Table 7.15 Typical recipes for chocolate without and with CBEs.

Ingredients	Milk chocolate		Dark chocolate	
	Without CBE	With CBE	Without CBE	With CBE
Cocoa mass	10	10	40	40
Cocoa butter	22	17	12	7
CBE		5		5
Full-cream milk powder	24	24		
Sugar	44	44	48	48
Fat composition				
Cocoa butter	27.3	22.3	33.2	28.2
CBE		5.0		5.0
Milk fat	6.5	6.5		
Total fat	33.8	33.8	33.2	33.2
Expressed as % of fat phase				
Cocoa butter	80.8	66.0	100	85.0
CBE		14.8		15.0
Milk fat	19.2	19.2		

The main adjustments required in tempering chocolate as a result of formulation changes are those needed as a consequence of the inclusion of milk fat. Tempering temperatures should be decreased by about 2 °C when 20% milk fat is included (in the fat phase of chocolate). Most CBEs will tolerate the inclusion of this level of milk fat without any need to significantly alter processing conditions. They will also tolerate somewhat higher levels of milk fat, but the tempering temperature would then need to be decreased (as indeed it would if higher levels of milk fat were used with cocoa butter alone).

CBEs can also be used in products usually called supercoatings or supercompounds. These are coatings which are prepared using real chocolate recipes, where all the added cocoa butter is replaced by a CBE. It was shown earlier that CBEs are compatible with cocoa butter across the whole formulation range (Figure 7.5) and thus supercoatings are equivalent to chocolate in most respects, but must not be labelled as such. Typical recipes for supercoatings are shown in Table 7.16.

As a guide to tempering conditions, a supercoating may have to be tempered at temperatures about 0.5 °C lower than for the corresponding cocoa butter chocolate. However, these figures also depend considerably on the actual recipe used and the tempering equipment, as well as the quality of the cocoa butter. Because of the close chemical similarity of CBEs to cocoa butter, supercoatings also require the same cooling regime. In addition, the equipment used requires no special cleaning when changing from supercoating to cocoa butter chocolate.

Table 7.16 Typical supercoating recipes.

Ingredients	Milk supercoating	Dark supercoating
Cocoa mass	10	40
CBE	22	12
Full-cream milk powder	24	
Sugar	44	48
Fat composition		
Cocoa butter	5.3	21.2
CBE	22.0	12.0
Milk fat	6.5	
Total fat	33.8	33.2
Expressed as % of fat phase		
Cocoa butter	15.7	63.9
CBE	65.1	36.1
Milk fat	19.2	

7.4 Lauric cocoa butter substitutes

Cocoa butter substitutes (CBSs) are fully refined fats produced from palm kernel and/or coconut oil by means of fractionation and/or hydrogenation. In this way fats can be produced which have characteristics in terms of hardness, mouthfeel and flavour release similar to those of cocoa butter.

These fats, however, contain a high level of lauric fatty acids and have a completely different triglyceride composition to cocoa butter. This means that there is a considerable degree of incompatibility between lauric CBSs and cocoa butter. An iso-solids phase diagram of mixtures of cocoa butter and a lauric CBS is shown in Figure 7.8. This confirms the occurrence of mixed crystals over a wide range and indicates a strong depression of melting behaviour in comparison to the mixing of CBEs and cocoa butter. A narrow band of "permissible" compositions is seen at each end of the diagram. Cocoa butter will retain its β-3 crystal form until about 5% lauric CBS is present. Equally a lauric CBS will retain its β′-2 crystal form until about 5% cocoa butter is present. Beyond these tight limits mixed β-3 and β′-2 crystals are formed which will result in processing problems, softer products and a substantial risk of fat bloom. (Crystal forms such as β-3 and β′-2 are described in more detail in Section 7.2.2) Thus, about 5% cocoa butter is the safe maximum level of addition to lauric CBSs. In practice this limits the cocoa inclusion in recipes based on lauric CBSs to low-fat cocoa powder or fat-free cocoa powder rather than cocoa mass. Thus typical formulations are shown in Table 7.17 (and see Chapter 20).

Tempering or any form of pre-crystallisation is unnecessary for enrobing or moulding thin bars. Following deposition, or enrobing, a glossy surface and fine crystal structure is obtained with lauric CBS based coatings by cooling them