Products made with fats that have not been fractionated have one further major drawback - that is the shelf-life of the coatings is only a few weeks compared with a few months for the corresponding fractionated lauric CBS formulation. This is because the products quickly lose their gloss, become dull and bloom due to crystal modifications which spoil the appearance of the products.

7.5 Non-lauric cocoa butter replacers

Non-lauric cocoa butter replacers (CBRs) are produced from non-lauric oils such as palm oil and soyabean oil, historically, by hydrogenation and fractionation. Because of the issues associated with hydrogenation and trans fatty acids, a newer generation of non-lauric CBRs has been developed. Although both of these types of CBR contain palmitic, stearic and oleic acid, their arrangement within the triglycerides is such that the structure differs considerably from cocoa butter. In addition, a high content of elaidic acid is present in the hydrogenated types. Consequently non-lauric CBRs have a limited compatibility with cocoa butter.

Figure 7.9 demonstrates the effect on melting properties of mixing non-lauric CBRs with cocoa butter. This diagram illustrates not only the formation of eutectics (extra softening due to incompatibility) but also the occurrence of mixed crystals in the critical central area which will provoke loss of gloss and fat bloom formation on the confectionery product. Only the outer areas on the left- and right-hand side of the diagram give fat mixtures which are stable. We may add up to 7% of non-lauric CBR to cocoa butter or we may allow up to approximately 25% cocoa butter in the fat phase of non-lauric fat-based coatings.

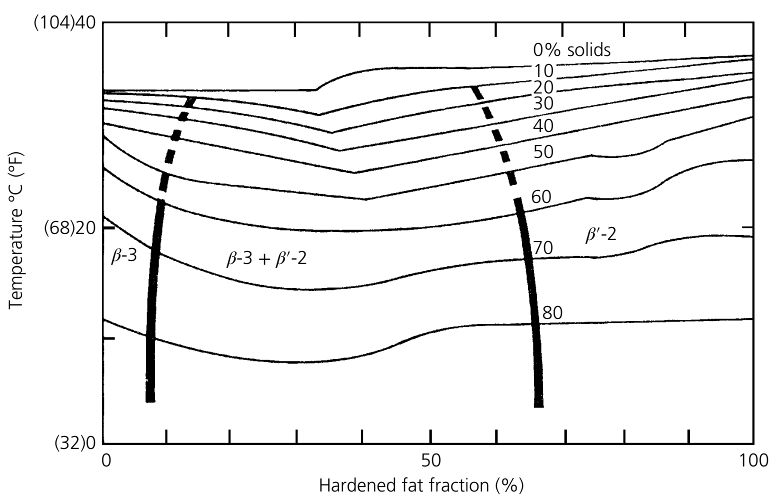

Figure 7.9 Iso-solids phase diagram for cocoa butter/non-lauric CBR. Source: Gordon *et al.* (1979). Reproduced with the permission of John Wiley & Sons.

Table 7.18 Typical recipes using non-lauric CBRs.

Ingredients	Dark	Milk	White
Cocoa mass	10	10	
Cocoa powder 10/12	15		
Full cream milk powder		6	20
Skimmed milk powder		12	5
Non-lauric CBR	28	28	30
Sugar	47	44	45
Total fat content	35	35	35
Non-lauric CBR as % of fat phase	80	80	85.7

As with lauric CBSs the central, unstable region gives mixed crystals, softer products and a likelihood of fat bloom formation. However, the region of stability at the CBR-rich end of the diagram is much broader than with lauric CBSs indicating that non-lauric CBRs have a greater tolerance to cocoa butter. In practical terms, this means that cocoa mass can be used with non-lauric CBRs resulting in a much more "rounded" cocoa flavour than can be achieved using lauric CBSs, where only low-fat cocoa powder is permissible. This allows typical recipes to be used such as those shown in Table 7.18.

The production of these non-lauric CBR based coatings is similar to normal chocolate production, for example mixing, roll refining and conching. A MacIntyre conche or a ball mill can also be used. Following production of the coating the product is ready to be used immediately. No tempering is required and application temperatures for moulding, panning or enrobing may vary from 40 to 48 °C. This non-temper process allows for lower viscosity at the enrobing or depositing stations, which has advantages in certain applications. Non-lauric CBR-based coatings should be cooled under moderate to strong conditions, similar to those commonly applied for cocoa butter-based chocolate.

To address the whole issue of trans fatty acids in non-lauric CBRs oils and fats manufacturers have produced low-trans and, more recently, "no trans" alternatives to their original high-trans CBRs. What is needed is a fat that is stable in the β′ form (so that it needs no tempering). If very specific processing of palm oil is carried out it is possible to obtain a mix of triglycerides that have not been hydrogenated but which are β′-stable. It has already been shown that POP (in palm mid-fraction) crystallises in a β-3 configuration because in this triple chain structure the oleic acid groups in the 2-position all line up more or less adjacent to each other and so can pack closely together. However, a coating based on palm mid-fraction could not be used as a non-temper, non-lauric CBR because, to get this structure, it has to be tempered. But, if POP is blended with PPO, then a crystal structure is obtained which is double-chain packed and in the β′ form because, then, the oleic acid groups in the 2-position of POP line up against the oleic acid groups in the 1- and 3-positions of PPO (Slager *et al.*, 2007). This is the basis of the newer generation of non-hydrogenated, non-lauric CBRs.