

**SULFITE PRODUCTION IN WINE FERMENTATIONS:
HOW MUCH SULFITE IS PRODUCED BY YEASTS
IN GRAPE MUST WITH NO ADDED SULFITES?**

Lyle C. Abrahamson
Enologist

Hallcrest Vineyards: The Organic Wine Works
Felton, Santa Cruz County, California

In order to answer this question a research project was undertaken during the 1991 harvest. There are many claims for natural sulfite production in wine fermentations but a scarcity of research results in this area. The research of Rankine and Pocock (1969) on sulfur dioxide formation during fermentation is the most pertinent. However, all of the results were based on 3 liter volumes of grape juice with sulfur dioxide added before fermentation or in defined growth media with added sulfur sources. Their results are very interesting, but the well documented variability of small scale fermentations is troubling and the effects of adding sulfur dioxide before fermentation to the subsequent sulfur dioxide formation is not mentioned. In light of the various claims based on few results it was necessary to conduct this independent research to measure sulfite production in full scale commercial wine fermentations.

A total of fifteen wines from both conventionally and organically grown grapes were tested for total sulfur dioxide during and after fermentation. The total sulfur dioxide was determined using the aeration-oxidation method. These are all commercial fermentations ranging from 132 gallon barrel fermentations to 3500 gallon temperature controlled fermentations in stainless steel tanks. The chosen method of vinification eliminates sulfur dioxide additions in any of the grape musts before or during fermentation. This choice has certain stylistic results in the finished wines and also simplifies the interpretation of the data. Any sulfur dioxide

detected originates with yeast activity during the fermentation.

The range of sulfite production is 0-41 ppm. Yeast strain appears to be a significant factor which is not a new result. The white wine fermentations produced sulfites more often and at higher levels than the red wine fermentations. It is not clear whether this is related to the nutrient level in the juice, the higher temperature of fermentation, or other factors. The only red fermentation that produced any significant level of sulfites was the Barbera. This may be due to the very low pH or other factors. No free sulfur dioxide was detected in any fermentation, all is in the bound form, which agrees with the findings of Rankine and Pocock (1969). The peak levels of sulfite formation generally occurred during the most rapid period of fermentation, although not in all cases. After the peak level of sulfites were reached they slowly decreased over time with the aging of the wines and various processing steps such as racking, filtration and bottling. The result is that there ends up being little or no detectable total sulfur dioxide in the bottled wines.

In conclusion, blanket statements such as "all fermentations produce 10 to 100 parts per million of sulfur dioxide appear to be contrary to the facts determined in this research. The level of sulfite production may indeed range up to 100 ppm in some fermentations, but this would seem to be an exception rather than the usual case. The production of sulfite is influenced by many factors including yeast strain, nutrient profile,

fermentation temperature, inoculation level, pH, oxidation - reduction potential, fermentor shape and size, and processing methods. The nutrient profile of grapes varies according to vintage and varietal rendering to a prior prediction of sulfite levels as well as hydrogen sulfide formation difficult if not impossible. Recent research indicates the levels of sulfites and hydrogen sulfide production depends on the interaction between yeast strain and juice. The production of wines without added sulfites presents many additional challenges in addition to those already facing the winemaker interested in producing high quality wines. In short, the winemaker can only rely on technology, innovation, experience, skill, and intuition to produce wines of distinction with or without added sulfites.

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