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## When Is Oxygen Beneficial to the Winemaking Process?

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On Planet Earth, oxygen makes up about 20% of the air we breathe. One of the first useful things you learn as a novice winemaker regarding oxygen is that you need to protect your wine from oxygen exposure at all stages in its life. Rule #1: Keep an airlock on fermenting wine; Rule #2: Replace the airlock with a solid bung once fermentation is complete and CO<sub>2</sub> has mostly ceased escaping through the airlock; and Rule #3: Secure your bottled wine with a good-quality cork to prevent oxidation. Oxidation occurs when wine is exposed to air during the winemaking process, including the aging of the wine. What happens is that free oxygen in the air can cause an enzymatic reaction in wine, resulting in a dulling of its fruity vitality and a browning of its pigmentation compounds. In a doomsday scenario, wine oxidation can lead to the development of volatile acidity, causing sherry-like, aldehydic flaws that make the wine undrinkable.



Wine oxidation sounds bad, right? In most instances oxygen exposure is definitely bad for wine, but not in all instances. While it is true that oxygen will negatively affect wine if the exposure is not carefully monitored, it is also true that oxidation—or aeration—can benefit wine during certain stages in its life. The first benefit occurs during primary fermentation and is known as macroaeration, while the second benefit occurs during long-term bulk aging and is known as microoxygenation. Let's explore each, starting with macroaeration because it occurs during the early stages of winemaking.

### Macroaeration

*Macroaeration* is the winemaking practice of aerating, or oxygenating—fermenting wine by vigorous racking to produce a softer, less astringent wine that exhibits more fruit character and improved color stability. This is a winemaking practice that is

mostly reserved for red wines because red grapes have much higher tannin content compared to white grapes, which provide them with greater protection from negative oxidation effects. Besides making red wine more approachable much earlier in its bottle aging, macroaeration also helps ensure a healthy fermentation by providing yeast cells with a sufficient amount of oxygen so they can thrive while converting the sugar in grapes into alcohol. This oxygen is used by the yeast to synthesize fatty acids and sterols to not only maintain the integrity of the yeasts' cell walls, but to also promote yeast population growth. When yeast have insufficient oxygen during fermentation they can become stressed and sluggish, ceasing their sugar conversion and causing a stuck fermentation. If the yeast become unhealthy in this manner, this can lead to the production of excess hydrogen sulfide (H<sub>2</sub>S) and volatile acidity (VA), which can destroy a wine's flavor profile.

There are numerous ways to infuse oxygen into your fermenting red must. First, a vigorous punch down a few times each day during primary fermentation will effectively insert oxygen into your young wine. Then, the day after pressing your young wine off its skins, the most common way of macroaerating it is to allow the young wine to splash against the wall of your carboy as you rack it off its gross lees. If that isn't sufficient

macroaeration for your tastes, you could also gently rock the wine-filled carboy back and forth for a few minutes following the initial racking.

One caveat here is that, because many red winemakers put their red wines through malolactic fermentation at this stage of the winemaking process, it is important to remember not to engage in macroaeration after this initial racking off the gross lees because malolactic bacteria tend to be very sensitive to oxygen and can become inhibited, resulting in a stuck malolactic fermentation.



Vigorous punch downs can infuse your fermenting red wine with needed oxygen that benefits its health.

## Microoxygenation

Now that you have introduced your young red wine to macroaeration, let's move on to the next important use of miniscule oxygenation. *Microoxygenation* is the winemaking practice in which the winemaker uses the controlled process of oak-barrel aging to allow the wine to interact very slowly with air penetrating through the barrel's oak pores. Besides the flavors and tannins infused into the aging wine by the oak wood, the barrel-aged wine will also exhibit more complexity than wines aged in stainless tanks or glass containers due to the process of microoxygenation.

When barrel-aging wine, no special microoxygenation equipment or process is required; the barrel does all the work. The winemaker only has two tasks: The first task is to check the wine level every three to four weeks to make sure that everything is developing as you envisioned. The second task is to top up your barrel after the "wine



Microoxygenation is one of the most important benefits of aging red wine in oak barrels.

angels” have taken their share during the evaporation process. This “topping up” will avoid bad oxidation, meaning offensive smells and unfavorable tastes in your wine.

For bottle-aging wine, natural, agglomerated, or synthetic corks are a good choice for beneficial microoxygenation, because screw caps may provide too much of an airtight seal, depriving the wine of the microoxygen that is necessary for it to evolve gracefully. The underlying belief here is that airtight seals inhibit microoxygenation and stifle the type of natural aging required in wines.

So there you have it; a brief introduction to the benefits of oxygen in the winemaking process. There are a lot more important details worth exploring in this area, so here is a YouTube video that explores this topic in more detail.

