Incorporating Confectionery Coatings, Fillings, and Inclusions in Baked Goods

R. A. Tietz and L. Miller
Clasen Quality Coatings
Madison, WI, U.S.A.

When it comes to using confectionery coatings, fillings, and inclusions in baked goods, there are many options available for customizing formulations to meet the required product and process characteristics of different baked products, whether enrobing a cereal bar, filling a cookie, or using an inclusion in a brownie. In addition to adding a dimension of indulgence and desired sensory characteristics, coatings also can serve as great vehicles for adding fiber and protein to baked products, creating a better-for-you product without impacting the sensory characteristics of the final product.

There are many ingredient options that can be used in creating a custom confectionery compound for a specific bakery application. When custom formulating, it is important to consider the overall baked product formulation, fats, processing conditions, storage conditions, and desired finished-product attributes. Understanding the fat and oil systems being used in both the baked good and confectionery compound is critical for optimizing product quality and shelf life. Other confectionery compound formula considerations include selection of bulking agents, desired melting point, flavors, colors, and nutritional requirements. The ingredients selected can have a significant impact on the performance and sensory properties of the final product. The inherent benefit of confectionery compounds is their formulation flexibility, which allows them to be optimized for a specific food system or various processing conditions.

Confectionery Coatings, Fillings, and Inclusions

Confectionery coatings, fillings, and inclusions are all forms of confectionery compounds that are fat and sugar based. They are very versatile, can be used in a wide variety of baked good applications, and can add a desired indulgent sensory characteristic. Confectionery compounds can be formulated with different fats and oils that have different respective melting points and solid-fat profiles to achieve the required coverage, texture, snap, mouthfeel, bake stability, and shelf life (2).

Confectionery coatings can be used to enrobe a cereal bar, brownie, or cookie. Similar coatings also are typically used to apply a bottom coat or decoration, such as a drizzle, on cookies, bars, and brownies. Confectionery coatings are typically higher in saturated fats and set up solid at room temperature. They also have higher melting points and need to be melted or heated to use in processing.

If one is looking for a soft or gooey center, there are confectionery fillings that can be used inside a pastry, cookie, or cake or as a soft layer in a bar. Unlike confectionery coatings, fillings are typically lower in saturated fats and tend to be semisolid at
room temperature. Their melting point and mouthfeel can have a wide range, from melting quickly in the mouth to a more sticky or gooey sensory profile.

Inclusions are confectionery compounds that usually consist of preset shapes of various sizes, such as a confectionery drop or chunk. These can be incorporated into a wide variety of baked goods. The majority of inclusions are used in baking and, therefore, are formulated differently than standard confectionery coatings to be bake stable and withstand oven temperatures. In addition, maintaining visual piece integrity is often a desired characteristic.

**Formulating Confectionery Coatings for Bakery Applications**

When choosing a confectionery coating, it is important to consider the ingredients that are being used in the bar or baked item. The type of fat, sugar, and colorants, as well as moisture level, are all important components. Confectionery compounds consist of a high percentage of some type of sweetener and fats and oils. Other ingredients in a compound could include cocoa powder, dairy powders, lecithin, flavors, and colorants. Depending on the application, desired product attributes, formula, and processing parameters, different ingredients can be selected to improve performance. Deciding on the best fat system to use depends on the desired melting point, heating and cooling capabilities, and baked product formulation. To understand how a fat system will perform at different temperatures, a solid-fat melting curve is used. The specific melting point and solid-fat profile will affect the bake stability of a confectionery compound. In addition to the type of fat used, the percentage of fat also plays a role in controlling viscosity. Viscosity is a critical factor, and range varies depending on the application and process parameters for enrobing, decorating, filling, extrusion, or molding (2,3).

