range of the instrument. Particles will diffract the laser beam at different angles depending on their size. The laser beam is focused on a field of particles and then the angle of diffraction is observed. Smaller particles diffract light at wider angles and different intensities than larger particles. This type of analysis can tell the distribution of the particles – information that is needed to evaluate fat requirements, equipment operation, yield value and mouth feel.

23.9.6 Type of fats

Cocoa butter is the ultimate fat with desirable melt in the mouth enabling proper flavour release. Cocoa butter with its unique melting characteristics requires tempering. Tempering is the process of inducing partial crystallisation of cocoa butter to ensure a finished product with acceptable gloss and shelf stability when cooled properly (see Chapter 13).

Recipes for semi-sweet chocolate and milk chocolate will vary in the amount of milk fat they contain; semi-sweet chocolate typically contains low amounts to no milk fat. Milk chocolate must contain a minimum of 3.39% milk fat and high quality milk chocolate will contain more.

The ratio of milk fat to cocoa butter can result in different functional properties of the chocolate (see Chapter 5). Milk fat tends to soften chocolate making it more plastic and less heat resistant than semisweet chocolate. Since milk fat is 75% liquid at room temperature and does not share the same crystal form as cocoa butter, it is incompatible at high concentrations (see Chapter 7) and creates a softening effect. It is known that a small amount of milk fat is semi-sweet chocolate aids in bloom stability.

Rules of thumb:

- >5% milk fat will require modification to tempering and cooling parameters;
- 2–3% milk fat in semisweet chocolate will provide protection against bloom.

23.10 Specifications

23.10.1 Physical parameters

Some physical parameters that could be listed on a specification sheet might be:

- Viscosity;
- Fineness;
- Percentage total fat.

A viscosity of:

190–200 MacMichael;
55–60 Brookfield at 20 rpm, 40 °C;
13 750–15 000 Centipoise;

would indicate a heavy or thick product.

A viscosity of:
65–75 MacMichael;
19–22 Brookfield at 20 rpm, 40 °C;
4750–5500 Centipoise;
would indicate a very thin product.

If you were to specify in plastic viscosity (PV) and yield value (YV), this would be where to analyse what works best in the specific plant finished product application.

23.10.2 Fineness (particle size)

Fineness specification would typically be reported in inches or microns:

15–20 µm (0.0006–0.0008 in) would be very fine and silky smooth to the tongue.

45–50 µm (0.0018–0.0020 in) would be a more coarse product and perceived as sandy to the tongue.

23.10.3 Fat content

24–26% fat would be a very low fat content for a chocolate and would result in high viscosity and most likely a lower cost product.

34–36% fat would be a high fat content for a chocolate and would result in a very flowable, thin product with a higher cost.

23.10.4 Microbiological specifications

Microbiological testing would be performed using AOAC/BAM Methodology by an accredited laboratory. With good manufacturing practices, there should be no issue meeting microbiological requirements.

- APC <25 000/g;
- Coliforms <10.0 MPN/g MPN;
- *E. coli* <3.0 MPN/g MPN;
- Yeast and mould <100/g;
- *Salmonella* – 2 × 375 g Negative/750 g.

Once chocolate is manufactured in a chocolate factory, it can be pumped, tempered and deposited into drops or moulded into ten pound bars or shipped in liquid tankers to the confectioner that will then make their fine candies. The integrity and quality of the shipping containers is crucial to maintain product quality during transit.

23.11 Tempering

Tempering is the process to ensure the formation of stable fat crystals (see Chapter 13). Correctly tempered chocolate will yield a bright, crisp and shiny chocolate (Figure 23.9). Measuring temper utilising a temper meter will assist with maintenance of product quality. A general guideline is as follows: