DETERMINATION OF SULFITE RESIDUE HALF-LIVES ON FUMIGATED TABLE GRAPES

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ABSTRACT:

The purpose of this study was to determine sulfite residue half-lives for several varieties of table grapes fumigated at sufficiently high levels of sulfur dioxide to produce a "blunder" (sulfite level exceeding 10 ppm). The grape varieties studied were Thompson Seedless (white - seedless), Flame Seedless (red - seedless), and Calmeria (red - seeded). These grapes were placed into cold storage; at various times small lots of these grapes were fumigated to simulate use of larger amounts of SO2 than calculated for room size, and failure to vent SO2 from fumigation room at specified time). These grapes were then analyzed for sulfite residues to determine decay rates for these residues.

For low level (10 - 20 ppm) blunders occurring early in the cold storage cycle sulfite residue decay to values below 10 ppm occurs within two days under typical cold storage conditions. The same level of blunder occurring late in the storage cycle requires approximately one week for sulfite residue levels to decrease to below 10 ppm. Somewhat higher level (30 - 50 ppm) blunders appear to require approximately two weeks for the residue levels to decrease to below 10 ppm. High level blunders (100 - 160 ppm) with Flame and Thompson Seedless grapes did not recover to below 10 ppm in two and one-half weeks of cold storage.

OBJECTIVES:

To determine sulfite residue half-lives for several varieties of table grapes fumigated at sufficiently high levels of sulfur dioxide to produce a "blunder" (sulfite level exceeding 10 ppm). To determine these residue half-lives for table grapes at various cold storage times.

PROCEDURES:

Three varieties of table grapes, Thompson Seedless (white - seedless), Flame Seedless (red - seedless), and Calmeria (red - seeded), were collected and placed into cold storage. The bulk of these grapes were subjected to a typical fumigation schedule (once per week at ~ 1000 ppm SO2 for 30 min). At various times during the storage period (9/89 to 1/90) small lots of these grapes were subjected to higher level fumigations to simulate possible types of fumigation blunder ([a] use of larger amounts of SO2 than calculated for room size, and [b] failure to vent SO2 from fumigation room at specified time). The small lots of excessively fumigated table grapes were returned to cold storage and analyzed for sulfite residues to determine decay rates for these residues. This process was repeated so as to obtain decay rates for grapes after various weeks of cold storage.

RESULTS:

The small lots of table grapes subjected to special fumigations were initially analyzed for sulfite residues approximately 24 hours after the fumigation. These grapes were re-analyzed at various time intervals in order to determine what the decay rate or half-life of the sulfite residues would be under typical cold storage conditions. Final results were separated into two categories: LOW LEVEL BLUNDERS in which the 24 hour residue level ranged from ~10 to ~55 ppm SO2, and HIGH LEVEL BLUNDERS in which the 24 hour residue level ranged from ~90 to ~170 ppm SO2.

LOW LEVEL BLUNDERS see Figures 1 - 3: If these occur early in the cold storage cycle and the 24 hour residue levels are in the 10 - 20 ppm range, residue decay occurs rapidly and levels decrease below 10 ppm within two days. If these occur late in the storage cycle (~10 weeks) and the 24 hour residue levels are in the 10 - 20 ppm range, residue decay occurs more slowly and it requires about seven days to get below 10 ppm sulfite residue.

When 24 hour residue levels are in the 30 - 50 ppm range, early storage cycle Calmerias took 14 days for sulfite levels to decay to ~10 ppm. Thompson Seedless grapes fumigated in the eight week of storage to essentially the same level (30 - 40 ppm residues at 24 hours) produced a similar residue decay curve, and therefore also require ~14 days to reach 10 ppm. It should be noted, that when Calmerias and Flames were fumigated in the same chamber, the Flame Seedless grapes acquired significantly higher 24 hour residue levels. It appears, therefore, that Calmerias have some resistance to blunders.

HIGH LEVEL BLUNDERS see Figure 4: Two early storage cycle high level fumigations of Flame Seedless grapes produced conflicting results and need to be re-examined. A first-gassing blunder producing 24 hour residue levels of ~100 ppm recovered to less than 10 ppm residues in about seven days. However, in a second-gassing blunder producing essentially the same 24 hour residue levels, the residue decay leveled off and was still measured at ~20 ppm after 17 days. Early storage cycle Thompson Seedless grapes fumigated to achieve 24 hour residue levels of ~160 ppm produced a decay curve similar to those of mid-cycle (third and fourth week) Flame Seedless grapes. Residue levels appear to continue to gradually decrease, but still exceed 60 ppm after 17 days in storage.

