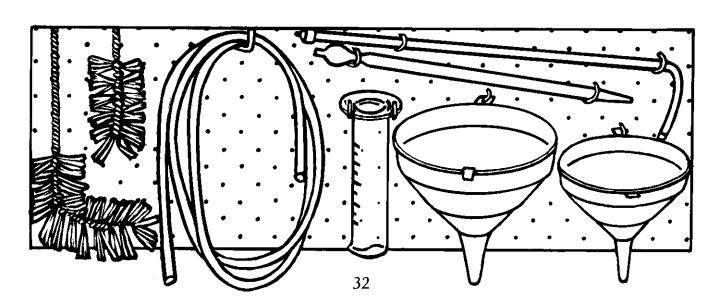
The Wine Making Facility

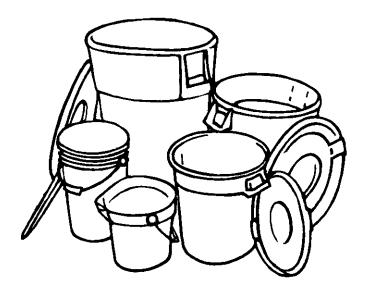
The home winemaker who produces an occasional small lot of wine can perform reasonably well in the kitchen or garage. On the other hand, the serious winemaker, who plans regular involvement with larger or many small wine lots, requires more work space, equipment, wine and supply storage, and other elements that will influence success of the operation. Although much of this section relates to a bigger scale of wine making, the principles are applicable to more casual wine making.

The processing work area

The space needed to handle grapes and make wine should be separate from the area needed for aging and storage. Crushing, pressing, fermentation, racking, fining/filtration, and bottling generate considerable waste (pomace, juice or wine spills, etc.) that must be quickly and continually removed. Experience has shown that a

major portion of the time and energy spent in wine processing is devoted to cleaning and sanitizing the work area, equipment, and related utensils. Without cleanliness, it becomes difficult to function and the waste matter can serve as an ideal medium for the growth of undesirable microorganisms that infect and spoil wine. Moreover, accumulated pomace, for example, attracts vinegar flies, beetles, roaches, and other undesirable guests that are not only nuisances but are incompatible with the production of substances intended for human consumption. Thus, the processing area should have the means for disposing of solid waste and for removing liquid waste with adequate quantities of cleaning solutions and rinse water. This calls for access to hot and cold water and to a drainage-sewage system. A large deep sink equipped with faucets is adequate for small operations; larger operations are more efficient conducted on a hard surface floor (like cement) that slopes toward a sewer drain.





In connection with indoor operations, adequate ventilation has been mentioned as well as cooling. Such activities as crushing and pressing can be performed outdoors, as long as the juice or wine does not become too warm and the work area can be kept sanitary. Indoor work areas should have adequate lighting to facilitate wine production and cleaning. Soil that cannot be seen is not removed. Racks or other devices should be available to suspend hoses and other utensils for air drying after cleaning to avoid mold growth.

Wine aging and storage areas

Since racking and topping are performed during aging in barrels or glass containers, where leakage or spillage usually occurs, separate this activity from the area used for storage and aging of bottled wine. Temperature and relative humidity are critical to the proper aging and storage of wine. For prolonged aging times the temperature should not be above 60°F (15.6°C), preferably at 52° to 55°F (11.1° to 12.8°C). Moreover, the temperature should be as constant as possible. Variations of more than a few degrees up or down should be avoided. The most cost-effective investment for achieving adequate temperature control is insulating the walls and entrances (doors and door jambs) of storage cellars. If after insulation the desired temperature control is not achieved, then air-conditioning (refrigerated air) equipment should be installed. To make a decision, ascertain temperature flucuations with an accurate minimum/ maximum thermometer. Because warm air rises, place the thermometer at about 6 to 8 feet from the floor or at a height that can be related to the location of wine storage, to obtain representative readings. Temperature checks should be made during the warmest seasonal weather and checked daily to determine extremes. Knowledge of the low and high temperatures, as well as the room size, is necessary for selecting the proper capacity air conditioner.

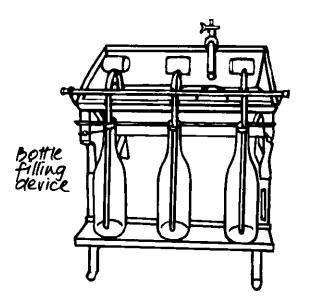
Relative humidity (RH) in the wine aging/storage areas should be between 40 and 60 percent, preferably about 60 percent in the case of barrel aging. Very dry air increases evaporation of wine during barrel aging and causes corks to shrink in bottled wines. Very moist air favors growth of mold on all surfaces, especially the outsides of barrels and corks. Besides the minimum/maximum thermometer, obtain an accurate instrument for measuring relative humidity, such as a wet bulb/dry bulb thermometer or a relative humidity meter. Should the readings indicate the need, both humidifying or dehumidifying equipment is available for home use from hardware, appliance, and department stores.

