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Potential Spoilage and Stability Problems

Certain problems can arise even when the wine-maker follows recommended methods. Some are best handled by preventative measures; others are generally not considered important in wines made at home for family consumption, but may be important to those interested in wine judgings or simply as a matter of pride or achievement. The major potential problems, their prevention or remedy, are dealt with next.

Acetification and oxidation

In acetification acetic acid bacteria present in wine under favorable (to the bacteria) conditions will slowly convert alcohol to acetic acid and ethyl acetate, the main components of wine vinegar. This undesirable change is readily prevented by following recommended wine making practices. Specifically, judiciously use sulfur dioxide, avoid air contact with the wine, and keep the wine at 60°F (15.6°C) or below. When these measures are not followed, bacteria can become established and acetification will start. *The reaction, once under way, is irreversible!* Even worse, should this occur in wine stored in an oak barrel or cask, these containers cannot be used again for wine making because there is no known way to sterilize the wood effectively.

Simple oxidation results from excessive or prolonged exposure of wine to air when insufficient or no SO_2 is present. Development of a brownish color and oxidized odors and flavors is readily apparent, especially in white wines not protected from exposure to air.

Hydrogen sulfide (H_2S)

The distinctive "rotten egg" odor of this obnoxious compound can be detected by smell at very low concentrations, that is, 1 ppm or even less. Its formation and presence in wine most often arises from the reduction of elemental sulfur (residue of sulfur dust on grapes from powdery mildew control) by the yeast, and can

occur even when the very best wine making practices are followed. As soon as the presence of H_2S is noticed, every effort should be made to remove it. Hydrogen sulfide is often formed during alcoholic fermentation, especially near the end of it, or some time after alcoholic fermentation when the new wine is still in contact with the yeast. When it is detected, it is sometimes possible to convert the H_2S back to sulfur by adding sulfur dioxide or by vigorous aeration to volatilize it from the wine. (Note: This is the only circumstance when deliberate aeration of wine is recommended.)

For small wine lots, pour the affected wine from its container, with splashing against the sides of another container, such as a clean plastic bucket, tub, or other suitable container. For larger volumes, pump the wine from one container to another, with the discharge end of the hose directed toward the wall of the receiving container to achieve splashing. This transfer with splashing may have to be repeated several times.

Well separated from the working area, smell the wine in a tasting glass after aeration or SO_2 addition. If it appears to be free of H_2S, filter the wine, and again adjust the free SO_2 from 30 to 50 ppm (lower amounts for red wine, higher for whites). Next, place the wine in a suitable storage container, following the instructions given for racking, topping, and aging. After a week or so, smell another sample. If H_2S is still present, repeat SO_2 addition or aeration, and filtration, followed by final SO_2 adjustment. This problem can be solved if detected early and the wine treated immediately. Filtration following SO_2 addition or aeration is required to remove elemental sulfur, which can be seen as a haze in the wine. If the sulfur is not removed, it can be reduced again to form H_2S.

As mentioned in white wine making, if the juice is clarified before fermentation, the possiblity for H_2S to form from elemental sulfur is greatly minimized. During settling, suspended solids including elemental sulfur, settle out. Of course, this technique for preventing H_2S from forming is not feasible in red wine making, as the juice must be fermented on the skins for color extraction. And discouraging as it may be, it must be said that adding SO_2 or aeration will not always remove H_2S. Furthermore, H_2S may be formed even when elemental sulfur is not present. Deficiency of certain amino acids during fermentation may cause the yeast to form and accumulate H_2S. Adding diammonium phosphate at the time of yeast inoculation (1 to 2 oz/100 gal) should minimize the potential for this to occur.

Other very undesirable sulfur-containing compounds, such as mercaptans, can be formed if H_2S is not removed early. The odor of these compounds has been described as garlic or skunky, and it is very difficult to remove, without adding certain chemicals that themselves may cause other instabilities.

Cloudiness and deposits

Under certain conditions, several naturally occurring substances in wine can lead to development of a cloudy or hazy appearance or crystalline deposits. These are usually of no concern to the home winemaker, but they are important to the commercial winemaker who must satisfy consumer demands for brilliantly clear wine free of deposits.

A common cause of cloudy appearance is an excess of certain proteins in the wine that may, under prolonged warm storage conditions, 70° to 85°F (21.1° to 29.4°C) or higher, form complex substances that remain in suspension and appear as a haze. This cloudy appearance is readily apparent in a white or pink wine. If this kind of instability is unacceptable to the home winemaker, the wine can be protein (heat) stabilized by treating it with an inert clay, bentonite, which removes some protein. (This treatment is called bentonite fining.) The wine can be bentonite fined anytime after the first racking and before bottling, but we recommend before barrel aging. Usually adding about ½ ounce to 1 ounce bentonite for each 10 gallons of wine is sufficient for most white varieties. Others, such as Riesling, Muscat, and Sauvignon blanc, may require twice this amount for complete stability.

Bentonite comes in the form of clay granules, and is available from home wine making shops. For maximum effectiveness, it should be rehydrated before use in a 6 percent solution of hot water, thoroughly mixed to avoid clumping of the clay, and finally allowed to stand 24 hours. After fining, the bentonite is allowed to settle and the wine racked from the bentonite lees, or the wine may be filtered to remove it.

