

White paper

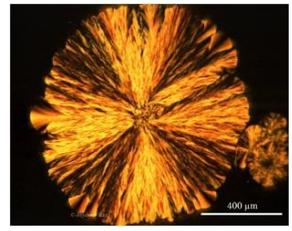
Where do the Chocolate flavours come from?

750+ sub-components are participating to the cocoa flavour

Schieberle and colleagues (Institute for Food Chemistry at the Technical University of Munich) have identified 750+ sub-components that, together, participate to make the cocoa flavour! While most of the products have up to 5 main flavour components, chocolate has more than 25. But when/ where do all those flavours comes from? How to improve the good ones / avoid the bad ones? Most of the flavours come from the bean itself and they are not studied here.

We have just discovered that the geographical origin (1990?) and the cacao variety (2008) have a terrific influence on the final taste. This revolution will lead to a fantastic discovery of new flavours in the next 20? years. Just as if white Bordeaux were before mixed with Merlot coming from the Napa Valley... and some crazy guys imagine tasting them separately! Today, our knowledge and the final flavour are improving very quickly.

This white paper, focusing on the main step of chocolate making, summarizes a very small part of our knowledge.



a) Growing

Cacao beans are very rich in Flavonoids. Flavonoids protect against insects, fungi, microbes, animals and other threats. These flavonoids are violet in colour. They comprise fully 20% of the cells in a cocoa bean. They have an astringent flavor. The strongest characteristic taste inherent to the cocoa bean is the bitter element that comes from theobromine, which is a milder form of caffeine. The suave et salvage cacao flavour finds its origin in the ferulic acid.



b) Harvesting

A perfect timing is necessary: if too early, then the cacao beans will be too acid, if too late, mold. If the pod is unripe, the beans will have a low cocoa butter content, or there will be insufficient sugars in the white pulp for fermentation, resulting in a weak flavor.

c) Fermenting

This step is very important and is done directly by the farmers in the cacao farms. That is why most of the excellent chocolate makers are now training and helping their producers in order to improve the fermentation process.



In the fermenting process, the germinating beans, in their sweet-sour pulp, are packed into small boxes or piled on wild banana leaves and then covered with more leaves. Almost immediately yeasts multiply on the sweet pulp and dominate. They convert the sugars in the pulp to form alcohol. This is one source of those tastes of wine, port and sherry that appear in chocolate. By the second day acetic acid bacteria take over and convert the alcohol into acetic acid, much as wine vinegars are made. This produces very mild vinegary flavours. You also get acetaldehyde, which is responsible for strong fruity flavours.

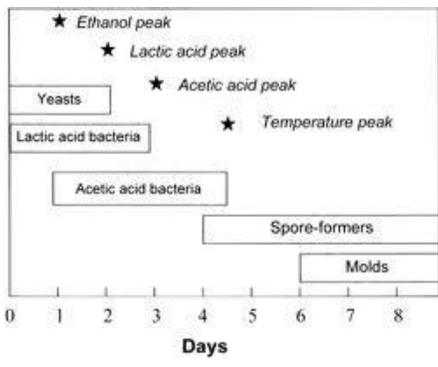


This action of yeast raises the temperature of the fermenting heap and ensures that the germinating cocoa beans are dead, assisted by the acetic acid which seeps into the cocoa beans. Once the cocoa bean is dead the enzymes it has produced on germination go to work and break down the sugars, proteins and flavonoids in the beans to produce the characteristic flavours of well-fermented cocoa beans.



Throughout the process, lactobacilli (the same ones that make yogurt) are working away, first on the lactic acid in the pulp, then on the acetic acid produced by the acetobacter. The lactobacilli produce the dairy flavour notes in chocolate.

