

The Effects of Heat and pH on Plant Pigments

Pigments are responsible for the colors in foods. In plants, the most common pigments are called carotenoids (red, yellow and orange colors), flavonoids (white and blue colors), and chlorophylls (green colors). Some of the changes in colors that occur during storage, preservation and preparation of foods are because of changes in the pigments. These changes can improve or detract from the appearance and acceptability of food.

In this experiment, you will determine the effect of heat and pH on anthocyanin and chlorophyll pigments. Anthocyanins are a type of flavonoid pigment and are blue and purple colors.

Materials

- Frozen green peas
- Canned green peas
- Vinegar
- Grape juice
- Cranberry juice
- 1 N NaOH
- baking soda
- pans
- hot plates or stove top
- graduated cylinder
- scale or balance
- beakers
- pH meter or pH paper

Procedure for Chlorophylls:

1. Add 10 milliliters of vinegar to 150 milliliters of deionized water and determine the pH of the solution. Place in a pan and heat to boiling.

2. Add 10 milliliters of 1 N NaOH to 150 milliliters of deionized water and determine the pH of the solution. Place in a pan and heat to boiling.
3. Heat 150 milliliters of deionized water to boiling.
4. Add approximately 25 grams of frozen peas to each of three pans.
5. When water returns to a boil, allow it to boil for 7 minutes.
6. Remove peas from water and place in beakers.
7. Add another 10 milliliters of vinegar to 150 milliliters of deionized water and add 25 grams of frozen peas. Let sit at room temperature for 7 minutes (do not cook).
8. Add 2 grams of sodium bicarbonate (baking soda) to 150 milliliters of deionized water. Add 25 grams of frozen peas. Let sit at room temperature for 7 minutes (do not cook).
9. Put 25 grams of canned peas into another beaker.
10. Compare color and texture of all samples.

Procedure for Anthocyanins:

1. Mix 10 milliliters of grape juice and 90 milliliters of distilled water.
2. Determine the pH of the solution.

3. Place 10 milliliters of this solution in a test tube and label.
4. Adjust the pH of the remaining grape juice and water solution to pH 5.0 with 1 N NaOH.
5. Place 10 milliliters of this solution in a test tube and label.
6. Adjust the pH of the remaining grape juice and water solution to pH 7.0 with 1 N NaOH.
7. Place 10 milliliters of this solution in a test tube and label.
8. Adjust the pH of the remaining grape juice and water solution to pH 1.0 with 1 N NaOH.
9. Place 10 ml of this solution in a test tube and label.
10. Compare the color of each of the solutions.
11. Mix 50 milliliters of cranberry juice and 50 milliliters distilled water.
12. Repeat steps 2 – 10 using the cranberry and water solution.

Questions

1. How do textures of peas and color of chlorophyll change when peas are heated at different pH values? What chemical changes occur in the chlorophyll molecule with differences in pH? What changes account for the changes in texture?

2. What chemical changes occur in the anthocyanin molecules as pH changes?

