THE CHEMISTRY OF GOOD CHOCOLATE

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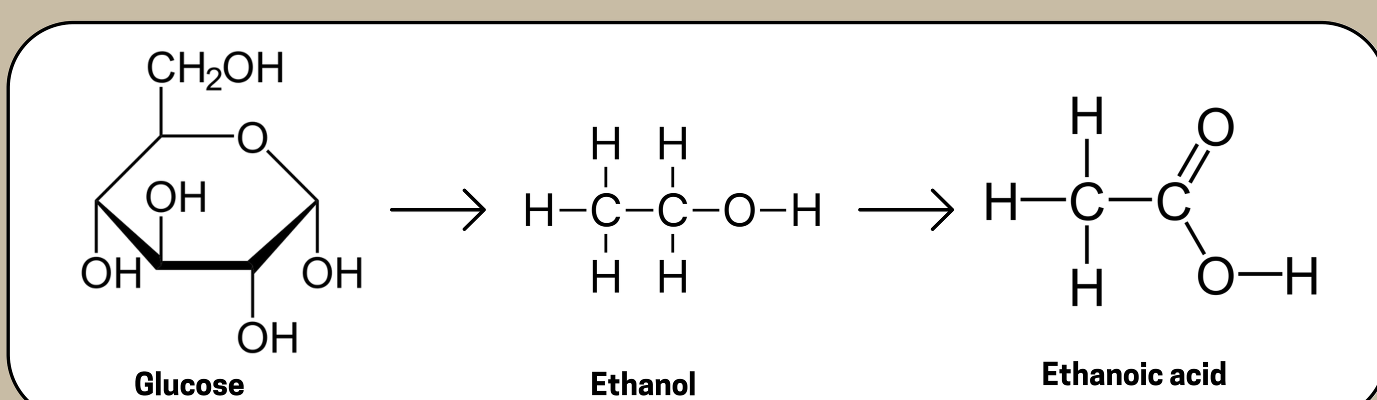
Making good chocolate involves a whole host of chemical transformations from bean to bar.

Stage 1: Fermentation

This initial stage of chocolate production begins with cocoa beans extracted from the pod which are very bitter and have an unpleasant taste. During fermentation, yeast grows in the cocoa beans converting glucose into ethanol which is then further oxidised to ethanoic acid.

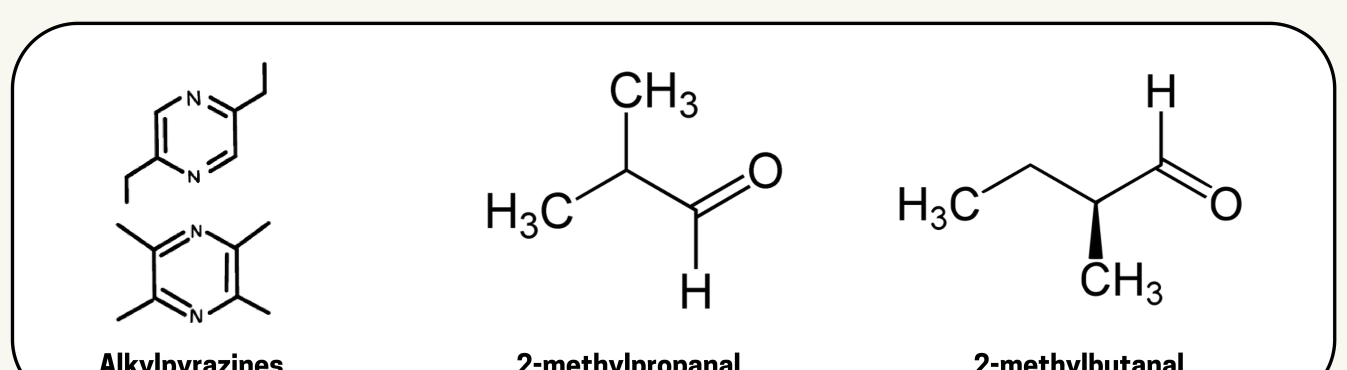
Heat is produced during this process, which, along with the acid, breaks down the cell walls of the cocoa beans to mix previously separated substances. Additionally, proteins are hydrolysed into amino acids. This stage develops important flavour precursors.



Stage 2: Roasting

Following fermentation, the cocoa beans undergo roasting. This allows many reactions to take place, creating molecules which further develop the cocoa beans' flavour and aroma whilst eliminating excess water.

The Maillard reaction occurs between the amino acids and sugars forming alkylpyrazines, which are a major contributor to the taste and aroma of chocolate. Some other molecules that contribute are 2-methylpropanal and 2-methylbutanal which belong to the aldehyde functional group.