Very small, often needlelike crystals of potassium bitartrate (KHT) are the most common precipitate or deposit encountered in wine stored for several days or longer under very cool conditions, 40°F (4.4°C) and lower. Tartaric acid is the predominant organic acid in most *vinifera* grape varieties and readily forms the salt potassium bitartrate. Wine can hold only a certain amount of KHT in solution, the solubility of which depends upon several factors, including temperature. As the wine's temperature is reduced to the usual refrigerator temperature of about 37°F (2.8°C) or lower, KHT crystals start to form and will eventually precipitate from solution to form a deposit. Knowledgeable wine consumers accept this phenomenon as natural to wine. Also, when the wine is warmed to room temperature 68° to 70°F (20° to 21.1°C), most, if not all, of the crystals usually return to solution. Thus, KHT stabilization is not required, but can be achieved if desired. The most common method for reducing excess KHT is to chill the wine to 23° to 25°F (−5° to −3.9°C) and to hold it at that temperature for 2 to 3 weeks. This causes

the excess KHT to crystallize and then precipitate. The wine must then be racked carefully or filtered at the same low temperature. The process is facilitated by adding powdered KHT, which acts as a "seed" for crystallization, and is thoroughly mixed with the wine throughout chilling. Cold or potassium bitartrate stability might be accomplished without refrigeration by using a proprietary compound such as Koldone. The manufacturer of this material suggests that 1 ounce for every 10 gallons of wine will achieve KHT stability, and depending upon the wine being treated, it will also reduce titratable acidity by about 1 gram per liter. If the wine is already low in acidity, this can be an important consideration. Note also, if the wine pH is high, using this agent could lead to calcium bitartrate instability. Therefore, although this material may work in certain wines, it can also create other problems.

When wines are barrel aged for extended periods under cool conditions, excess potassium bitartrate precipitates out and forms crystalline deposits on the inside of the barrel. Naturally, as this deposit accumulates, it reduces the wine's exposure to the wood surface; this in turn limits the extraction of desirable wood components by the wine. Moreover, because the KHT deposit is a rich medium for the growth and development of various spoilage organisms, it should be removed each time the barrel is emptied. Removal requires using hot, strong, alkali solutions and, while this will effectively remove the KHT crystals, it also will remove valuable wood extractives. For these reasons, winemakers who intend to cold stabilize their wines should do so before the wine is placed in barrels for aging.

Other clarifying and fining agents

Under some circumstances using other clarification or fining agents may be desirable. However, their use requires filtration for removal, a process possible for those not intimidated by filtration equipment and operations. It should be mentioned that all materials, previously discussed and those following, have been legally approved for use in commercial wine production, and home winemakers, therefore, should be confident they are safe.

Some wines may develop tastes considered too astringent or bitter. This is usually related to excessive amounts of certain tannins, as when red wine is left too long on the skins and seeds. Gelatin treatment has been successfully used to reduce astringency and is used in very small amounts, that is, 4 to 8 ounces per 1,000 gallons. Adding egg whites has also been used to "soften" wines that taste "rough." Because they are proteins, do not use either agent after a wine has been previously protein stabilized. Alternatively, gelatin and/or egg white can be followed by bentonite fining.

Excessive amounts of certain polyphenolic compounds in white wine can lead to browning or cloudiness. One treatment for browning calls for the polymeric resin polyvinylpolypyrrolidone (PVPP), also known as Poly-Clar AT. This adsorbent resin is expensive, but is added in very small quantities, and is removed by racking or filtration. Poly-Clar AT will probably remove more tannin than gelatin and does not need to be followed with bentonite fining.

Activated carbon or charcoal is useful in removing undesirable odors and flavors and off-color in white wines. However, it can impart other off-tastes and/or remove desirable components, and therefore should be used cautiously. From 1 to 20 lb/1,000 gal (120 to 2,400 mg/L) are usually added directly, followed by about 2 lb/1,000 gal (240 mg/L) of bentonite, and finally by racking or filtration.

Other clarifying agents, such as Klear-Mor and Sparkeloid, may be helpful with wines difficult to clarify just before bottling. Again consult your home wine shop. Further information about fining agents may be found in *The Technology of Wine Making* (see **Selected References**).

Wine filtration

Most persons making wine at home would not want to go to the expense or effort involved in wine filtration, and by and large it is not necessary. However, advances in filtration technology offer the serious home winemaker reasonably affordable small-scale equipment and relatively simple techniques. Filtration facilitates wine clarification, can follow fining or aeration, and can also remove yeast and/or bacteria.

Depending upon the objective, there are three major kinds of filtration that relate to the size and amount of particles to be removed from the wine: rough, tight or polish, and microbiological. For home wine making there is now available a series of cartridge-type filters of several sizes, designed to meet the needs of all three objectives. Sheet or pad filters are less expensive. Both are either gravity-flow (quite slow) or pressure-flow (rapid). Rough filters are used to hasten wine clarification, thus reducing the number of rackings, or to filter wine from fining agents, such as bentonite lees. They may involve using a filter aid, such as diatomaceous earth (DE). Tight filtration media, used to polish filter wines before bottling, will remove most yeast cells. It is necessary to polish filter a wine before using a "microbiological" or membrane filter to remove yeast and bacteria—this latter application is useful to the winemaker who does not want the malolactic fermentation. Further information on filters, filter housings, their use and prices, can be obtained from suppliers listed at the end of this publication.