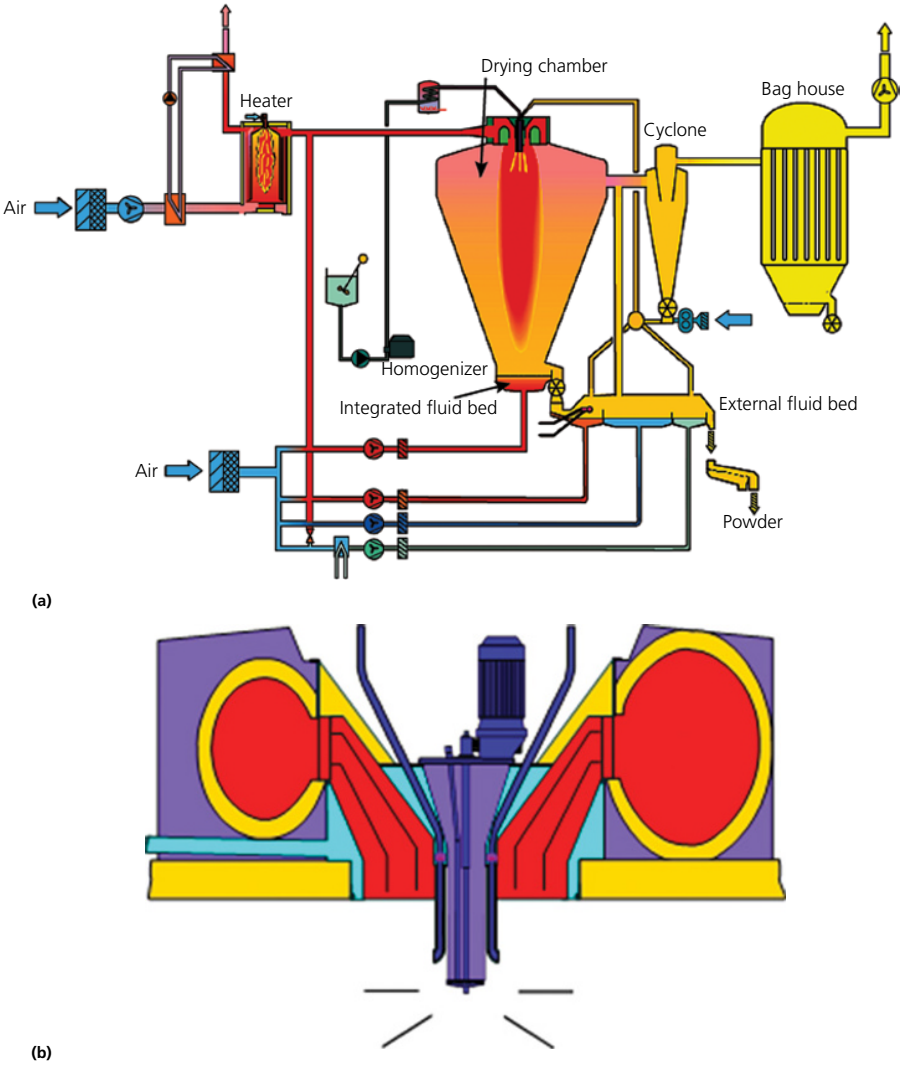

Figure 5.9 (a) Example of a multi-stage spray drying process. (b) Example of a centrifugal atomiser (Anhydro Triple A® spray dryer).

In nozzle atomisers, the particle diameter is inversely proportional to the pressure applied. The higher the pressure, the lower the particle size and the occluded air in the powder, resulting in an effective distribution of fat during the chocolate processing, ensuring a lower chocolate viscosity (Hansen and Hansen, 1990).

5.3.2.2.5 Hydrodynamic cavitation

Hydrodynamic cavitation is a new technology associated with spray dry processing. In recent years new technologies have been introduced to the market with the objective of increasing the dry matter in the feed for the dryer without influencing

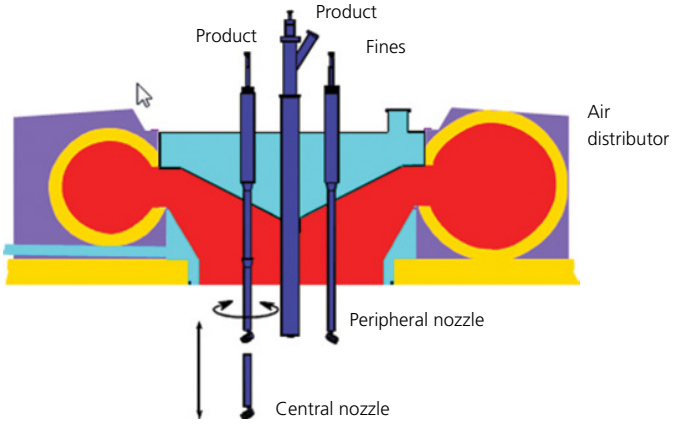

Figure 5.10 Example of a high pressure nozzle distribution atomizer. Source: Anhydro (2012).

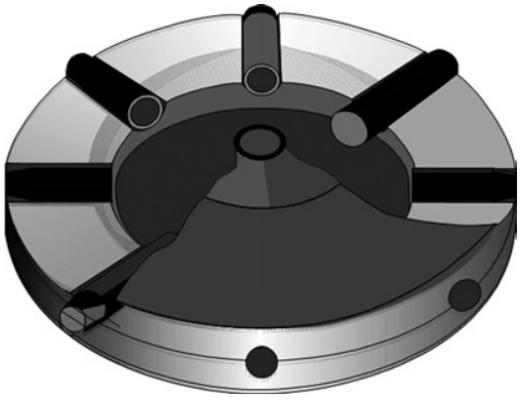

Figure 5.11 Example of a centrifugal atomizer wheel Source: Anhydro (2012).

the properties in the final powder. Feed concentration to spray-drying atomisers is usually limited by the viscosity of the feed.

A new breakthrough technology based on controlled hydrodynamic cavitation has proved its excellence in combined viscosity reduction and microstructural conditioning to the feed. Hydrodynamic cavitation is a process of vaporisation via bubble generation and bubble implosion occurring in a flowing liquid as a result of decreases and subsequent increases in pressure. The (temporary) viscosity reduction enables an increase in the solids level during the spray drying, thereby significantly reducing operational costs and improving sustainability.

The heart of the technology is a rotor with a number of radial holes spinning in a liquid chamber, as shown in Figure 5.12. The spinning action generates internal liquid friction (disk friction) and the holes generate hydrodynamic cavitation. Cavitation occurs when the pressure decreases to some point below the saturated vapour pressure of the liquid and subsequent recovery above the vapour pressure. This technology is used in many areas of the food and beverage industry for hydration and emulsification purposes.