

Wine Aeration and Its Adverse Effects*

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Prolonged contact with air is detrimental to wine quality. Certain wines, such as sherry and madeira, are exposed to air during the course of their production. On the other hand, premium table wines are produced with minimum or limited air exposure. White wines tend to improve when processed under low oxygen conditions. Red wines usually benefit with air exposure up to a certain point, but beyond this critical point, aeration is detrimental.

How does prolonged air contact impair wine quality? There are two ways in which wine quality is impaired by air exposure over a long period of time:

- (1) oxidation
- (2) spoilage by aerobic microorganisms.

Oxidation

Let us first consider oxidation and its effects on wine quality. When a wine is exposed to air, the oxygen from the air is dissolved into the wine. This step is a physical process. The dissolved oxygen reacts with certain phenolic compounds in the wine and causes their oxidation. The oxidation reaction is a chemical reaction. It is catalyzed by the enzyme polyphenol oxidase, but it can also occur without the participation of the enzyme. Oxidation causes a loss of fruity and varietal aroma, browning, and development of aldehydic or nutty flavor.

Spoilage by Aerobic Microbes

When a wine is stored in contact with air over a long period, spoilage due to the growth of aerobic microorganisms can occur. Aerobic wine spoilage causing organisms include certain yeasts and acetic acid bacteria.

Yeast

Film forming yeasts such as those belonging to genera *Pichia* often develop on the surface of wines exposed to air. The sources of these yeasts are grapes and/or contaminated processing and storage equipment. The growth of these yeast are often associated with the formation of undesirable compounds such as acetaldehyde and ethyl acetate. These and other undesirable compounds contribute to off odors.

Acetic acid bacteria

The acetic acid bacteria are known to cause spoilage in wines stored in the presence of air. The bacteria oxidize ethanol and produce acetic acid. Some ethyl acetate is also produced during their growth. These two compounds give the wine a typical vinegar-like aroma. The aroma is very offensive and consequently the wine is undrinkable. The bacteria gain entry into wine from grapes (especially rotten ones) and contaminated cooperage. When the conditions for their growth becomes favorable, they grow and cause wine spoilage. Since the air (oxygen) stimulates their growth, it is important to protect wine from excess air contact.

Winemakers often use sulfur dioxide (SO₂) as an antioxidant and antimicrobial agent to protect wine from the harmful effects of aeration. In addition to SO₂ wineries also use inert gas(es) to protect their wines from undue air exposure. This approach helps in reducing the amount of SO₂ in wine.

Practical Consideration to Minimize Air Exposure

Winemakers should first follow those measures which will enable them to minimize excessive aeration of wine during the course of processing. These should include things like keeping the containers full, filling tanks and barrels from the bottom, keeping pumps and hoses leak-free, and exercising caution when pumping cold wine and when agitating, mixing and blending the wine. These measures coupled with judicious use of inert gas will prevent wine from undue aeration and subsequent deterioration.

Keeping Wine Containers Full

Not keeping containers full is one of the most important causes of poor wine quality. It is more common than often realized. One way to deal with this problem is to have containers of various sizes at the winery so that a wine can be stored in full containers. The other approach is to use a variable capacity wine storage tank. This type of tank is designed so that the top lid can move up and down inside the tank. The rim of the lid is equipped with a food grade, inflatable rubber tube, which is inflated with nitrogen. When inflated, the tube seals the space between the tank wall and the rim of the lid. When the tube is deflated, the lid can move freely inside the tank. These tanks are available in stainless steel or fiberglass. They come in different sizes and are very useful in eliminating the problem of ullage space.

Checking the Pump for Air Leaks

Use of a leaky and defective pump is another reason for excess aeration of wine during processing. This is particularly serious if the air leak is on the suction side. One way to check the hose and pump for leaks is to place both suction and delivery ends in a tub or bucket containing soap solution. Circulate the solution through the hose and pump, and look for small bubbles. The presence of bubbles indicates an air leak.

Another way to spot a leak is to connect the delivery end of a hose to a closed valve and the suction hose to the water outlet, then turn the water on. (This will build pressure.) Examine the hose and pump for leaks. Once the leak is spotted; it is important to fix it before the pump and/or hose is used.

Danger of Aerating Cold Wine

The solubility of oxygen in wine is greatly influenced by temperature. The lower the wine temperature, the greater the solubility of oxygen. A cold wine such as one racked after cold stabilization will absorb a great amount of oxygen if exposed to air. The oxidation of O₂ will become noticeable when the wine warms up. For this reason, great care should be exercised to protect a cold wine from air exposure.

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