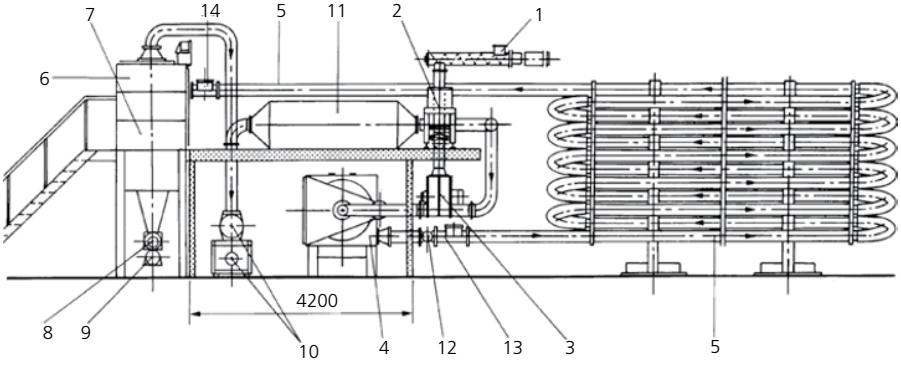

Figure 3.14 Schematic diagram of a cocoa powder milling, sifting and cooling unit. (1) Dosing screw, adjustable for broken cocoa cake; (2) metal detector for broken cocoa cake; (3) rotary valve (blow-through-valve); (4) pin mill; (5) cooling tubes for cocoa powder; (6) cyclone pre-separator for cocoa powder; (7) dust filter for fine cocoa powder; (8) rotary valve; (9) discharge screw for cocoa powder; (10) rotary piston blower; (11) air cooler and dehumidifier; (12) ball valve (cleaning system); (13) sending station for pig; (14) receiving station for pig.

cocoa butter into its stable forms (see Figure 3.14). Incorrectly tempered cocoa powder may result in changes in its visual appearance, so-called "external" colour, and lumps may be formed. The visual appearance of powder will become lighter which is basically fat bloom. It should be noted that the so-called "intrinsic" colour of the powder (colour following use e.g. in a drink or cake) will not change.

For the production of cocoa powders with fat contents of less than 10% further extraction is needed and CO_2 and/or other solvents can be used. Other techniques such as cryogenic grinding of cocoa mass are available to produce cocoa powders with fat contents exceeding 30%. Normally the cocoa cakes produced have residual fat contents of 10–12% or 22–24% and by blending the different cakes in any ratio any cocoa powder type with specific characteristics can be produced. An advantage of this approach is that it is possible to standardise properties such as the colour of a powder.

It is also possible, however, to blend different cocoa masses before pressing to obtain cocoa cakes which can be pulverised without blending, but this is harder to standardise. During the cake mixing process, flavourings and/or lecithin can be added. The latter is added to increase the wettability of cocoa powder for specific applications, for example (agglomerated) dry drink mixes.

3.9.1 Types of cocoa powder

A wide variety of cocoa powders can be produced for many different applications, and the final characteristics may vary in:

- ***Fat content:*** generally ranging from 10–12% towards 22–24%. The following reasons may determine the choice:
  - *Price*: generally low fat cocoa powders are less expensive;
  - *Legal*: in relation with the labelling. See also EU directive 2000/36;

Table 3.4 Quality parameters for cocoa powder (*Source:* Cargill Cocoa, 2007).

Parameter	Value (range)	Method	Remarks
Fat content	10–24%	IOCCC 37, 1990	Depending cocoa powder type
pH	5.0–8.2	IOCCC 15, 1972	Depending cocoa powder type
Moisture	Maximum 4.5%	IOCCC 26, 1988	
Fineness	Minimum 99.8% passing sieve	IOCCC 11, 1970	Wet sieving using 75 μm sieve
Colour	Conform to standard		
Flavour	Conform to standard		
Total Plate Count	Maximum 5000 cfu/g	IOCCC 39, 1990	
Moulds	Maximum 50 cfu/g	IOCCC 39, 1990	
Yeasts	Maximum 10 cfu/g	IOCCC 39, 1990	
Enterobacteriaceae	Absent per gram	IOCCC 39, 1990	
Escherichia coli	Absent per gram	IOCCC 39, 1990	
Salmonella	Absent per 750 g	IOCCC 39, 1990	FDA sampling scheme
Contaminants	Conform EU legislation		Pesticides, heavy metals

  - *Taste*: high fat powders give improved flavour characteristics in certain applications;
  - *Colour*: specifically when "external" colour of powder is important. High fat powders are darker.
- ***Colour :*** the "intrinsic" colour can vary from light brown ("natural", non-alkalised) towards dark brown and dark reddish colours. Even black colours can be produced.
- ***Flavour:*** depending on alkalisation and roasting conditions, customised flavours can be developed. Flavours, for example vanillin, are added if required.
- ***Physical behaviour:*** addition of lecithin to cocoa powder will increase the wettability properties. Also, stabilisers can be added with other ingredients or flavours to produce premixes, for example for the dairy industry.

3.9.2 Quality of cocoa powder

Table 3.4 gives a selection of quality criteria for cocoa powder. These are generally accepted values, although other values may be used and/or added depending on the supplier and/or special requirements of the customers.

To produce products within the agreed specifications it is of great importance to start with good quality raw materials, followed by optimum processing conditions. When appropriate analysis and control schemes are implemented for the semi-finished products, a high quality cocoa powder can be produced. For final product approval it is recommended that relevant quality parameters are determined, for example colour, pH, flavour, fat content, fineness and microbiology.

Salmonella analysis of the final product is of great importance. Due to the nature of the harvest and subsequent fermentation in the country of origin and conditions in the supply chain, the presence of *Salmonella* cannot be excluded. The total bacterial load of cocoa beans can be up to $1–10 \times 10^6$ cfu/g. This can be reduced by