Stage 3: Conching

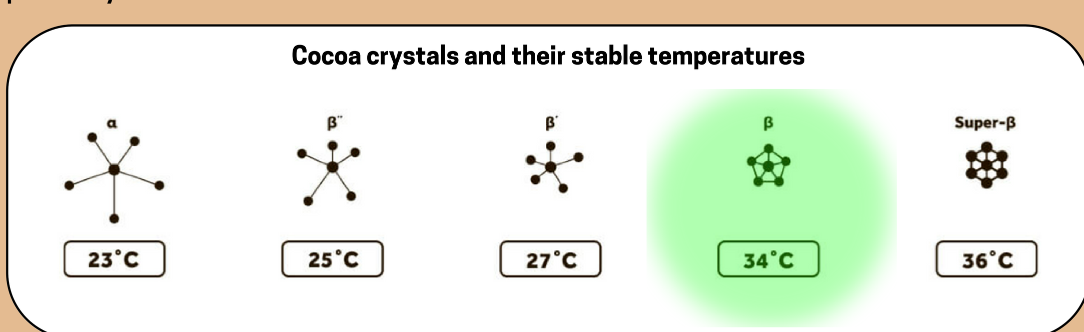
During this stage, the cocoa solids, cocoa butter, and other chocolate ingredients are gently mixed and ground together with slight heat. This process breaks down sugar and cocoa into finer particles, making them undetectable by tongue receptors, resulting in a smoother texture.

Stage 4: Tempering

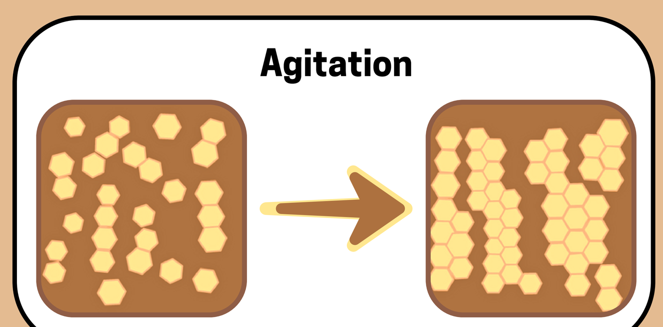
Last but not least is the tempering process. This is a very important stage and gives good chocolate its glossy appearance and all important snap. The fats in cocoa butter can crystalise in 5 different ways called polymorphs. The process of tempering manipulates how these crystals are formed and ensures they are all of the same type and interlock to form regular ordered rows.

The beta polymorph (or type V) gives the chocolate with the smoothest texture, best snap, and a melting point of just below body temperature, (34 °C), allowing it to slowly melt in the mouth.

This process is done by carefully heating and cooling the chocolate between 30 °C and 45 °C to promote and stabilise the formation of the beta type crystals.



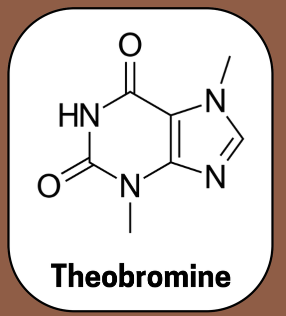
Throughout this process, the chocolate must be stirred to allow the crystals to join together and form a regular structure, this process is called agitation.



Chocolate can be categorised into three types based on the varying proportions of cocoa solids they contain.

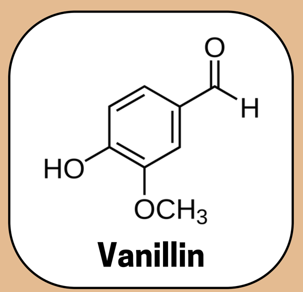
Dark chocolate (50-90% cocoa solids)

Chocolate is the richest natural source of the alkaloid theobromine. This compound accounts for the bitter taste of dark chocolate, a crucial element in achieving the desired balance between bitterness and sweetness. Additionally, theobromine contributes to a similar stimulating effect as caffeine. This is because the chemical structure of theobromine differs from caffeine by only one methyl group, allowing it to bind to the same receptors as caffeine does. The combination of caffeine and theobromine is what is thought to provide the uplifting effect after eating chocolate.



Milk chocolate (25-50% cocoa solids)

Synthetic vanillin is added to many milk chocolate products to sweeten and enhance the flavour.



White chocolate (0% cocoa solids)

White chocolate has the highest milk solids content compared to other types, with most varieties containing over 30%.

Some do not consider white chocolate as true chocolate, due to its lack of cocoa solids.

However, white chocolate does contain cocoa butter which mainly consists of stearic acid and palmitic acid. Cheaper white chocolates have their cocoa butter substituted with other vegetable oils, compromising flavour, so better tasting white chocolate contain mostly cocoa butter.