

Fruits

OXIDATION TRANSFORMATION

Did you know that a chemical reaction occurs after fruit has been exposed to oxygen?

Once the skin on some fruit is removed, the fruit will be exposed to air, and a chemical reaction called **enzymatic browning** occurs. This happens because of a reaction between specific enzymes and oxygen (O₂). **Enzymes** are substances that can help speed up reactions. The oxidation of fruit pigments activates specific enzymes in plant tissues causing this reaction to occur. **Oxidation** occurs when a substance is exposed to oxygen. For fruit, oxidative browning occurs when enzymes interact with amino acids in the presence of oxygen, which then causes brown pigments to form. **Pigments** make up the natural coloring of plant and animal tissues.

Enzymatic or oxidative browning typically occurs at warm temperatures in slightly acidic or neutral environments. A pH between 5.0 and 7.0 would provide the perfect environment. The reaction rate can be increased by the presence of iron or copper. This reaction causes a reduction in the quality of fresh fruit and vegetables by decreasing the food's lifespan and nutritional



quality; however, enzymatic browning can have its advantages. For instance, the browning reaction can contribute to the desirable color and flavor of dried fruits, like raisins and prunes.

There are various treatments that can prevent enzymatic browning. One way is by adding an acid and changing the pH. **Acids** cause a sour flavor in foods. To neutralize acids, **bases** are used. Acids and bases are categorized based on a **pH scale**, which ranges from 0-14. Items that have a pH of 7 are considered to be neutral. Items with a pH less than 7 are acidic, and items ranging from 8-14 are basic. Lowering the pH by adding an acid prevents the enzymes from functioning properly, which stops the browning process. **Ascorbic acid**, also called Vitamin C, is found in citrus fruits and vegetables. The



Baking soda (base) decreases the acidity of foods by increasing the pH.

addition of a base, such as baking soda, will cause the pH to increase and possibly speed up the browning process. You will observe these types of reactions in *Food Lab Explorations Part I* of this chapter.

Chemical reactions not only occur in fruit itself, but in the human body as well. **Oxidation** is the process in which an electron is removed from an atom. For our bodies, it is considered a normal process that cells undergo, but it can cause stress on our bodies too. This stress can lead to diseases, such as cancer and heart disease.

Antioxidants are substances that can inhibit or slow oxidation. Antioxidants can work to

reduce the damaging effects of oxidation in the body. The antioxidants found in fruit will fight disease-promoting cells in your body. Vitamin C is the most common antioxidant. Citrus fruits including grapefruit, lemons, limes, oranges, and tangerines are the highest in Vitamin C. Be sure to include fruits in your diet for a good source of antioxidants! You will explore antioxidant reactions further in *Food Lab Explorations Part II* of this chapter. Try preventing enzymatic browning in your own fruits!



Include fruits in your diet as a good source of antioxidants.

Think About It

Food Explorations Lab I

1. What is the purpose of an enzyme in a chemical reaction?

Speed up the reaction

2. What gas is necessary for oxidation to occur? *Oxygen*

3. What conditions are best for oxidative browning to occur?

Slightly acidic (pH 5-7), warm temperature

Food Explorations Lab II

1. What is an antioxidant? *A substance that inhibits or slows oxidation*

2. What is another name for vitamin C? *Ascorbic acid*

3. Why are antioxidants important to our bodies?

They fight against damage-causing oxidants
