

The Effects of Water Temperature on Starch Dispersion

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Introduction

The objective of this lab was to evaluate the effect of water temperature on starch dispersion. Mixtures of cold or boiling water and flour were prepared and evaluated. The hypotheses or Food Science Principles were:

- 1) Mixing flour in cold water will form a temporary suspension.
- 2) Mixing flour in boiling water will expand starch granules to form a permanent dispersion.

Materials and Methods

One level tablespoon of flour was stirred into 8 ounces of cold water in a glass measuring cup. A second level tablespoon of flour was added to 8 ounces of boiling water while continuously stirring. Each flour and water mixture was allowed to set for 10 minutes. Photographs were taken of each mixture.

Results

The results of this experiment are shown in Figure 2a for the cold water and flour mixture and in Figure 2b for the flour and boiling water mixture. Flour added to cold water was held in a



Figure 2a. Flour stirred into cold water formed a layer on the bottom of the cup.



Figure 2b. Flour stirred into boiling water formed a permanent dispersion.

temporary suspension that was reversible when the stirring stopped (Conforti, 2008). This contrasted with an irreversible suspension or colloidal dispersion when flour was stirred into boiling water as shown in Figure 2b (Conforti, 2008).

Discussion

The objective of this lab experiment was met and the results agreed with the hypotheses or expected outcomes. The Food Science Principles that were demonstrated by this experiment were 1) starch formed a temporary suspension when mixed with cold water and 2) starch formed a permanent colloidal dispersion when mixed into boiling water. In this experiment, flour stirred into cold water formed a suspension only as long as the stirring continued. The flour settled to the bottom of the measuring cup when stirring ceased (Figure 2a). The explanation for this result is that starch in flour is insoluble in cold water but dissolves in hot boiling water (Bennion and Schuele, 2010). Heat disrupts the molecular structure of starch allowing starch granules to absorb water, expand and form a permanent dispersion. Gelatinization is the term used to describe the changes in starch granules in the presence of moist heat (Bennion and Schuele, 2010).

Flour mixed into boiling water formed clumps of undissolved flour that floated to the surface of the measuring cup. Lumps form when the outer surface of flour becomes moist while the flour inside remains dry. These lumps can be prevented by adding sugar or fat to separate the starch granules which allows uniform dispersion of moisture in the starch (Bennion and Schuele, 2010). Another method to prevent lumps is to prepare a slurry of cold water and flour and to slowly add the slurry to the hot water while stirring (Bennion and Schuele, 2010).

Another experiment could be conducted to test the hypothesis that the addition of fat to starch before adding hot water to the mixture will prevent lumping. The experiment could be designed to prepare a roux of liquid fat and flour before adding hot water. This method is used for preparing gravies and white sauce (Bennion and Schuele, 2010).

References

- (2010). Chapter 13: Starch. In: Bennion, M., Scheule, B. (Eds.), *Introductory Foods*. 13th Ed. (pp. 213-229). Upper Saddle River, NJ: Pearson Education, Inc.
- (2008). Laboratory 3: Starch and Cereal Cookery: Role of Gelatinization and Gelation. In: Conforti, F.D. (Ed.), *Food Selection and Preparation. A Laboratory Manual*. 2nd Ed. (pp. 22-36). Ames, IA: Wiley-Blackwell.