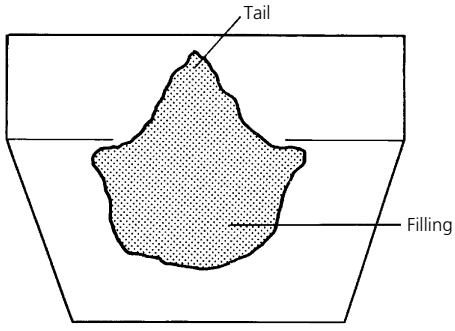

Figure 15.16 Diagram of "tailing" in a moulded product.

15.6.3.4 The ratio of centre to chocolate

Early single shot depositors had a centre that was about 40% of the product. This has been increased to 55% or more by the use of electronically controlled machines, and one manufacturer claims that products with 80% have been produced (Awema, 2007). The shape is also important with more spherical egg-shaped products having higher centre proportions than moulded tablet shapes (Figure 15.15).

15.6.3.5 "Tailing"

Of course this is also a problem with shell moulded products and occurs when the centre forms long "tails" or "strings" due to its elastic or gummy nature, which prevents flow from stopping cleanly when the depositor closes. These form a passage through the chocolate (Figure 15.16), which often results in the centre leaking out of the sweets. This is a major cause of rework with soft caramels, syrups and jellies.

15.6.4 Key control parameters

Jeffery (1990) gave the following parameters as being key to obtaining satisfactory results from a single shot system:

1. Accurate timing of both chocolate and centre deposits, which must be independent of each other;
2. Accurate control of depositor piston or pump speeds, independent of depositing rate, to control the velocity of the fluid through the nozzle;
3. Accurate valves to stop the depositors and obtain the material from the feed hoppers (often rotary valves are used);
4. A controlled "suck back" to minimise "tailing";
5. Temperature control of centre and chocolate to within ±0.1 °C (±0.4 °F);
6. Accurate weight control of both components;
7. Accurate location of the deposit in the mould. Otherwise the chocolate "skin" may distort, leading to weak spots;
8. Good design of nozzle assembly;

9 Correct temper and viscosity: both temper and viscosity need to be consistently well controlled (use of accurate viscometers and tempermeters strongly recommended);
10 Shakers should have a length, amplitude and frequency which is independent of the product throughput, so that the plant conditions can be optimised;
11 A cooling time of at least 40 min is normally required to avoid cracking of the chocolate;
12 The mould shape is particularly important with blocks or tablets, where cooling stresses on the product must be minimised to prevent cracking. An "egg" shape is almost ideal for this technique.

15.7 Aeration of chocolate

15.7.1 Types of aeration

Aerated chocolate has a lower density than normal chocolate, as some of the solid material and fat is replaced by a gas. This gives the consumer what appears to be a larger product at the same weight and usually a softer texture and melting sensation. It does not reduce the calorific value, as this is measured in calories per gram and is therefore the same whether or not there is air inside it.

There are four very different types of products that have been produced over the years (Jeffery, 1989). The most common is where the individual bubbles within the chocolate are clearly visible and have a mean diameter within the range of about 0.05–3.0 mm (0.002–0.1 in). The normal density of chocolate is 1.3 g/cm^3, but due to the presence of the bubbles aerated chocolate tablets are produced with densities of 0.4–0.8 g/cm^3. This can be produced under vacuum (Section 15.7.2) or by beating in gas under high pressure (Section 15.7.3). The first product on the market was Rowntree's Aero® in 1935, which is currently still manufactured by Nestlé. Most of these products are produced by first making a shell either by traditional shell moulding (Chapter 14) or by cold forming (Section 15.8). The aerated centre is then deposited and allowed to set, before further liquid chocolate is poured into the mould to give a smooth back.

It is possible to produce very fine bubbles, so that they are not clearly visible to the naked eye. This is sometimes known as micro-aeration and can produce densities as low as 0.7 g/cm^3. At these densities it produces a quicker melt and creamier texture. The main application is for moulded chocolate biscuits, where it is able to reduce the percentage by weight of chocolate on the final product.

Another type of aeration is where continuous tubes of air run within the chocolate. These can be produced by extruding semi-set or solid chocolate, as described in Section 15.5.4. An example of this type of product was marketed by Cadbury under the name of Spira®.

In normal chocolate the fat is the continuous phase which binds it all together, but certain aerated products are held together by the solid particles, in particular