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# Chocolate Chips in Cookies Do Not Bloom

***Fat migration appears to be the primary factor controlling bloom on chocolate chips baked in cookies.***

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Chocolate bloom is of major concern for anyone who uses chocolate. Many factors can cause chocolate bloom, including improper tempering, temperature cycling during storage and mixing of incompatible fats. Tempering is the process of precrystallizing cocoa butter to seed the chocolate with the proper number, size and polymorphic form of seed crystals. Untempered chocolate blooms rapidly because the cocoa butter crystallizes in uncontrollable fashion.

Bloom on untempered chocolate occurs shortly after solidification. This is also true for tempered chocolate that has been exposed to temperatures high enough to completely melt cocoa butter. Initially, cocoa butter crystals will crystallize in an unstable form. These cocoa butter crystals rapidly transform to the more stable  $\beta V$  and  $\beta VI$  forms. This polymorphic transformation results in a contraction effect of the cocoa butter crystalline matrix. The shifting to a more compact cocoa butter structure produces cavities in which cocoa solids and sugar particles become entrapped. It is

these particles that are responsible for the whitish appearance of untempered-chocolate bloom. Chocolate that is allowed to solidify without tempering will usually bloom within one to two days.

This, surprisingly, does not appear to happen in all cases. For example, bloom does not occur on chocolate chips baked in cookies, even though they melt completely during baking. When the cookies are cooled, the chocolate chips solidify without tempering. Despite this, chocolate chip bloom is not a common problem and is rarely observed on ordinary chocolate chip cookies.

Our initial studies demonstrated that the fat content of cookie dough is directly related to the amount of bloom that forms on chocolate chips after baking. The higher the fat content of the cookie dough, the less bloom will form on the chocolate chip. At some level, which can vary somewhat depending on the type of fat used, bloom can be completely inhibited. From these results, fat migration appears to be the primary factor controlling bloom on chocolate chips baked in cookies, although there may be other ➤



*Amelia Frazier is currently pursuing a master's degree in food science at UW—Madison under Dr. Rich Hartel, studying fat migration and chocolate bloom.*