. Fruit pieces were also dried in a tray drier for 1-3 hours at a temperature of 130°C - 150°C. The dried sample was ground in a mixer-grinder for the extraction of pectin. (Ranganna S, 2001)

**Extraction of pectin**

Pectin was extracted by following the standard procedure (Ranganna S, 2001). Pectin extraction was also carried out using different acids such as hydrochloric acid, Sulphuric acid and Nitric acid according to the following procedure:

**Extraction of pectin**

1. **10 grams of ground dried tissue**
2. **Added 1.4g sodium hexametaphosphate**
3. **Adjusted pH to 4.5 using different acids such as hydrochloric acid (HCl), Sulphuric acid and Nitric acid (HNO₃). Heated at 90-95°C for 30min.**
4. **Checked the pH 4.5 Water lost by evaporation was replaced at intervals.**
5. **Water addition was restricted during the last 5min of the extraction period and filtered it using filter cloth.**
6. **Rounded the cooled weighed filtrate into 1 volume of ethanol and separated the precipitate on coarse mesh cloth after 30min and the filtrate was dried.**

After drying the sample was weighed and the yield of pectin calculated and tabulated.

Pectin yield \( y_{pec} \) (% \( = \) 100(P/B₁)

where,

- \( y_{pec} \) = Extracted pectin in per cent (%).
- \( P \) = Amount of extracted pectin in g.
- \( B₁ \) = Initial amount of ground dried tissue (10g).

**Results:**

The present study gave the following results which are described below:

Fruits-orange, apple, guava, and grapes were selected for extraction of pectin. Pectin yield was calculated as per the standard analytical procedure (Rangana, 2001), as shown in Table 1.

**Table 1**

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Pectin Yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>25</td>
</tr>
<tr>
<td>Guava</td>
<td>30</td>
</tr>
<tr>
<td>Apple</td>
<td>15</td>
</tr>
<tr>
<td>Grapes</td>
<td>10</td>
</tr>
</tbody>
</table>

**Figure 3 Pectin extracted from fruits (Ranganna, 1995)**

The yield of pectin content was found to be high in orange and guava which was more than that of the pectin obtained from apple and grapes as shown in figure 3.

**Comparison of Pectin Yield using Different Acids**

Pectin was extracted from the fruits using different acids after they were dried under sun. The yield of pectin thus obtained is shown in table 2.

**Figure 4: Comparison of Pectin yield for different acids (sun dried sample)**

Results indicated that the pectin content was found to be high using hydrochloric acid for all fruits as shown in Table 2. There was a considerable decrease of the pectin obtained from nitric acid and sulphuric acid. The yield of pectin for sun dried orange using nitric acid was found to be high when compared to the pectin content obtained from hydrochloric acid and sulphuric acid as shown in figure 4. The pectin content was same and did not change for apple and grapes even though different acids were used.

Pectin was also extracted from the fruits using different acids after they were dried in a tray drier for 1-3 hours at a temperature of 130°C - 150°C. The dried sample was ground in a mixer-grinder for the extraction of pectin.

**Figure 5: Comparison of pectin yield for different acids (tray dried sample)**

**Conclusion**

Selected fruits were dried under sun and using a tray drier before extraction of pectin. During the drying process it was observed that there was a considerable difference in the pectin yield using different acids. The pectin content was found to be high using hydrochloric acid for all fruits that were dried under sun. On the other hand, guava reported highest values of yield after it was tray dried and pectin extracted using different acids.

**Reference**


Table 1: Yield of Pectin

<table>
<thead>
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</tr>
<tr>
<td>Guava</td>
<td>25</td>
</tr>
<tr>
<td>Apple</td>
<td>20</td>
</tr>
<tr>
<td>Grapes</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 2: Comparison of Pectin yield for different acids (Sun dried sample)

<table>
<thead>
<tr>
<th>Type of Acid (0.05 N)</th>
<th>Yield of Pectin(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Orange</td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>20</td>
</tr>
<tr>
<td>Sulphuric Acid</td>
<td>15</td>
</tr>
<tr>
<td>Nitric Acid</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 3: Comparison of Pectin yield for different acids (tray dried sample)

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