



The colour of cocoa powder

The importance of colour

One of the criteria by which cocoa powder is selected is the required colour of the end product. Strong and consistent cocoa powder colours contribute to the development of attractive consumer products. The colour of Gerkens® cocoa powders is partly determined by choosing the right quality of cocoa beans. Cargill Cocoa has years of experience with its own sourcing of cocoa beans and hence the required expertise to ensure that the basis, the cocoa bean, is optimal for the production of cocoa powders.

Creating the colour of cocoa powder is a complicated interaction, in which in addition to the bean many other factors play a part. There are three factors that affect the colour of the cocoa powder.

1. Chemical composition of the bean

There are different types of cocoa beans, the majority of which are the 'Forastero'. In spite of genetic composition amongst beans, great differences in 'colourability' can still be found. Good colourability means that beans have a 'chemical composition' that ultimately (after alkalization) gives a better-coloured end product. The chemical composition is partly determined by regional differences in the soil composition and the climate.

2. Fermentation process

During the growth, fermentation and drying of the cocoa beans precursors form different essential molecules, from which in later process stages (in particular during alkalization) the final colour is formed. Flavonoids including polyphenols are important precursors that after many reactions ensure the final colour of cocoa powder.

An important precursor molecule is shown in figure 1.

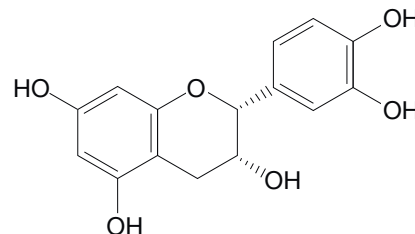


Figure 1. Flavonoid monomer: epicatechin

The quality of the fermentation process is of essential importance to produce a good colour. After harvesting, cocoa beans are fermented for 4 to 7 days. A number of microorganisms sequentially play a part in this natural fermentation. The beans are piled in heaps with the sugar-rich fruit pulp and covered over with banana leaves for instance. During the first part of the process yeasts and anaerobic bacteria ensure the fermentation of the sugars from the pulp to form CO₂ gas and alcohol. The white pulp becomes transparent and drains away. More oxygen can now reach the beans. In the further course of fermentation lactic acid and acetic acid bacteria in particular play a part. These bacteria produce acids, which reduces the pH. The temperature rises during this phase to 45 to 50°C. The germination capacity drops as a result. The protective cell wall of the cocoa bean becomes permeable and from then on 'chemical' reactions take place in the kernel, or nib, of the cocoa bean.

These reactions can only take place at the end of a carefully and well-conducted fermentation process.

The different precursor molecules in the nib of the cocoa bean oxidise and condense.

A number of new, very large and insoluble compounds are produced.

These tannins provide the brown colour of a well-fermented bean.



The fermentation process must be stopped at the right time. Drying the beans does this; otherwise 'over-fermented' beans of a very dark colour are produced.

Good fermentation is crucial for the colouration during alkalization, which determines the final colour of the cocoa powder. The way in which fermentation is carried out varies greatly in different countries.

You can see from the colour of a fermented cocoa bean whether the right degree of fermentation is present. For example badly fermented beans are a violet colour and a typical grey colour shows the beans are unfermented. Well fermented beans have a brown colour.



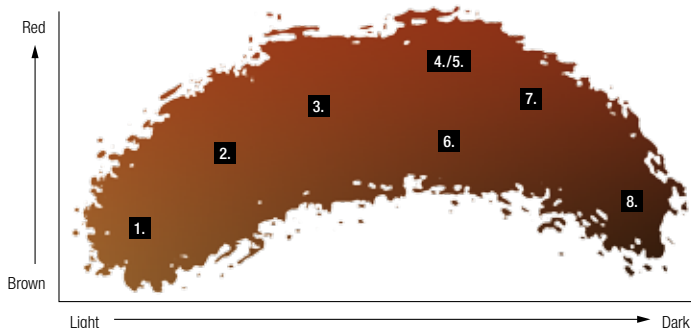
3. Alkalization

The right selection of well fermented beans and in particular the process stage in which the so-called natural cocoa nib is treated with alkali (= alkalization) is of essential importance for the final colour of the cocoa powders. During the (nib) alkalization all the particles are thoroughly impregnated with alkali (e.g. potassium carbonate, such as potash); the pH increases and the colour formation reactions take place. Nib alkalization leads to very intense colours contrary to the so-called cake alkalization where alkali is only added to (natural) cake. This also increases the pH but the colour/flavour balance is far from optimal. The right production conditions during nib alkalization will ultimately give the required colour varying from e.g. light brown to dark brown and even to dark red. Alkalization has a clearly positive effect on the flavour of the final cocoa powder too. Based on its many years of cocoa expertise Cargill Cocoa can make very dark coloured cocoa powders with an excellent flavour/colour combination.

Colour in the end product

Cargill Cocoa has many cocoa powders with different colour/flavour combinations that meet the requirements of our customers and ultimately the consumer. The 'intrinsic' colour of cocoa powder determines the colour in an application. The visual colour of the cocoa powder itself (also 'external' colour) is not important here. However this external colour is important when it is sprinkled on a product or sold as such. The 'external' colour is partly determined by allowing the cocoa butter in the powder to crystallize into the right stable crystal form. This is also called tempering. The visual colour depends on the fat content of the cocoa powder too. Starting with two cocoa powders with the same 'intrinsic' colour, the one with a higher fat content gives a darker colour.

Colour spectrum of Gerken's® cocoa powder



1. Light brown, non alkalised, low fat
2. Medium red brown, light alkalised, low fat
3. Dark red, medium alkalised, low fat
4. Dark strong red, strong alkalised, low fat
5. Dark strong red, strong alkalised, high fat
6. Dark red brown, strong alkalised, low fat
7. Dark reddish brown, max strong alkalised, low fat
8. Black, extra strong alkalised, low fat

Literature

Praktijkboek Cacao & Chocolate (Practice Book Cocoa and chocolate) 1997.
Industrial chocolate manufacturing and use. Third Edition 1999, Editor S. Beckett, Blackwell Science.