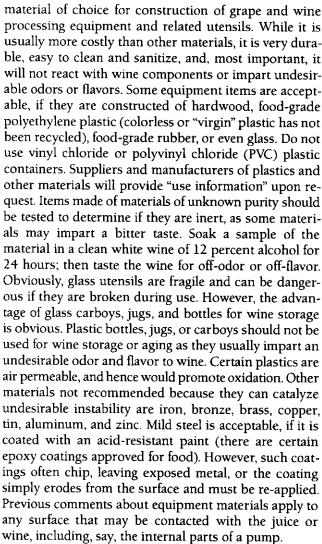
Equipment and supplies

Locate a reliable supplier for processing and laboratory equipment, utensils, and other wine making supplies. Suppliers are listed at the end of this publication. Telephone directory yellow pages often list "Winemakers' Equipment and Supplies." Some nature or health food stores and hobby or specialty shops may also carry home wine making supplies. Wherever the possibility may exist, home winemakers should consider a group purchase, especially for large equipment such as a press. In this way the expenses, as well as the use and upkeep of the equipment, are shared.

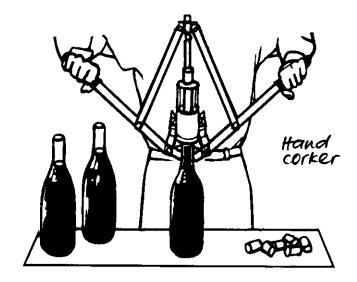
A few comments should be made about equipment design and construction. Processing equipment (crushers, presses, filters, pumps, etc.) should execute a given function efficiently without adversely affecting the quality of the wine. Equipment should be so designed as to facilitate cleaning and sanitizing. Stainless steel is the







Several kinds and many sizes of pumps greatly facilitate transfer of liquids during processing. The internal parts should be made of stainless steel, a tough heat-resistant plastic approved for food, or food-grade



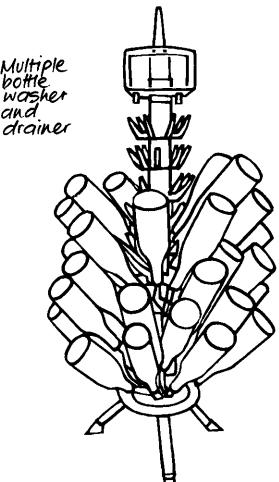
rubber. Piston or progressive cavity pumps are the most useful for pumping semi-solid liquid (must or wet pomace), while centrifugal pumps are suggested for pumping clear juice or wine. Make sure pump seals don't leak air to avoid oxidizing the juice or wine being pumped.

Bottling and corking equipment for small-scale wine making also is available in several kinds and capacities. There are bench-top, hand-operated, floor-mounted, hand-operated or semi-automatic corking machines as well as one- or two-spout and multiple-spout, gravity-fill, bottle-siphoning devices. Remember, the simpler designs are easiest to operate, maintain, and clean. Bottling equipment surfaces in contact with wine should be made of inert materials.

Finally, because barrels are important and potentially expensive, several aspects should be stressed. White oak, the wood of choice for wine barrels, is used in making both American and European barrels. Whenever possible or affordable, buy new oak barrels rather than used ones. The risk with a used barrel is the uncertainty about past history, use, or abuse. Is it sound (doesn't leak)? Has it ever contained spoiled wine? Has it ever been used to store toxic or other undesirable substances? These are questions for which candid and dependable answers may not be available. Used barrels from wineries are usually less risky, and if they must be purchased, seek reliable sources through your home wine shop. Related to the use of wine barrels in general and, in particular, topping and bottling, is the use of oxygen-free nitrogen gas. Home wine shops can provide small cylinders of nitrogen, together with regulators and valves, to permit topping of partly filled barrels with inert gas, to replace the air. This is advantageous when topping wine is lacking or to preserve wine in a partially filled barrel during bottling, especially when it is not possible to complete bottling during a single day's operation.

Cleaning and sanitizing

The need for clean and sanitary wine making conditions is repeated here to provide additional guidance. Because there are special considerations involved, cleaning and care of wooden cooperage will be discussed separately. Practically speaking, cleaning is the removal of soil deposits (organic matter) from a surface. There are three cleaning steps: prerinsing, washing, and postrinsing. Generally, these steps should precede sanitizing, which is, for purposes of this discussion, the reduction of potential spoilage microorganisms from a previously cleaned surface. Most cleaning tasks involve use of a lot of water, although the amount can be conserved by employing mechanical energy (scrubbing, pressure) whenever appropriate. During prerinsing and washing, do not use very hot water (170° to 180° F or above) as it will tend to "cook" the organic matter onto the surface being cleaned. Use either cold water or warm water between 120° to 140° F. Use of detergents alone or with such alkalies as soda ash and trisodium phosphate (TSP) is recommended for washing surfaces. Several small rinses, especially of fermentation vessels and other containers, are usually more effective than one large rinsing, which wastes water.



