Fat Bloom in Chocolate

New Directions in Research

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Fat bloom is a physical defect that appears during chocolate storage as a grayish-white film on the surface of the product. This defect has been a significant problem leading to sensory defects in chocolate ever since the industry was initiated. Although fat bloom has been studied extensively for many years, the bloom mechanisms and kinetics are not completely understood. In this paper, the current understanding on the mechanisms of fat bloom are summarized and suggestions for future research work are proposed.

BLOOM FORMATION

Fat bloom can be considered as a product of changes that occur over time in chocolate. An example of fat bloom is shown in Figure 1. These changes are primarily related to the polymorphism of cocoa butter and the migration of liquid fat. Bloom formation may result from any of the following: a polymorphic change; a transformation from a single solid phase to a mixture of a solid phase and a liquid phase; or a transformation from a single solid phase to a mixture of two solid phases. These phase changes/transformations that result in fat bloom may be traced to specific processing steps/storage conditions. These steps or conditions include the following:

- Improper tempering of the chocolate.
- Incorrect cooling of the chocolate.
- Storage at elevated temperatures and/or with thermal fluctuations.
- Abrasion and finger marking.
- Fat migration from the centers of chocolate-covered confections.

FAT BLOOM MECHANISMS IN DARK AND MILK CHOCOLATE

There is no single, universally accepted theory that describes fat bloom in chocolate. Current theories about fat bloom fall into two categories: polymorphic transformation theory and phase separation theory.

Polymorphic Transformation

The polymorphic transformation theory is based on the fact that bloomed chocolates are always found to contain the most stable VI polymorph of cocoa butter. According to this theory, bloom occurs through the uncontrolled polymorphic transformation of cocoa butter from a less stable form (form IV or form V) to the most stable form (form VI). In poorly tempered chocolate, form IV will transform to form V and eventually to form VI, resulting in bloom, while in well-tempered chocolate, form V will transform to form VI and bloom also may occur. Elevated and/or fluctuating temperatures promote the transformation rate and thus also promote the rate of bloom formation. However, it is found that the production of form VI from form V does not always lead to bloom, and a direct

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