Anthocyanin Concentration of Various Fruits and the Effect of PH

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Science Seminar

Introduction, Part I
- Plants contain unique pigments that give them their colors. Chlorophyll produces the green pigment in plants, while carotenoids are responsible for orange colors.
- Anthocyanins are the blue, purple, and red pigments found in many flowers, fruits, and vegetables.
- The reason that such plants appear more red or blue is directly due to the anthocyanin concentration in the plant.
- Anthocyanins are easily influenced by external factors such as PH, temperature, and metal concentration.

Introduction, Part II
- Anthocyanins are water-soluble pigments
- Many times, the temperature that certain substances perform the best in, varies. (i.e., Enzymes have specific temperatures for maximum performance.)
- Anthocyanins thrive in acidic solutions and therefore appear more colorful in solutions of low PH.
- Different fruits also have different anthocyanin concentrations.

Introduction, Part III
- The structure of the anthocyanin is what allows it to change colors in varying PH values. When in a basic solution, the anthocyanin has an extra hydroxyl which then becomes an O in an acidic solution. The addition of the OH removes the positive charge of the structure and causes the absorbance of protons of greater wavelength—thereby appearing green.
- Hypothesis
  - Fruits that are more darkly colored red will be more transparent and more absorbent than fruits that are duller reds.
  - The lower the PH of the solution that an anthocyanin is placed in, the more intense the red, blue, or purple the color projected will appear. As solutions become more and more basic, the color will become more muted and eventually green at a PH of 14.
  - The more acidic the solution becomes, the lower the absorbance and the higher the transparence. And visa versa for basic solutions.

Methods, Part I
- These 3 different types of fruit were ground up and then placed in a spectrophotometer to measure absorbance and transparence of each fruit sample.
Methods, Part II

- After the fruits were grinded, 10g of each fruit extract was combined in a test tube with 5ml of the 1% HCl methanol solution. The tubes were then diluted 20x and placed in the spectrophotometer to measure absorbance and transparency.
- A 2x diluted cherry solution was then exposed to varying levels of PH (using a hopper system to create molar solutions) and the results for each PH concentration were recorded using a test tube with 1% HCl methanol solution as the control.

Results, Part I

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Transparence</th>
<th>Absorbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pear</td>
<td>95</td>
<td>0.022</td>
</tr>
<tr>
<td>Strawberry</td>
<td>23.8</td>
<td>0.622</td>
</tr>
<tr>
<td>Cherry</td>
<td>17.1</td>
<td>0.766</td>
</tr>
<tr>
<td>Blank</td>
<td>100.3</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Results, Part II

<table>
<thead>
<tr>
<th>PH</th>
<th>Transparence</th>
<th>Absorbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>73.8</td>
<td>0.131</td>
</tr>
<tr>
<td>13</td>
<td>61.2</td>
<td>0.131</td>
</tr>
<tr>
<td>12</td>
<td>53.6</td>
<td>0.271</td>
</tr>
<tr>
<td>11</td>
<td>42.3</td>
<td>0.374</td>
</tr>
<tr>
<td>Blank</td>
<td>100.5</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Conclusions, Part I

- With the knowledge gained from this study, the possibility of using anthocyanins in solar cells or photo-voltaic cells in order to conduct electricity can be considered.
- Also, food containing anthocyanins can be specially tailored so that it stays a certain color for a maximum amount of time.
- This study makes clear that PH has an effect on molecular properties (i.e. color)
Future Studies, Part I

- This experiment can be conducted in lab conditions with much more advanced conditions.
- Also, more experiments can be done to examine the anatomy of an anthocyanin and why exactly they thrive in acidic solutions.
- A larger sample can also be tested including many other fruits which contain anthocyanins.
- To examine if chlorophyll has properties similar to anthocyanins, with regards to change in PH concentration on color.
- To examine the exact effect of other factors on the color change of anthocyanins (metal presence, oxygen concentration, temperature...).