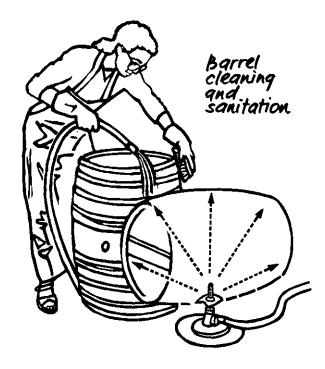
Sanitization, properly done, lowers the potential for wine spoilage organisms to develop. A good sanitizing agent is heat or hot water. In this application, the water should be about 185°F, and the surface to be sanitized must reach that temperature for 1 to 2 minutes to obtain germicidal action. An excellent alternative sanitizing agent is chlorine, readily available in ordinary household bleach. An effective solution is obtained by diluting about 1 ounce of chlorine bleach in 1 gallon of water. Higher concentrations require thorough rinsing followed by air drying to remove residual chlorine.

Cleaning and sanitizing the work area and equipment after each use should become routine. Don't neglect small items, such as rubber or plastic racking hoses and tubing, sampling and measuring utensils, mixing devices, buckets, and tasting glasses, etc. Whenever practicable, "clean as you go" to avoid a laborious and difficult cleaning period at the end of the day.

Cleaning and maintaining wooden cooperage

This discussion is concerned primarily with new and used oak barrels, but it also applies to larger wood cooperage. Oak barrels are usually expensive, and every effort should be made to keep them in near perfect condition because their primary contribution in aging wine is the oak extract they impart for a desirable aroma and flavor complexity. To benefit from this, a clean new barrel requires minimal treatment. Just rinse thoroughly, fill with acidified water (add 3.5 ounces citric acid for each 50 gallons of water), allow to soak, and check for leaks. This soaking permits the wooden staves to swell and should close small potential leaks. If the hoops were driven too tightly when the barrel was dry, the staves may collapse or warp during soaking. If there are serious problems, contact your supplier. Wine placed in untreated new oak barrels for aging must be tasted frequently to test whether there is excessive wood flavor. You may want to remove the wine after only a few days or a week. Or the wine may be left in the barrel to attain an excess level of oak and then blended with wine that has not been barrel aged. After the third filling or use, the wood extractives in a new barrel have been greatly diminished. Generally, after five fillings a barrel is considered used. Wine stored in used barrels ages but attains little oak or wood flavor.

Some winemakers feel that the taste that results from the first use of a new untreated barrel is too harsh. The barrel can be "conditioned" before using it. Oak extractives can be partially removed by soaking overnight with a solution of potassium or sodium carbonate (soda ash); use 250 grams (8.8 ounces) in 50 gallons of 140° F water. Rinse several times with water after conditioning and, if possible, refill immediately with wine.



This treatment will reduce the tannin content of the new barrel by about 80 percent. This is also an accepted procedure for cleaning a barrel, especially to remove deposits of potassium bitartrate crystals that have formed inside it. In this case, longer soaking is recommended, followed by one hot and several cold water rinses, to completely remove the alkali. But remember, much of the cost of a new barrel is related to the oak flavor it possesses; hence, soda ash treatments will greatly reduce valuable flavor that could be extracted for wine quality improvement.

One problem that confronts a home winemaker is maintaining a barrel in "sweet" condition when it is not in use. The best method is to keep the barrel filled with wine. Often, unfortunately, this is not always possible. To maintain barrels for extended periods (more than 2 months) when not in use, thoroughly clean, sanitize, and air dry drained barrels; then store upside down in a clean dry place. This system, however, can lead to leaks due to shrinkage and possible buckling of the staves; therefore, several days before reuse, fill the barrels with acidified water, allow to soak, and check for leaks. For shorter periods of nonuse, fill the barrels with an acidic sulfur dioxide solution of 200 to 500 ppm to prevent

mold and spoilage yeast or bacteria from souring the barrel.

For a 50-gallon barrel, fill about two-thirds full with water; add 700 to 1,600 ml of a 10 percent $K_2S_2O_5$ solution, prepared as previously described; add 100 g citric acid (about 3.5 oz); mix thoroughly; completely fill the barrel with water; mix again and close tightly with the bung. Top the barrel and check SO_2 concentration frequently. When the SO_2 falls below about 200 ppm, replace it as often as every 2 to 4 weeks. This technique is also useful for sanitizing previously cleaned barrels just before using for wine.

Finally, once a barrel has become contaminated with spoilage organisms, such as vinegar bacteria, it is impossible to "sterilize" it. Therefore, every effort should be made to prevent contamination with a strict program of cleaning and maintenance. One common error committed in home wine making is to infect a clean barrel with a wine that is already turning to vinegar. Naturally, this renders the barrel unfit for sound wine making. Also remember: Although a barrel that has been used to age white wine can be used to age red, the reverse is not true—unless a pinkish, slightly orange, or tawny white wine is acceptable.