COOPERATIVE EXTENSION ● UNIVERSITY OF CALIFORNIA

Enology Briefs

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CAMPUS AND DEPARTMENTAL TEACHING

At a time when enrollments in the California College and University systems have been approaching a "steady state", the Davis Campus of the University of California noted a 1.6% increase in total enrollments for the past Fall quarter. Fall, 1981 campuswide enrollment totaled 19,189 compared with 18,887 recorded for Fall, 1980. This set an all time record for UC Davis.

Likewise, student "majors" in viticulture and enology (undergraduate and graduate) continue at high levels, with about 180 recorded before the end of last year. This is the heaviest teaching load in the College of Agricultural and Environmental Sciences and is the equivalent of 42 students per faculty member. The average student/faculty ratio in the College is 22:1. No wonder some of the faculty are not as frequently visible in the industry as they were 10 and 15 years ago. Alas, many of us recall the era of the 1950's and early 1960's when viticulture and enology "majors" averaged between 15 and 30. More about faculty and students in issues to come.

WORDS OF ENCOURAGEMENT!

Your editor is most grateful for the many complimentary cards and letters readers have sent about the first issue of Enology Briefs. I would also appreciate receiving ideas and topics readers would like to have discussed in future issues. Also, a reminder for those wine industry members who are employed at a winery location other than the address as given in the Wines & Vines Directory, and who would like to receive Enology Briefs, please let me know so that you may be added to our mailing list. Write: George M. Cooke, Department of Viticulture/Enology, University of California, Davis, CA 95616, or Phone: 916/752-1906.

TECHNICAL NOTES

"Review of Basics on Sulfur Dioxide -- Part II"

Editor's Note: Part I of this series on sulfur dioxide in the first issue of Enology Briefs stimulated quite a few inquiries. Notably: In the table showing "Distribution of free SO_2 at various pH's", were the free SO_2 values listed in the right hand column determined by the usual Ripper method or by the vacuum aspiration procedure? The answer is neither; the values were derived by calculation using the equation given on the bottom of page 2, Issue #1. A second frequent question: What is the origin of the recommended

level of 0.8 mg/L molecular SO_2? Again, the article's author, Clark Smith, provides the answer: "This is based upon evidence [Beech, F. W., et al. 1979. Bull. l'O.I.V., Paris. 52(586):1001-1022] that this level of molecular SO_2 achieved a 10,000 fold reduction in 24 hours in the number of viable cells of Brettanomyces sp., certain lactic acid bacteria and other wine spoilage microorganisms". Briefly, the intended message in the first article, is that for SO_2 to be an effective antimicrobial agent, application rates must be determined in relation to pH!

In this issue, Clark Smith, U.C.D. Enology graduate student, continues with: "Sulfur Dioxide As An Antioxidant: The bisulfite ion species (HSO_3^-), whose concentration is relatively independent of pH in the wine range, protects wines from oxidation in various ways. It inhibits polyphenoloxidase browning reactions, scavenges H_2O_2 (formed enzymatically), stabilizes red color, and retards a whole series of non-enzymatic browning reactions by combining with intermediate compounds.

However, there are important limitations on the capabilities of SO_2 as an antioxidant. In particular, its reaction with molecular oxygen itself is very slow, on the order of months to deplete a saturated solution under wine conditions. It is therefore impractical for scavenging oxygen from wines exposed to air.

Ascorbic acid (or its isomer, erythorbic acid) reacts quickly with O_2, but is also an important source of binding of bisulfite. Therefore its use should normally be restricted to bottling time. This is an effective strategem when the wine is sterile filtered and bottled asceptically so that a high molecular SO_2 in the bottle is not required.

Sulfur dioxide is also essentially ineffective in inhibiting the botrytis browning enzyme 'laccase'. Wines containing it will continue to brown by this reaction even after bottling. Pasteurization of the must can be used to prevent this type of browning.

Analytical Methods for SO_2: Since it is quick, inexpensive, and sufficiently accurate and reproducible for most uses, the iodometric titration (Ripper) procedure is generally the analytical method of choice for determination of free and total SO_2 in white wines. If the shelf life of reagents is a problem, an iodate standard may be titrated instead of iodine, and an excess of KI added to the flask to convert it to I_3^- as it enters the flask. Alternatively, sodium thiosulfate (dried, weighed as $Na_2S_2O_3 \cdot 5H_2O$, dissolved, and titrated) may be used periodically to standardize the iodine titrant.

The Ripper method is poorly suited to red wines, where it is neither precise nor accurate. Iodine reacts with anthocyanins to give false and unpredictably high values. The endpoint is not sharp and is very difficult to see.

The vacuum aspiration procedure overcomes these difficulties. Both free and total SO_2 can be determined reproducibly if a condenser is employed to reflux the sample for the latter. However, these values do not represent the true free SO_2 because they include the portion loosely bound to anthocyanins; the antimicrobial effect of anthocyanin-bound species is presently unclear. A spectrophotometric method may be employed to estimate the actual free SO_2 value (A.J.E. & V. 1975. 26:25-29).

Whatever method is used, the free SO_2 is best determined at cellar temperature. The equilibria which exist with many binding species are quite temperature dependent.

Forms of Sulfur Dioxide: Compressed SO_2 in cylinders is the easiest and least expensive way for many winemakers to introduce SO_2 and does not increase K or Na ion content. It may be metered directly, or dissolved in water to make a saturated solution (≃5%).

Potassium metabisulfite ($K_2S_2O_5$) and potassium bisulfite ($KHSO_3$) are commonly employed, but should not be added after cold stabilization.

Sodium metabisulfite ($Na_2S_2O_5$) is too unstable for normal use, and often contains disagreeable impurities. The addition of sodium salts to wine should be avoided whenever possible; however, the use of sodium bisulfite to make small adjustments after cold stabilization may be countenanced for small-scale operations where liquid SO_2 may be less practical.

None of these salts is effective in a sterilizing or barrel-storage solution unless the pH is adjusted below 3. This may be accomplished by the addition of a roughly equivalent quantity of citric acid.

All forms by which SO_2 may be added to wine are subject to loss of potency over time. Elevated storage temperatures, moist conditions, and unsealed containers contribute to loss of strength. Some may even yield initial concentrations above theoretical purity. It is therefore advisable to monitor periodically the potency of these reagents.

Calculation of the Addition of Various Salts

$$\text{Grams of reagent to add} = \frac{\text{Increase in } SO_2 \text{ (mg/L)} \times \text{Gallons wine} \times K^*}{\text{Fraction of full potency} \times 1000}$$

*K values for various reagents: $K_2S_2O_5$ = 6.57; $KHSO_3$ = 7.10 and $NaHSO_3$ = 6.15." This is the final article on sulfur dioxide (Ed.).

SHORT COURSES

1982

April 23-24	Continuing Education in Enology: North Coast Counties	Santa Rosa
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May 15	Topics in Sensory Evaluation of Wine: Chardonnay and Pinot Noir	Davis

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