Chocolate Tempering

with Jessica Pedemont

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Chocolate

Chocolate is said to have originated in the Amazon or Orinoco basin at least 4000 years ago. Frothy chocolate drinks used to be the ritual beverage of Mesoamerican royalty. The beans were used in Aztec currency, 100 beans were sufficient enough to but a slave.

The biological name for the cocoa plant, Theobrama Cacao, means "the food of the gods".

Couverture

For a rich chocolate flavor, only the best quality chocolate should be used.

Couverture must be made from pure cocoa nib, cocoa butter and sugar.

Dark couverture must contain a minimum of 5% of cocoa butter and 45% chocolate liquor.

For milk chocolate - milk, cream and/or milk fat are added. To remove most of its water content, the milk is either condensed or dried. The resulting product is called milk crumb. Milk chocolate must contain a minimum of 10% cocoa butter and 30% chocolate liquor.

Flavoring (mainly vanilla), stabilizers and emulsifiers may be used.

So-called "white" couverture (contains no chocolate liquor, therefor is not considered true chocolate), consists of cocoa butter, sugar and milk.

When couverture is being manufactured, it is exposed to an enormous amount of pounding, grinding, refining and conching, so that a very fine smooth chocolate results. This chocolate is then tempered, run into moulds and passed through coolers. After de-moulding, the couverture is wrapped for sale.

Couverture must be stored in a cool dry place. Under favorable conditions, dark couverture improves with some 'aging". Under unfavorable storage conditions, the full fresh aroma deteriorates rapidly.

The above descriptions are globally used by the confectionary industry and also form a legal point if a product is sold as couverture.

Compounded Chocolate

Tempering is not required, as the cocoa butter has been replaced by hydrogenated fractionated palm kernel oil (known as 'lauric fats'). Although an optimum application temperature can be found (by trial, each brand reacts differently) for each specific situation.

Compounded chocolate is lower in cost, has a better heat resistance and is very easy to use.

Compounded chocolate must be labeled as such.

Fat Bloom

Fat Bloom appears as a grayish coating or streakiness or dots on the surface of the chocolate. It is greasy to touch and it is easily rubbed off. Upon magnification minute fat crystals are visible.

Some of the causes of fat bloom:

- *Bad tempering of chocolate (inadequate per-crystallization, crystals are too large. This slow transformation of stable into unstable crystals creates fat bloom).*
- *Insufficient melting or holding at that temperature*
- *Incorrect boiling (too low)*
- *The presence of low melting fats in the centers (nut oils)*
- *Storage area temperatures too high or fluctuating too much*
- *The addition of fat from coated centers (hazelnut or fillings containing hazelnut oil or coconut paste encourages the formation of fat bloom)*

Fat bloom is more noticeable on dark chocolate than on milk chocolate.

An addition of 2-4% butter oil (dehydrated cow butter) or Biscuitine (arachis oil and hardened fat) will greatly inhibit bloom formation. A 4% addition will also soften the "snap" of a chocolate and therefore change its characteristics.

Sugar Bloom

Sugar Bloom also appears as a greyish coating on the surface of chocolate. Unlike fat bloom, it isn't greasy to touch. When magnified, minute sugar crystals are visible. Its crystalline appearance (frosting) is quite rough to touch and affect both milk and dark chocolate.

Common causes of sugar bloom:

- *Humid Storage conditions (above 80% humidity)*
- *Deposit of 'dew' (condensation) if cooled too quickly or for too long*
- *Storage in damp conditions*
- *When moulds, equipment or packaging are not completely dry*
- *Use of hygroscopic ingredients (low grade or brown sugars)*

Sugar Bloom is also formed when the jump in temperature between cold storage (10 degrees and below) and the removal from storage (20 degrees and more) is too great. If a difference of about 8 degrees exceeds, intermediate storage is necessary. When water (condensation) settles on the surface, it will dissolve some sugar from the chocolate. Upon evaporation, this sugar crystallizes and remains on the surface.

Cocoa Butter

Cocoa Butter is essentially the natural fat of the cocoa bean. An understanding of cocoa butter and its various forms is vital is one is to work successfully with chocolate.

Usually obtained by the hydraulic expression of cocoa nib, it is light yellow in color and has a distinct brittle fracture below 20 degrees.

The cocoa butter in tempered chocolate starts to soften at 30-32 degrees and at about 34-35 degrees it has a fairly sharp complete melting point. This means that chocolate is generally solid or liquid.

As the complete melting point is just below body temperature, it gives the impression of cooling the mouth as it melts, as the change from solid to liquid absorbs energy without raising the temperature of the fat.

