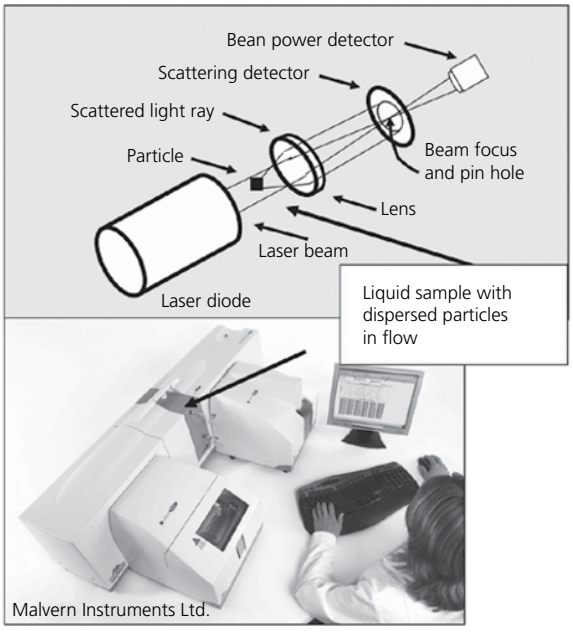

Figure 24.33 Overview of the principle of operation of a laser diffractometer. Reproduced with permission of Mavern Instruments.

the lens and sensed by a photo-diode array (scattered light detector). The intensity of the light that is not scattered is monitored by a beam power detector. The scattering patterns with which to compare the detected signals can be calculated assuming simple Fraunhofer diffraction. The choice of lens determines the size range that can be detected. The model for calculating the particle size distribution is critical for interpretation and estimating errors. These models use an assumed form factor. Often a spherical shape is used, which gives an added uncertainty. For closer monitoring additional camera systems are commercially available. But in all cases it is useful to have a closer look at measurement capabilities and limitations. The structure of the individual particles leads to limitations in the accuracy of the measurement methods. For example differences between particles having the same size, but different shapes are not taken into account. The results are usually presented in table form as volume distribution or number distribution with a statement of the calculated percentage per particle size class and reference to the model used. The particle size is usually plotted logarithmically along the x-axis, see Figure 24.34. Data transmission (e.g. protocol with ASCII characters) is technically possible permitting remote use. Laser diffraction units should be equipped with multi-access levels to allow purpose-optimised operation/modification. In addition such measurement units can be seen as single workstations connected via networks and utilised accordingly. Calibration routines can be run in an automated manner between sites regardless where they are located across the world. The almost unlimited availability of digital particle size data gives the possibility of integrated sampling, for example

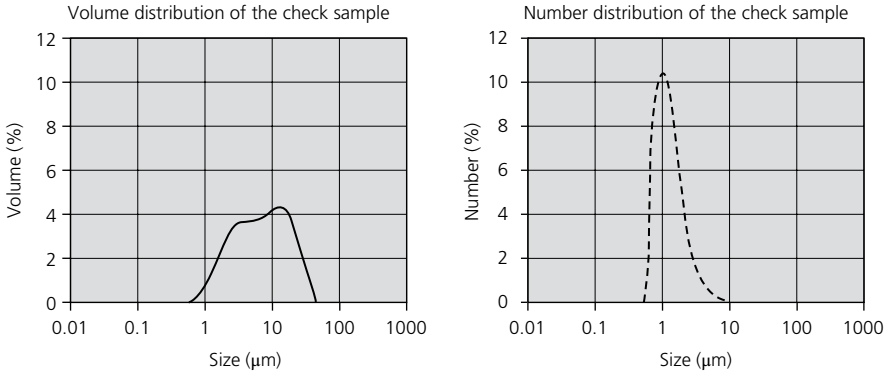

Figure 24.34 Typical particle size distribution for a sample of milled material shown as volume and number distribution curves.

of flakes per refiner, conche and system run time, making automated off-line systems a likely development.

24.3.5 Triglyceride (triacylglycerides) composition (vegetable fat content)

The European Union (EU) chocolate regulations (Chapter 28) limit the types and amounts of vegetable fat that can be added to chocolate and it is therefore important to be able to distinguish between these fats and cocoa butter. Chapter 7 gives further details about the approved raw materials and the properties of the special cocoa butter equivalents (CBEs) that are permitted in chocolate. No other type of CBEs may be used in the EU (legislation elsewhere varies from country to country) and, if the amount of these CBEs exceeds the maximum limit of 5%, the product cannot longer be called chocolate.

The special fats classified as CBEs contain no lauric acid, but possess large amounts of symmetrical and simple unsaturated triglycerides (POP, POS, SOS) and are completely miscible with cocoa butter. Generally, the determination of the triglyceride distribution is made by means of high-temperature gas chromatography (Figures 24.35, 24.36).

As part of the implementation of the EU cocoa regulation, the Joint Research Center (JRC) of the European Commission has over the past few years prepared a data base of triglyceride distributions from hundreds of samples (cocoa butter, CBEs, milk fats) from various geographic regions, as well as from fat mixtures of these in a wide range of proportions. With the aid of existing analytical data, multivariate statistical formulas were established and validated. They are now available for practical use for quantification of cocoa butter, milk fat and CBEs from fat mixtures; no additional fats must be present, however.

Other problems arise from the presence of fats from other sources such as nuts and almonds from filling fats. In addition to the distribution of triglycerides,