As mentioned earlier, this moisture takes with it many of the unwanted flavour compounds. For dark chocolate, however, the initial moisture may already be below 1% and care must be taken to avoid the chocolate picking up moisture and becoming thicker. It is undesirable to conche dark and milk chocolate in the same room in open conches, as the transfer of moisture and flavour volatiles between the two can give rise to unpleasant flavours and thicker dark chocolate. The temperature must, of course, be increased slowly to enable the moisture to escape and minimise the risk of the formation of agglomerates.

As can be seen in Figure 10.5, as the filling progresses the electrical current drawn by the conche increases and continues to do so throughout the subsequent dry conching phase. This is because the crumbly chocolate is becoming more pasty. This often starts with the formation of small balls 1–4 cm (0.5–2.0 in) in diameter on top of the mass. Sometimes large lumps attach themselves to the mixing elements as the mass becomes pastier and, in exceptional circumstances, the whole mass can turn with the elements, resulting in no mixing taking place. This can be off-set by changes to the temperature and/or fat content.

With certain conches the motors are not sufficiently strong to continue operating as the power increases and fat and emulsifier additions are required very early on in the conching cycle in order to turn the chocolate mass into a thin paste or liquid. In this case there is little or no dry conching. Normally, however, this results in a relatively high viscosity chocolate at the end of processing.

10.3.2 Pasty phase conching

The energy put into the chocolate by the mixing action towards the end of the dry conching and at the beginning of the pasty phase is often so high that the temperature rises rapidly. The water jacket temperature, therefore, has to be several degrees lower than the chocolate, in order to maintain a steady increase to the required conching temperature. The latter has a large effect on the final chocolate flavour and so must be controlled carefully in order to manufacture a reproducible product. This is particularly critical during the pasty phase**,** when thermostatic water jacket controls capable of reacting to sudden temperature changes should be used.

Once the chocolate has become pasty, the viscosity starts to fall, in part due to continued moisture removal and also because many of the solid particles are now being coated with fat. The actual final viscosity, however, is partly dependent upon the amount of shear/work that can be put into the chocolate (see Section 10.2). In traditional conching (see Figure 10.6), this shear energy input (as denoted by the conche amperage) falls steeply as the chocolate becomes thinner. This can only be off-set by increasing the shear rate through an increase of the speed of the mixing elements or by changing the elements themselves. Figure 10.7 shows the power curves of a conche that has been fitted with a servo-mechanism which changes the speed as the viscosity changes to give a uniform power input.

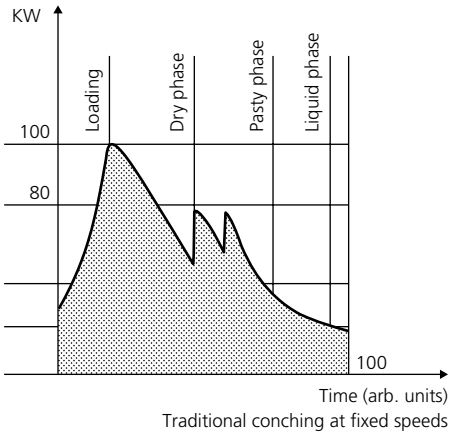

Figure 10.6 A graph illustrating typical conche power amperage during the three stages of conching (conche with two speeds and reverse direction operation).

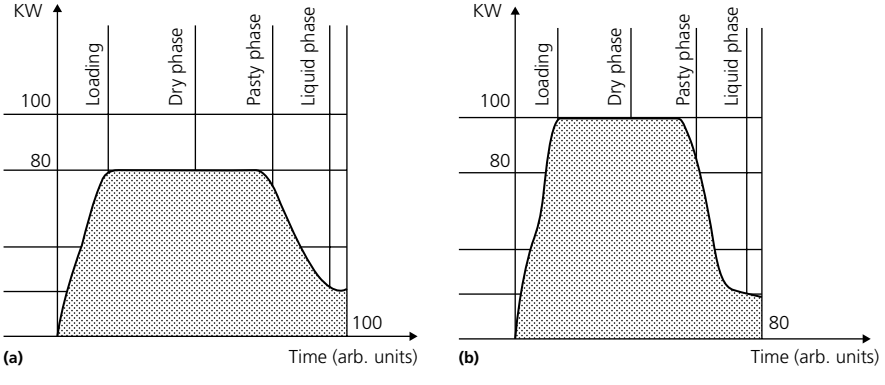

Figure 10.7 A graph illustrating the conche power amperage during the three stages of conching, when the motor speed is continuously adjusted according to the chocolate viscosity. (a) Lower power motor. (b) Higher power motor.

In order to develop a cooked flavour within a chocolate it is necessary to reach a certain temperature for a given time. Within limits it is possible to raise the temperature and shorten the time and vice versa. The same is true for conche power input, and if the power is increased, shorter conching times are possible (Figure 10.7). Once the final additions of fat and emulsifier have been made, however, the chocolate becomes very thin and it is very difficult to put a significant amount of shearing energy into the chocolate.

10.3.3 Liquid phase conching

This phase can be very short and is required to mix in the final recipe additions. Sufficient time must be allowed for the viscosity to reach an equilibrium. As there is little change in flavour or additional work input, however, there is little reason for extending this stage. Research has shown a very big consumer preference for chocolates processed with a long dry conching phase