The bottling of wines is arguably the most important of all winemaking operations since it determines the condition in which the wine is delivered to the market. It is the culmination of the sequence that began long before, starting with grape development, harvesting, fermentation, and aging. Mistakes are costly to rectify and quality control is of primary importance.

The glass bottles used for wine are generally the 750-mL size, of clear or colored glass and in a number of traditional shapes. Other volumes, smaller and larger, are also used depending on the interest in further aging, the setting in which it is likely to be consumed, and the value of the wine. The inertness and protection offered to wines by glass bottles has been verified by many years of usage. The most vulnerable aspect of bottled wine is the nature of the closure or seal that is employed. For many years corks have been unquestioned as the closure of choice due to their compressible, relatively inert nature. However, in recent decades, the elimination of many defects due to improved winemaking technology has made the incidence of defects attributable to corks to be a major problem in some wines (Lee and Simpson 1992).

The preparation of wines for bottling, the steps involved in bottling and the aspects of their behavior under bottle storage conditions are the subjects addressed in this chapter. The addresses of equipment companies mentioned in this chapter can be found in Appendix I.

A. PREPARATION FOR BOTTLING

The preparation of wines for bottling involves any final adjustments of chemical composition, final filtration, and modification of the dissolved oxygen and carbon dioxide levels in the wines. The preparation of blends, fining, stabilization, and adjustments of acidity should not be considered as finishing operations and will generally have been attended to some period before the time of bottling.

1. Final Filtration

The type and style of wine will somewhat influence whether filter pads or a membrane are
to be employed as the final filtration. The use of nominally sterile pads is widely practiced, particularly with dry wines, while wines containing residual sugar, or those in which the malolactic fermentation has been prevented, will generally be membrane filtered. The assumption that dry wines that have completed malolactic fermentation will not support additional microbial growth is not always true in practice (Lee et al. 1984). While the incidence of later microbial spoilage is lower in such cases, it is not eliminated entirely. The continuing trend for the use of lower levels of chemical additives and the desire to use minimal concentrations of sulfur dioxide only enhance the recommendation of membrane filtrations as the means to prevent unwanted microbial action in bottled wines.

Concerns about color removal from red wines by membrane filters have no sensory basis since the material collected on such filters has already precipitated from solution and insoluble particles have no taste or flavor associated with them. Such material will usually deposit in the bottle within the first months after being bottled and the collection of it on the filter is simply deferring the onset of such a deposit. The removal of yeast and bacterial cells, which also have no taste contribution in themselves, is for reasons of quality control and the assurance that the wine that is consumed closely resembles that which was put into the bottle. The point is, that only soluble components that can be sensed by taste receptors on the tongue or volatile ones reaching the nasal cavity can have a sensory impact and there is no evidence that soluble components and small volatile molecules are significantly removed by such filtrations.

The need to remove all microbes by filtration is a far more acceptable approach to controlling unwanted microbial activity than the chemical additive approach. The variation in quality due to microbial effects can often be seen in wines that have not been filtered, within the first two years after bottling. Tasting of a series of wines from different vintages made in this style by the same producer will generally show such changes and they are undesirable in vintage-dated varietal wines.

The notion of stripping of wine components by filtration has little scientific basis. While some individuals claim to have shown this to be real, there are no panel tests or published results to support it. It has become fashionable, in some circles, to claim that unfiltered or unfined wines are superior, but this has no basis in fact. There are wines that will not need to be fined and perhaps not need to be filtered, but they are not necessarily any better than those that have been. These arguments are generally driven by public relations efforts that try to distinguish wineries from one another or by wine writers who try to be controversial rather than educational in their comments. Bottle sickness, a temporary lowering of flavor in freshly bottled wines, appears to result from the disturbance of an established vapor-liquid equilibrium and not from filtration.

2. Membrane Filtration of Wines

Membrane filters are made of synthetic polymers such as cellulose acetate, cellulose nitrate, and polysulfone. They have closely controlled pore sizes and are set up so that the flow is perpendicular to and through the membrane (with pore sizes of 0.45, 0.65, 0.8, and 1.2 μm). Membrane filters rely on their pore size to exclude larger particles (microorganisms or crystals) or partially soluble colloids (proteins, polysaccharides, or tannins and complexes involving them). They have far less capability to collect suspended matter internally in the way that filter cakes and pads do, and so generally wine is prefiltered with a depth-collection pad or cartridge or a fine grade of diatomaceous earth before it is contacted with a membrane filter. The membrane should be thought of as the capture surface for the few particles that are not collected by the prefilter. A more detailed discussion of filtration and filter testing can be found in Chapter 7.