Oil Migration: Minimization of Extent and Effects

New solutions to the problem of oil migration may involve optimization of the chocolate rather than changes to the filling

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Oil migration has been, and indeed still is, a major problem in some composite foods. It is prevalent in any composite food in which two components each having a different continuous fat phase are in contact.

In previous articles we reviewed what we might call the basics of oil migration—its effects, how we can detect and quantify it and the latest ideas on what the mechanism is. In this article, we will focus on two further aspects of oil migration: what are the important factors in oil migration and how can we use our knowledge of these to suggest ways of minimizing both the extent of oil migration and the effects it has? As with the previous article, we will review and use information published over the past 15 years or so as our guide.

FACTORS AFFECTING OIL MIGRATION

If we know what things affect oil migration we are then well on the way to suggesting possible solutions. Ziegleder (1997, 1999) details a number of factors which will affect the rate of migration of, for example, a filling fat into a coating fat.

Factors which Influence the Diffusion Coefficient

A number of factors related to both chocolate and filling will have an influence on the diffusion coefficient:

- Percentage of fat in the chocolate
- Solid fat content of the chocolate fat phase
- Viscosity of the chocolate
- Interactions between the oil phase and the nonfat particles
- Percentage of liquid oil in the filling
- Mobility of this liquid oil phase

Chocolate Thickness

The thicker the chocolate, the more readily it can absorb migrating filling fats before its texture becomes unacceptable.

Filling-to-Chocolate Ratio

To some extent this is linked to chocolate thickness. The lower the filling:chocolate ratio, the less filling fat there is available to migrate and the more chocolate there is to accommodate it.

Product Geometry

Even at given filling:chocolate ratios and given weights some product geometries allow a thicker chocolate coating. For example, a hemispherical product would have a thicker chocolate coating than a cylindrical one.

Storage Temperature

The higher the storage temperature, the higher the liquid oil contents of both filling and chocolate and the faster the rate of migration. Not only will the rate of migration be quicker but the degree to which the fats will migrate will also be higher. For example, a palm-kernel-oil-based filling stored in contact with a cocoa-butter-based chocolate showed the following degrees of migration after 56 days storage (Talbot and Bennett, unpublished work):

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>20°C</td>
<td>11%</td>
</tr>
<tr>
<td>25°C</td>
<td>46%</td>
</tr>
<tr>
<td>30°C</td>
<td>55%</td>
</tr>
</tbody>
</table>

Ali et al. (2001) stored a filling based on palm mid-fraction and desiccated coconut adjacent to a dark-cocoa-butter-based chocolate. The chocolate itself had an ini-