Understanding the solid-fat profile of a fat system is important for understanding the performance of the coating, but when it comes to processing and shelf-life stability, it is also important to understand the migration of fats and oils, their interaction with other ingredients, and their interaction with other fats. Whether or not a baked item undergoes stress due to temperature, there are physical and chemical changes that take place. One common issue is softening of the coating over the shelf life of an enrobed baked product. If the baked good has a high oil content, the liquid oil can migrate to the coating and cause softening. Migration can occur when the fat used in the coating is chemically different than the fat system used in the baked item. For example, using a palm kernel oil-based coating on a peanut butter cookie made with a high percentage of peanut butter (high in peanut oil) and vegetable oil will result in a soft coating that smears over the shelf life of the product. This is due to the inability of lauric fats to recrystallize with nonlauric fats. The

---

**Fig. 1.** Bloom stability of hydrogenated palm kernel oil (top row) compared with fractionated palm kernel oil (bottom row) as a result of cooling. The samples on the left were cooled at 45°F; the samples on the right were left to set at room temperature.

**Fig. 2.** Dough balls weighing 20 g were evenly coated in 5 g of drops before baking at 350°F for 9 min. A and C, Raw cookie dough and baked cookie containing drops without dextrose, respectively; B and D, raw cookie dough and baked cookie containing drops with dextrose, respectively.

**Fig. 3.** Soft fillings (5 g each) were baked at 350°F for 6 min and cooled completely. A and C, Uncooked and cooked dairy-free filling, respectively; B and D, uncooked and cooked filling formulated with high levels of dairy, respectively.
migration of liquid oils can solubilize some of the fats in the coating. Their chemical incompatibility causes a eutectic effect, and they are unable to fully recrystallize, creating softening in the coating (4,5). This can be overcome or minimized using similar or like fats in the coating and baked item, as well as by increasing the solid-fat content of the fat in the baked item.

It also is important to keep fat migration in mind when using fillings inside a baked item, such as a filled cookie, brownie, or extruded cereal shell. Once again, you can have migration of fats over the shelf life of the product, which can lead to an undesirable change in the texture of the outside of the baked good, as well as undesirable changes in the sensory properties of the filling. Depending on the migration of oil, “drying” or firming of the filling with softening of the shell or toughening of the shelf and softening of the filling may occur.

The most effective way to reduce fat migration is to reduce the amount of liquid oil and overall fat in the baked item. However, fat in a baked product formulation allows for lubricity and ease in manufacturing and helps maintain product tenderness throughout its shelf life. As a result, it can be challenging to reduce the overall fat in a formula and maintain desired product attributes. Fats and oils can be reduced in baked products through the addition of glycerin, glucose syrups, gums, and other humectants. It is also important to use like fats in a confectionery compound and to have percentages in the coating or filling that are similar to those in the baked item. This was proven in a study performed by Frazier and Hartel (1), which showed that for fat to migrate either from a dough to a chip or a chip to a dough there must be a difference in the composition of the two fat systems.

Using Hydrogenated and Fractionated Fats

The recent proposal in early 2014 by the U.S. Food and Drug Administration (FDA) to eliminate partially hydrogenated oils, as well as the desire of customers to have “hydrogenated” removed from the label, has many bakeries searching for coatings made with nonhydrogenated oils. Coatings made with fully or partially hydrogenated oils are very easy to work with, both in application and handling. These coatings can set at room temperature and do not necessarily require cooling. They also set with a nice gloss and have a good snap or hardness. However, there are nonhydrogenated oil options available for those looking to remove “hydrogenated” from the label.

Nonhydrogenated oils are processed using physical fractionation to achieve the same melting point and solid-fat melting profile as their fully or partially hydrogenated counterparts. However, confectionery coatings made with these fats require more attention to processing parameters, particularly cooling. Immediate cooling is required to initiate proper nucleation and crystallization of these fats. The coating does not need to be tempered like a cocoa butter-based product but does require cooling to prevent bloom formation. Without cooling, fat bloom forms immediately as the product sets up. In Figure 1, the top row of petri dishes shows the crystallization of a coating made with partially hydrogenated oil: the petri dish on the left was cooled, and the one on the right was left out at room temperature. Both have a good gloss and show no signs of bloom. The bottom row of petri dishes shows the crystallization of a coating made with fractionated oil: the petri dish on the left was cooled, and the one on the right was left at room temperature and developed bloom and “skin” surface formation.