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The melting and crystallization characteristics of cocoa butter are physical properties of prime importance.

Cocoa butter is a mixture of glycerides which are polymorphic. (Polymorphic - liberally defined, means of many forms) This means that cocoa butter is a mixture of several forms of fat. Therefore, several crystalline arrangements can exist in cocoa butter, each with its own characteristic melting point.

Of these crystalline arrangements, only one is stable and the remainder unstable.

Gamma (G) is very unstable, melting point 17 degrees
Alpha (A) unstable, melting point 27-29 degrees
Beta Prime (B1) unstable, melting point 27-29 degrees
Beta (B) stable, melting point 34-35 degrees

In the process of tempering chocolate, the aim is to initiate a process where Gamma transforms to Alpha, which then changes to Beta prime and ultimately to mainly stable Beta crystals.

This is primarily understood as specific creation for high melting, stable crystal modifications of the cocoa butter in order to obtain optimum glass, a crisp break, optimum melting behavior and fat bloom resistance for the solidified chocolate. The existence of very small cocoa butter crystals of equal size guarantees a microfine structure in the finished chocolate.

Tempering of Couverture

Tempering is a method of inducing cocoa butter to crystalize in a stable form in the fluid chocolate mass.

The process of tempering consists of heating the chocolate evenly (to 45-50 degrees) to completely dissolve all of the cocoa butter. The liquid chocolate is now cooled to initiate crystallization (see crystals). By gently reheating the chocolate to just below the melting point of the desired fat type (Beta), so as to melt out any of the undesirable types/

How does it work?

In well tempered chocolate, the dry cocoa particles and the finely ground sugar are evenly dispersed in the liquid cocoa butter.

It is the coca butter which reacts to temperature. If the chocolate is heated to above 33 degrees, the cocoa butter will liquefy. The evenly arranged dry cocoa and the sugar particles will now float freely, the homogenous fusion does not exist anymore.
The heavier particles will sink to the bottom, while the oily substance, (cocoa butter), having a smaller specific weight, will float to the top.

This process will not only take place in a container of warmed chocolate, but also in moulds, on chocolates or other coated items when overheated (about 33 degrees). The proof will be evident when the chocolate hardens with pale brown to grayish discoloration (fat bloom) on its surface, sometimes in the shape of streaks, dots, or even honeycomb pattern.

The aim of tempering chocolate is to re-unite and evenly distribute all of the component of the chocolate. This can be achieved by any one of the following tempering methods.

In each case, irrespective of the method used, the chocolate must show a noticeable thickening effect, the indicator that all the particles are bound together. A gentle heating to the required temperature and thorough stirring will render the chocolate ready for use.

Tempering Methods

METHOD 1 - *Direct Warming*

As most manufacturers of chocolate will temper their products, it is possible to carefully melt the chocolate and retain original temper. Only very gentle heat must be applied. When dissolved, the chocolate must be well stirred occasionally and 32 degrees not exceeded. Tempering tanks with very sensitive thermostats are well suited to this methos: there chocolate can soften slowly overnight. At 27 degrees it will take on a dough like consistency and soften further with increased heat until ready to use.

METHOD 2 - *Vaccination or Addition method*

Part of the chocolate is completely dissolved (45-50 degrees). Some of the finely chopped shaved or grated chocolate is now added to the chocolate (seeded) until the temperature falls below 32 degrees and signs of thickening occurs. By gently reheating or by the addition of some more overheated chocolate, the final correct state of temper can be achieved. This method of seeding is also used if the chocolate is slightly accidentally overheated (1-2 degrees), incorrect thermostat setting etc. always keep it covered or sealed, as the increased surface area becomes easily contaminated (dust, moisture) thus hindering easy and complete dissolving.

METHOD 3 - *"Tablier" or Tabling or Manipulation Method*

Pour in excess of half (2/3) of the completely dissolved chocolate onto a marble slab. Spread 10-15mm thick. To assist in the cooling process, scrape the chocolate together and spread it out again. Cocoa butter seed crystals are formed as they come into contact with the cold marble. Scraping them off the surface of the marble will distribute the crystals through the rest of the chocolate. This is carried out repeatedly with a flexible palette knife or scraper. The seeding is complete when the chocolate starts to thicken (26 degrees). Add the manipulated chocolate back into the remaining warmed portion and stir until smooth,. The chocolate should now register about 29-31 degrees. After undergoing a gentle feating process, the chocolate is tested for setting properties and 'sheen' and should now be ready for use. If correct temper is not achieved straight away, the process has to be repeated until satisfactory.