CONCLUSIONS:

In all but one instance of high level blunders with Flame and Thompson Seedless grapes, sulfite residue levels did not recover to below 10 ppm in two and one-half weeks of cold storage. One can conclude that this is not an effective treatment for the depuration of high level sulfite residues.

Recovery from low level (10 - 20 ppm) blunders occurring early in the cold storage cycle should pose minimal problems for the industry. Sulfite residue decay to values below 10 ppm occurs within two days under typical cold storage conditions. The same level of blunder occurring late in the storage cycle requires approximately one week of typical cold storage conditions for sulfite residue levels to decrease to below 10 ppm. Somewhat higher level (30 - 50 ppm) blunders appear to require

approximately two weeks of typical cold storage conditions for the residue levels to decrease to below 10 ppm. Depuration rates under storage conditions that are warmer and/or have more air movement, may be greater than those determined in this study.

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FIGURE 2

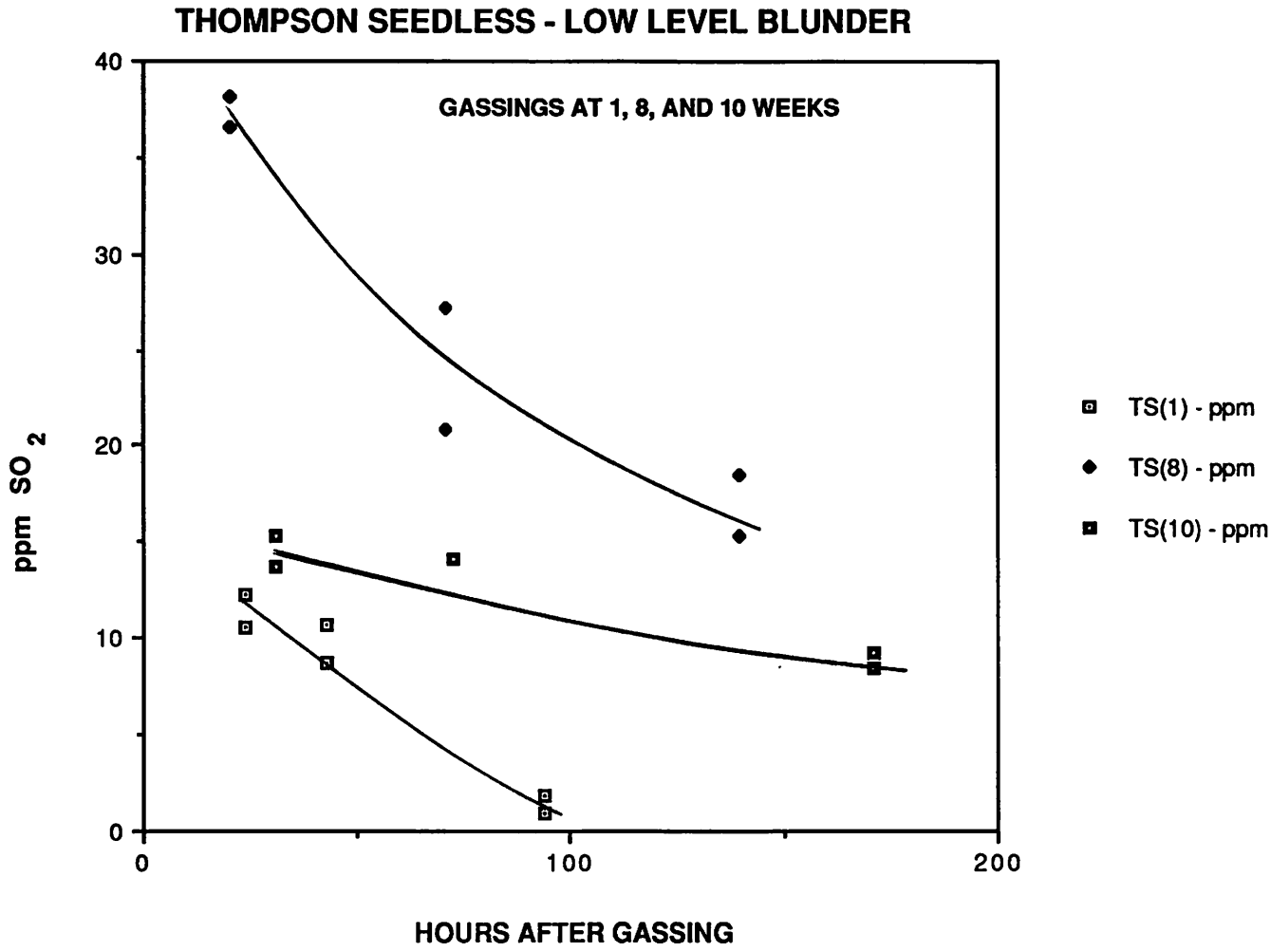

THOMPSON SEEDLESS - LOW LEVEL BLUNDER
GASSINGS AT 1, 8, AND 10 WEEKS
ppm SO 2
40
30
20
10
0
0
100
200
HOURS AFTER GASSING
TS(1) - ppm
TS(8) - ppm
TS(10) - ppm