When using fractionated oils it is important to cool the baked product immediately after applying the coating. It also is important to make sure the baked product is cooled prior to application of the coating. If the core of the brownie, cookie, or bar is still hot, cooling may not be sufficient to overcome the thermal transfer of heat from the core of the bar to the coating, resulting in undesirable crystal formation and fat bloom on the surface. If sufficient cooling is not possible, addition of seeding agents, such as monoglycerides, diglycerides, and sorbitan tristearate, to help with nucleation to set proper crystal growth has been shown to be effective.

Processing and Bake Stability

To make a cereal bar, cookie, or brownie requires a different baking and cooling process for each product. Coatings, fillings, and inclusions can be formulated specifically for optimal performance under different processing conditions to create the appearance and texture attributes desired for the finished product. To make an inclusion bake stable, a fat with a higher melting point can be selected to hold up better at specific baking temperatures. Typically a fat with a melting point of 102°F is selected. Simple bake tests can be done to test inclusions made with oils with different melting points. In addition to modifying the melting point, bake stability can be improved through formulation of inclusions with added sugars and fibers. Formulas with higher levels of sugar or added ingredients such as dextrose can be used to modify the yield value and flow properties of inclusions exposed to high temperatures (Fig. 2). This prevents oils from flowing and maintains piece integrity. The type and amount of fat in both the inclusion and baked item needs to be determined to maintain the desired quality and appearance.
after baking. Work conducted by Frazier and Hartel (1) demonstrated that chocolate- and fat-based drops do not bloom when baked in a cookie. This is due to the rapid migration of liquid oil from the cookie matrix into the drop during baking. Their research showed that fat from the cookie will migrate into the drop and fat from the drop will migrate into the cookie dough, changing the fat composition of both once the cookie has been baked and is cooled.

Fillings also require special consideration with regard to formulation and bake stability. Formulas with high levels of sugar and a solid-fat profile optimized for specific process conditions will result in optimal baking performance and a gooey texture. Formulas with low levels of sugar and a fat blend that has not been optimized for specific process conditions can result in the filling becoming “dry,” crumbly, firm, and/or chewy. As a result, it is important to consider sugars and fats when formulating a baked item with specific sugar requirements.

Baking and heat also can affect the color and flavor of a confectionery compound. Customized formulations and baking parameters need to be considered and tested. Using natural colors can be challenging because many are not heat and light stable. “Bleeding” of colors into the cookie or cake matrix also can occur. This is due to natural, plant-derived oleoresins that contain oil fractions with low melting points that when heated migrate and carry the pigment out of the inclusion and into the dough matrix, leaving the drop a dull and different color than what was desired.

Browning is another issue when heating coatings and fillings at high temperatures or for an extended period of time. Coatings containing a high percentage of dairy components tend to be at higher risk of browning during processing, as well as over the course of the product shelf life, due to high levels of reducing sugars and protein. As a result, time and temperature, along with level of dairy ingredients, need to be considered. The effect of dairy ingredient content on soft fillings is illustrated in Figure 3.

Confectionery Coatings as Vehicles for Creating Better-for-You Products

Formulating baked products to be high in fiber and protein while maintaining a workable dough with a desirable cell structure, crumb, and eating qualities is a challenge. Pulling protein or fiber from the dough matrix and incorporating it in a confectionery coating, filling, or inclusion is a great way to eliminate the technical challenges of working with a high-protein or -fiber dough. Coatings are great vehicles for adding protein and fiber to baked products with minimal impact to their sensory properties. Typically, protein and fiber can be added to coatings at levels up to 20%.

Conclusions

Adding confectionery coatings, fillings, and inclusions to a baked product can be a key driver in overall consumer preference. In addition to adding a dimension of indulgence and desired sensory characteristics, they can also be used as carriers of added nutrients such as protein and fiber. It is critical to understand the formulation, fat systems, and processing parameters of a baked product to ensure the appropriate confectionery coating, filling, or inclusion is selected and formulated for optimum performance and quality. The versatility of confectionery compounds and the ability to tailor them for specific process conditions make them a great choice for use in baked product applications.

References