

## Viscosity of Fluid Foods

Viscosity refers to the thinness or thickness of a fluid food. Foods that are more viscous are thicker and foods that are less viscous are thinner. Viscosity can be determined by the length of time it takes for a food to run through a small hole of a known diameter, the time it takes for foods to flow down an inclined plane, the resistance of a food to a falling weight, or the resistance of a food to a rotating spindle. Devices used to measure viscosity are viscometers and can be quite simple (as the devices used in this experiment) or quite complicated (as devices used in research laboratories).

Heat, acid and sugar can change viscosity of some foods. For example, the viscosity of starch solutions (such as puddings and gravies) changes as we heat them. Adding sugar or acids can also change the viscosity of these products. Also, heating protein solutions causes changes in viscosity due to denaturation and aggregation of the proteins. As a protein is denatured, the chemical bonds holding the proteins together are broken. Other bonds form and the proteins aggregate. An example of this is heating an egg white. The first change noticed is that the egg white turns from clear to white (denaturation), then it changes to a solid (aggregation).

### Materials

- Foods of varying viscosities, such as ketchup, eggs, syrups, oils, or salad dressings
- 600 milliliter beakers
- 10 milliliter wide-bore pipettes
- stopwatch

### Procedure

1. Place at least 200 milliliters of each food to be tested in the beakers.
2. Place at least 200 milliliters of water into another beaker.
3. Pipette 10 milliliters of water into a 10 milliliter pipette. Allow the water to flow out of the pipette and record the time required for the pipette to empty.
4. Pipette 10 milliliters of each food into 10 milliliter pipettes. Allow the foods to flow out the pipettes and record the time required for the pipettes to empty.
5. Graph the results.

### Variations

1. Compare viscosities of regular and low sugar syrups, regular and low fat salad dressings, different types of oils, or egg whites that have been heated to 25, 35, 45, 55, and 65 degrees C.
2. To the heated egg whites or prepared unflavored gelatin, add 10 milligrams meat tenderizer or 5 milliliters of fresh pineapple juice. Record changes in viscosity at 2, 5 and 10 minutes.

### Questions

1. Give 3 examples of foods in which greater viscosity is desirable. Give 3 examples of foods in which less viscosity is more desirable.
2. How does heat affect viscosity of proteins? How do enzymes affect viscosity of proteins?
3. How does heat affect viscosity of starches? How do enzymes affect viscosity of proteins?