FIGURE 1

FLAME SEEDLESS - LOW LEVEL BLUNDERS

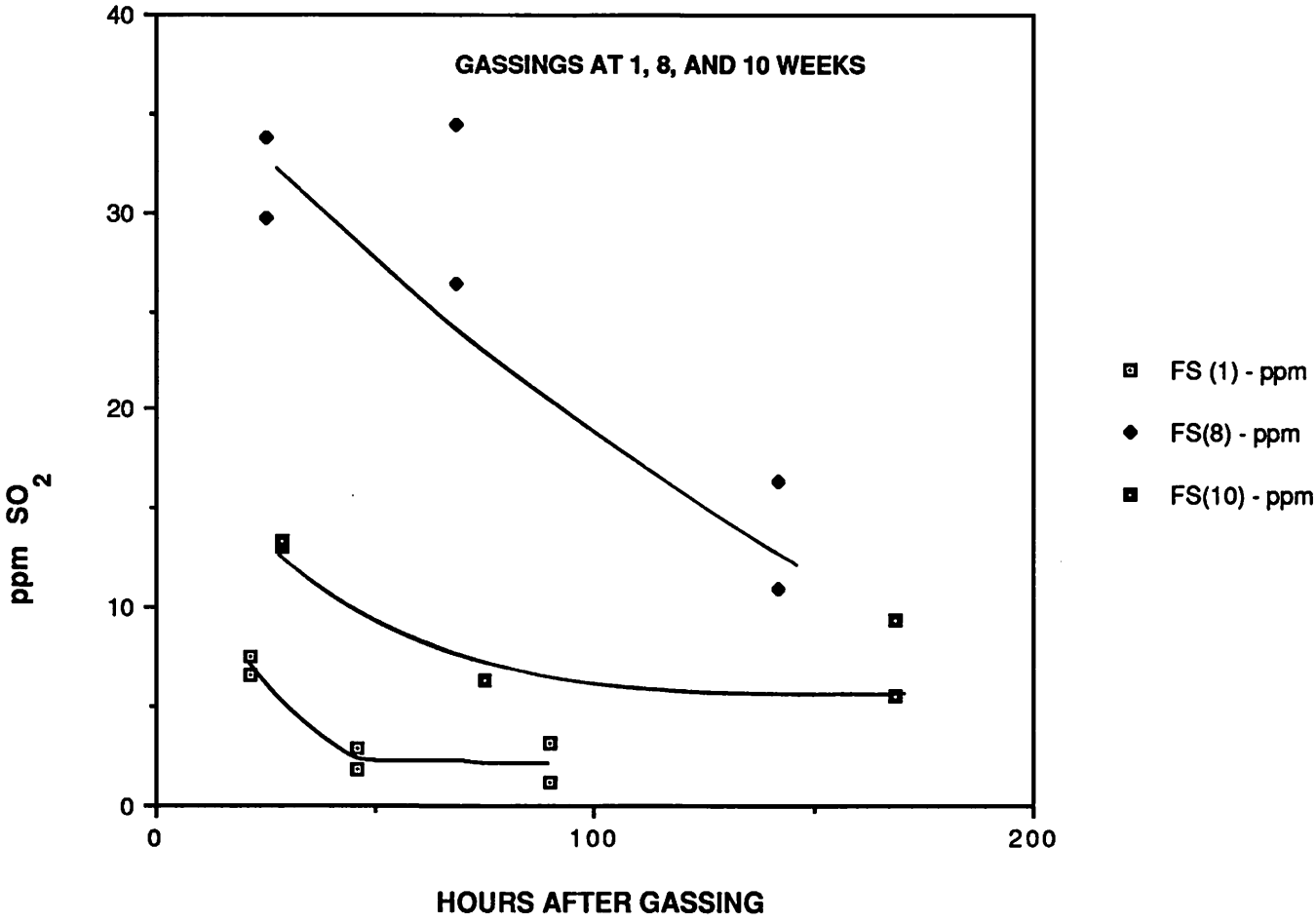


FIGURE 3

CALMERIA - LOW LEVEL BLUNDERS

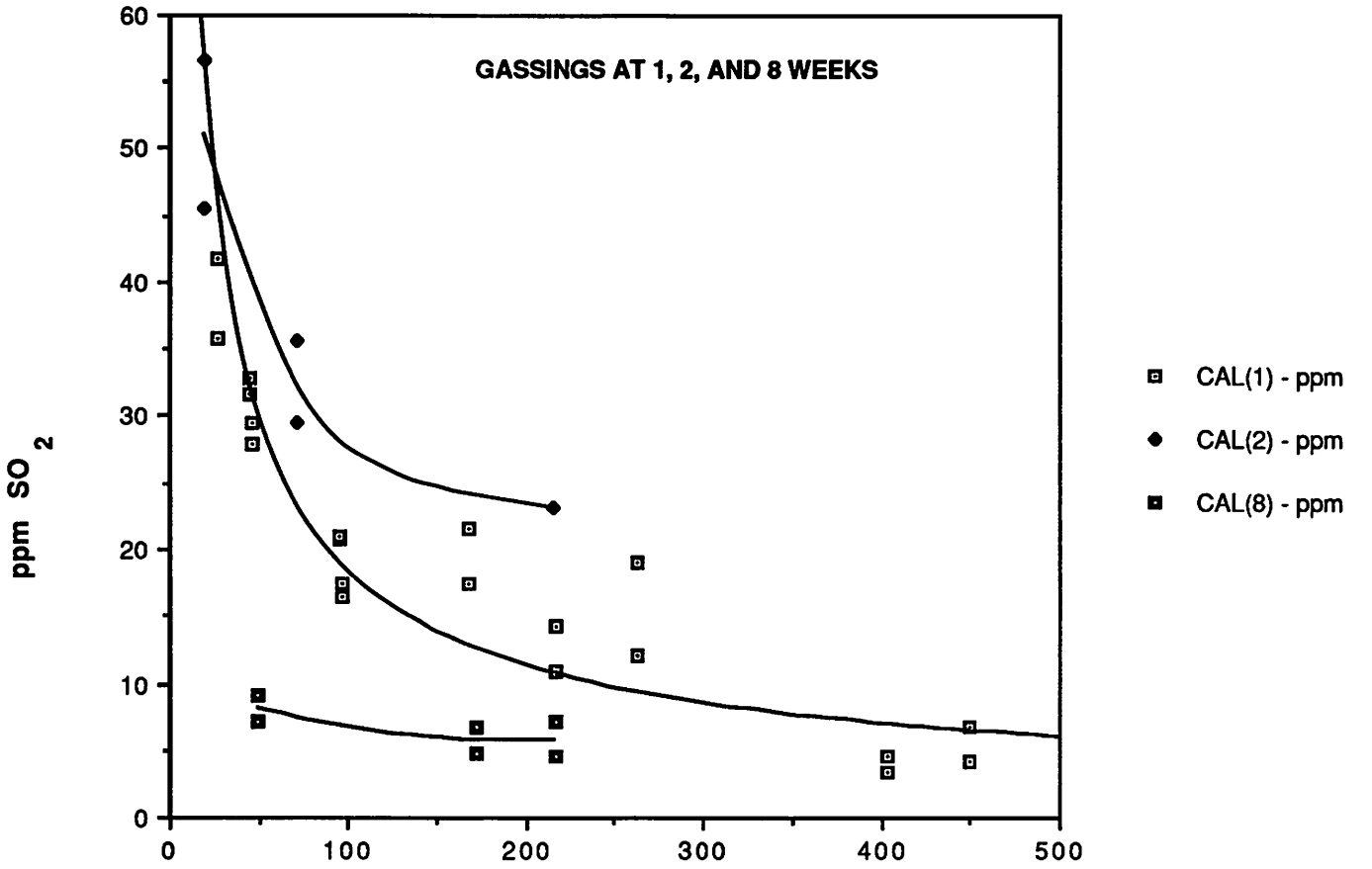
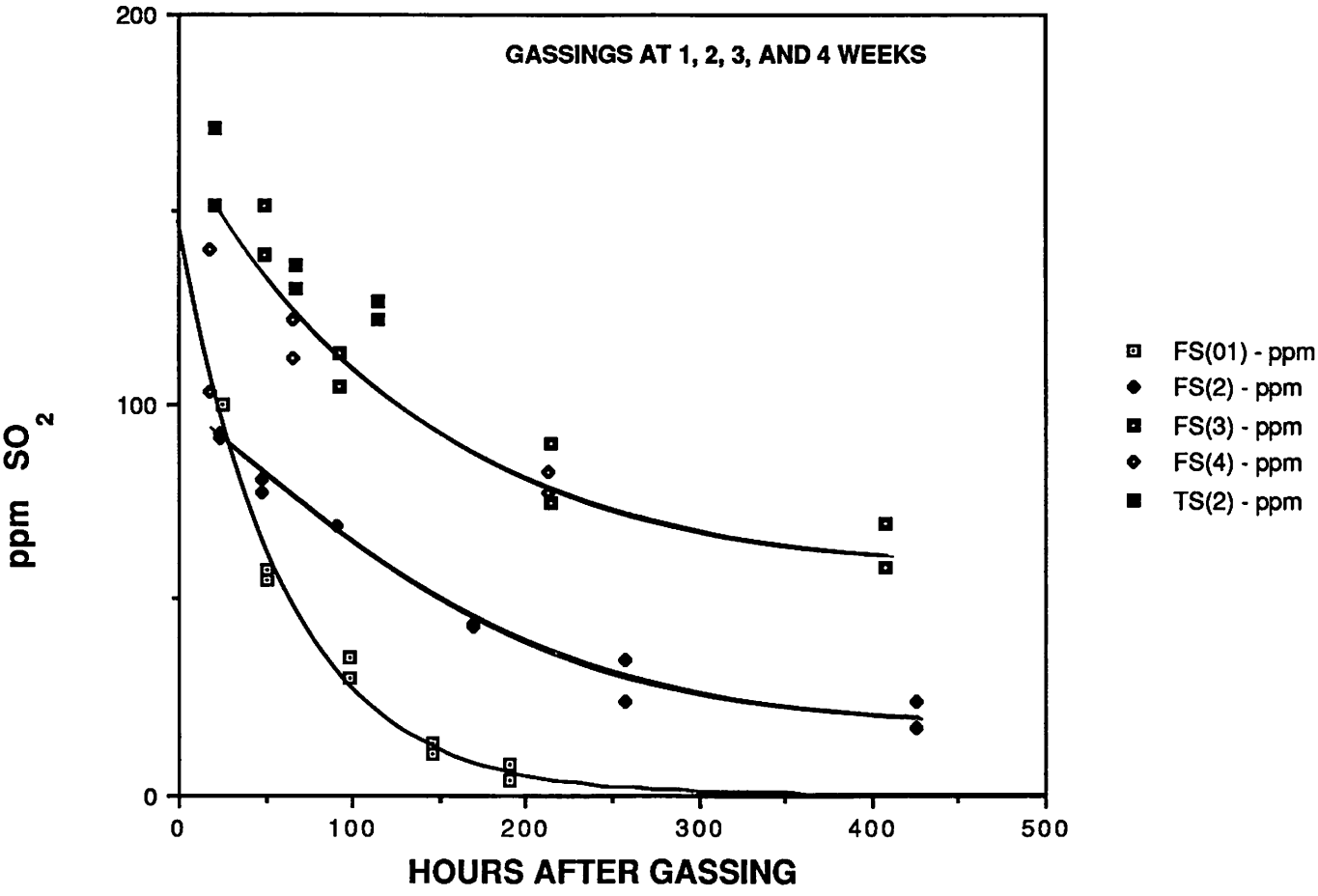


FIGURE 4

FLAME & THOMPSON SEEDLESS - HIGH LEVEL BLUNDER



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BUDGET SUMMARY:

Original budget: $ 6,000

Expenditures:

Salaries and Benefits	$ 1843.28
Supplies	153.68
Equipment (HPLC detector, co-funded with School of Natl. Science $3,000 and Dept. of Chemistry $1,000)	2546.00
Clerical/Library Services	44.51
Total Direct	4587.47
Foundation Indirect @ 15%	688.12
Total	5275.59

Money remaining will be used to train in the use of the HPLC detector and to continue to measure sulfite residues on grapes in storage.

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