



Sulphur in winemaking

by Colin Ford

Wine is a completely natural product. Nature will make wine without any intervention from man when airborne yeasts begin to ferment the juice of grapes either on the vine or when they've fallen to the ground, fully ripe.

But you wouldn't want to drink it. No sooner do the grapes become wine than nature begins to undo her handy-work, oxidising the alcohol into acetylaldehyde and then into acetic acid (vinegar), browning as enzymes oxidise phenolic compounds and eventually returning the whole creation to the earth.

The interventions of man into nature's winemaking are more about influence and craftsmanship than total control. We try to exclude harmful microbes, ones that we know will cause spoilage, but at the same time encourage beneficial microbes, ones that enhance or improve the natural production of the wine. For example, great care goes into excluding as much of the yeast 'Brettanomyces' as possible because it produces compounds that in high enough concentrations are detrimental to the wine. But great care goes into encouraging the growth of another species of yeast, 'Saccharomyces cerevisiae' which is responsible for alcoholic fermentation.

There are a number of tools available to winemakers to help influence and guide the complex biochemistry nature employs to produce wine but perhaps none is as misunderstood – or as unfairly maligned – as the use of sulphur.

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Look on the back label of any bottle of wine and you'll see a disclosure statement that says, "Contains Sulfites" (the American standard) or "Contains Preservative 220", which is more common in EU markets. Both refer to the same compound, sulphur dioxide, SO₂.

Both elemental sulphur and sulphur dioxide are as natural as natural can be. Pure, elemental sulphur is mined as Flowers of Sulphur from volcanic deposits and is so-called because under a microscope, the tiny crystals of sulphur have the appearance of flowers. Volcanoes also produce vast quantities of sulphur that has combined with oxygen, to form sulphur dioxide.

It is sulphur in this form, as sulphur dioxide, that is used in winemaking. It is both an antimicrobial agent and an antioxidant. (Another compound of sulphur, hydrogen sulphide, is a different substance that is sometimes associated with wine and it is important to distinguish that we're not discussing that compound in this article.)

A little SO₂ added to grapes between picking and transport to the winery will inhibit the action of undesirable yeasts and bacteria that are endemic in the outdoors and will help to keep

the fruit in pristine condition.

Cut a banana or an apple, then leave it in the fridge and after even a few minutes, you'll begin to observe browning of colour and degradation of flavour. Exactly the same thing would happen to grapes and juice during initial handling in the winery and so a small amount of SO₂ is added at the crusher, to prevent both enzymatic and chemical oxidation of phenols.

Sulphur provides protection to wine during its maturation, particularly while in barrel and again during the bottling process, ensuring that the wine remains stable and in sound condition while it is on the shelf or in the cellar.

The winemaker can make additions of sulphur dioxide in a number of ways; as a gas, by dissolving SO₂ gas in water or in the form of a natural salt such as potassium metabisulphite (K₂S₂O₅).

When a winemaker adds SO₂, some of it (50 – 90 percent) will combine with compounds in the wine such as acetylaldehyde and anthocyan; this is then called 'bound SO₂' and is no longer available to function as a protectant against oxidation or against bacteria. The rest, which is available to provide protection to the must or wine, is called 'free SO₂'. The sum of the bound and free SO₂ is the 'total SO₂'.

The free SO₂ in wines exists in two different chemical forms, molecular and as bisulphite ions. When you measure free SO₂ you measure both the molecular SO₂ and the bisulphite,



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but only the molecular SO₂ is effective as an antimicrobial. And in wines, only between one and seven percent of the free SO₂ is present as molecular SO₂.

This ratio of molecular SO₂ to free SO₂ is strongly influenced by pH. So much so that a tenfold increase in molecular SO₂ is observed between pH 4.0 (0.6 percent) and pH 3.0 (6.1 percent).

It is important to understand that the concentrations of SO₂ we are talking about are miniscule - measured in parts per million. For example, under normal conditions, 0.8 ppm of molecular SO₂ is considered adequate to provide the required protection.

The winemaker walks a fine line with sulphur additions and will add the minimum acceptable to maintain the level of protection the wine requires.

Too little and the wine is at risk of spoilage by microbes, enzymes and oxidation. Too much and the sensory enjoyment of the wine can be marred; by a sulphurous odour or by diminished colour and astringent texture in the mouth caused by the excessive sulphur impeding the polymerisation of tannins.

Although there is considerable variation between individuals, the sensory threshold for most humans is about 10 parts per million of molecular SO₂ in air and between 15 and 40 parts per million in wine. Since around 0.8 parts per million of molecular SO₂ (a subset of free SO₂) is considered sufficient to provide adequate protection, there's little likelihood of detecting any sign of SO₂ in good quality wine, unless it is literally fresh off the bottling line.

Some consumers seek out wines that are said to have little or no added SO₂ in preference to others, believing that the sulphites present in wine cause an unpleasant reaction for them. I have no ability to dispute this belief and indeed, I would encourage wine drinkers to avoid bag-in-a-box wines if this (or indeed quality) is an important issue to them. However, because SO₂ is actually produced by yeast during alcoholic fermentation, you're never going to find a completely SO₂-free wine.

The unpleasant reactions I have experienced have been more closely related to poor wine quality (sometimes immoderate quantity) and so I can recommend drinking a little less but of the best quality you can afford, to be assured of a satisfying wine experience, every time. **CF**