The real process is the ongoing breakdown of proteins by hydrolysis into the peptides which give cocoa its chocolaty and nutty flavours on roasting. The last couple of days of fermentation are where these elements develop. (Craig Sams, founder of Green & Black's)



During the last stage of fermentation, there are peptide developments bringing umami taste. The high levels of theobromine and epicatechin (or tannin) stay pretty much as they are. The peaks of the astringent-tasting purple anthocyanidins have died down. On some plantations, fermentation is done in big tanks and the beans are usually dried in heated ovens. This leads to monotony of flavor and doesn't always give the enzymes time to work.



d) Drying the cacao beans

During the drying step, the enzyme action will produce flowery, dairy and almond flavor notes and the other distinctive precursors of chocolate flavor that roasting will develop. Sometimes it is necessary to heat. Whenever smoke comes to the beans, it develops smoky flavours.

e) Roasting:

Temperature and length of the roasting influence deeply the final set of flavours. There tend to be three categories of cocoa-bean roasts referred to in the industry: Low - maintains the volatility of the flavor profile to produce slightly acidic and aromatic chocolate liquors. Favored by most European chocolate makers. Medium - produces a chocolate liquor with balanced flavor and less acidity. Favored by North American chocolate makers such as Guittard. High - produces a chocolate liquor with intense and more bitter flavor with the least acidity and aroma as most of the volatile flavor notes are lost under high heat. Favored by the Spanish chocolate makers. The better the beans, the shorter the roasting time and the lower the roasting temperatures can be.



Low temperature teases out and develops the good flavors inherent to the beans rather than roasting to drive bad flavours out.

Careful roasting prevents the formation of bitter and tannic compounds from the flavor precursor components that are the result of fermentation and drying. Roasting develops and intensifies many of the inherent flavours of chocolate, and it reduces the sugar levels as the result of a Maillard reaction between the sugars and the amino acids in the beans. Maillard flavours, because of their protein content, are more complex and meaty than caramelized flavours - roasting gives us some of both. This is where nutty, sweet, spicy and flowery flavours emerge. Roasting can also emphasize bitterness for low quality chocolates.



f) Recipes: Adding cacao butter, sugar...

The Cacao butter absorbs and carries the volatile flavours of the chocolate. It melts at just below body temperature. So as soon as it's in your mouth, it starts to melt, drawing heat off your tongue to do so and leaving you with a physical perception of coolness. And as it melts, it releases all the flavours of the chocolate. That's the sensual flavor-delivery method that is so unique to chocolate.



Vanilloids: They include vanillin (which is found naturally in vanilla beans but also in oak wood and in cocoa), eugenol (which is found in allspice and cloves), zingerol (which is found in ginger) and capsaicin (which is found in hot peppers and cinnamon). They all smell different but all have one thing in common. They increase the penetration and potency of other aromas by opening up and



holding open our vanilloid receptors, which increase our perception of both taste and flavor. That's why vanilla is almost always added to chocolate; it lengthens and expands its impact. That's why wine is kept in oak barrels; the vanillins from oak lengthen its finish.



Milk: Look for toffee, caramel, butterscotch and vanilla notes. Chocolate already has inherent dairy flavours so it blends well with milk and milk products.

Mint: the combination of mint and chocolate causes the sphincter at the base of the esophagus to relax. That's why we have mint chocolate at the end of a meal - it helps your tense little esophagus to relax. Because you aren't going to eat anything else, you don't have to keep that tight barrier between incoming food and the stomach contents. The flavour of mint does something to your tastebuds, too - it exaggerates the cooling effect of the melting cocoa butter.

g) Conching

The mild heat and aeration of conching lifts excess acidity and moisture out of the chocolate. This warmth and mixing also increases other desirable flavours of roasted chocolate, caramel and maltiness.



Conclusion

A fantastic period begins now. Chocolate specialists will focus more and more on Geographical Origin and Cacao varieties. Some big companies such as Lindt have already put a bar code on each bag, allowing tracability and preparing fantastic improvements in quality.

We are impatient to learn from all the specialists and studies in order to write soon a white paper taking in account the coming discoveries!