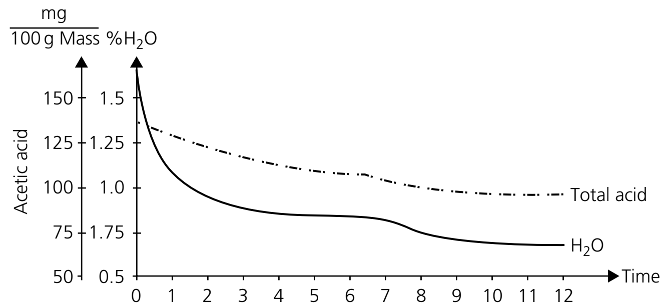

Figure 10.1 Graph showing the changes in moisture and acidity during a conche cycle (time in hours).

Figure 10.1 shows the changes in moisture and total acid during a 12 h conching cycle. As can be seen, the majority of the moisture is removed very early on in the conching cycle. This is because much of the moisture comes from the milk components, and once these have been coated with fat, it is much harder for the water molecules to reach the surface of the mass and be extracted from the conche. It is very likely that this moisture removal also has a major effect upon the chocolate taste by "steam distilling" some of the flavour components. The acidic components however, continue to decrease throughout the conching time and it is possible to over-conche and produce too bland a chocolate.

Adequate ventilation is of paramount importance during conching to enable the moisture and other volatiles to escape. Conche filling is a very dusty and dirty operation and may partially block some of the ventilation ports on a conche. Not only is this a hygiene hazard, but it can also reduce the conche's efficiency and may lead to increased conching times. Forced ventilation, using fans to blow or suck air through conches can effectively shorten conching times, when the ventilation area is small relative to the amount of chocolate inside the conche.

The rate of moisture removal will depend upon the temperature of the chocolate mass. A higher temperature not only makes the water molecules in the mass more mobile, but also lowers the relative humidity in the conche for a given air moisture content, thus in turn speeding up the rate of evaporation. It would appear, therefore, that a high initial temperature would be beneficial to the conching process. This is not the case, however, as this frequently leads to a very high level of free moisture in the conche, which is unable to escape into the room atmosphere. This is instead absorbed by the hydrophilic (water attracting) sugar particles, which then stick together to form large agglomerates (grit). This means that, even when a chocolate has been correctly refined/milled, the chocolate tastes rough to the pallet. This is especially likely to happen when the air in the conche room itself is very humid or when there are cold, unheated metal parts near the top of the conche, on which the moisture can condense and then fall back into it. Gritty chocolate can best be avoided by having the mass temperature high enough to melt the fat, but not so high as to rapidly evaporate the water at the beginning of the conching cycle. This should be coupled with a high ventilation rate, forced by fans if necessary. The temperature should then be raised once the majority of the moisture has been removed (see Figure 10.1).

The actual maximum temperature used depends upon the ingredients used and the type of taste required for the final product (Chapter 20). If cooked (Maillard) flavours are desired, temperatures above 100 °C (212 °F) may be used. The actual flavour depends upon a combination of time and temperature, that is a higher temperature can be used for a shorter time and vice versa. Crumb chocolates frequently contain some of these flavours from their drying process, so may require shorter conching times. For the more milky chocolates, Maillard flavours must be avoided, and the temperature must be kept lower, usually below 50 °C (122 °F). Some sucrose-free recipes containing sugar alcohols require lower temperatures still, to avoid melting and agglomeration of the particles (Chapter 4).

10.2.2 Fat and emulsifier additions

As mentioned previously, one of the main aims of conching is to produce the optimum viscosity for the subsequent processing. The actual viscosity can be reduced by adding more fat (Chapter 11), but as the price of the fat is frequently several times that of the other ingredients in the chocolate, this in turn increases the cost of the product. The aim, therefore, becomes one of obtaining the optimum viscosity at the lowest practical/legal fat content. It thus becomes necessary not only to remove the excess water content, but also to ensure that the fats and emulsifiers used have their maximum effect upon the flow properties.

The most commonly used emulsifier is lecithin (Chapter 11), which is hydrophilic (that is it can attract and hold in moisture). Figure 10.1 shows that the majority of moisture evaporates from the chocolate mass during the early part of conching. If a large amount of lecithin is present at this stage it will hold in the moisture and make the chocolate thicker. Similarly excess fat, present in the early stages of conching, will coat the solid particles, making the removal of moisture significantly more difficult.

The actual amount of fat present at the beginning of conching is to a certain extent determined by the previous milling procedure. If the dry milling method is used (Chapter 9), very little fat is present. When a five roll refiner is used, however, enough fat must be in the mass to prevent the particles being thrown from the rolls and consequently the majority of the fat is already present. In both cases, however, fat is normally added at the beginning of conching. As a general rule, this should be kept to a minimum, but must obviously be sufficient to make the mass thin enough not to stall the conche motor. Fat and emulsifiers added towards the end of conching normally have a much bigger effect on the final