Colorado State University

CSU Enology Program

SO_2, Acid, Sorbate Considerations

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Weight (Grams) of Sulfur Dioxide (SO_2) or Potassium Metabisulfite ($K_2S_20_5$) Added to One Gallon of Wine to Produce Various Levels (ppm) of Sulfur Dioxide[1] at pH 3.40								
PPM SO_2	SO_2	$K_2S_2O_5$	PPM SO_2	SO_2	$K_2S_2O_5$	PPM SO_2	SO_2	$K_2S_2O_5$
1	0.0037	0.0064	35	0.1303	0.2241	68	0.2532	0.4354
2	0.0074	0.0128	36	0.1340	0.2305	69	0.2569	0.4418
3	0.0112	0.0192	37	0.1378	0.2369	70	0.2606	0.4482
4	0.0149	0.0256	38	0.1415	0.2433	71	0.2643	0.4547
5	0.0186	0.0320	39	0.1452	0.2497	72	0.2681	0.4611
6	0.0223	0.0384	40	0.1489	0.2561	73	0.2718	0.4675
7	0.0261	0.0448	41	0.1526	0.2625	74	0.2755	0.4739
8	0.0298	0.0512	42	0.1564	0.2689	75	0.2792	0.4803
9	0.0335	0.0576	43	0.1601	0.2754	76	0.2829	0.4867
10	0.0372	0.0640	44	0.1638	0.2818	77	0.2867	0.4931
11	0.0410	0.0704	45	0.1675	0.2882	78	0.2904	0.4995
12	0.0447	0.0768	46	0.1713	0.2946	79	0.2941	0.5059
13	0.0484	0.0832	47	0.1750	0.3010	80	0.2978	0.5123
14	0.0521	0.0896	48	0.1787	0.3074	81	0.3016	0.5187
15	0.0558	0.0961	49	0.1824	0.3138	82	0.3053	0.5251
16	0.0596	0.1025	50	0.1862	0.3202	83	0.3090	0.5315
17	0.0633	0.1089	51	0.1899	0.3266	84	0.3127	0.5379
18	0.0670	0.1153	52	0.1936	0.3330	85	0.3165	0.5443
19	0.0707	0.1217	53	0.1973	0.3394	86	0.3202	0.5507
20	0.0745	0.1281	54	0.2010	0.3458	87	0.3239	0.5571
21	0.0782	0.1345	55	0.2048	0.3522	88	0.3276	0.5635
22	0.0819	0.1409	56	0.2085	0.3586	89	0.3313	0.5699
23	0.0856	0.1473	57	0.2122	0.3650	90	0.3350	0.5763
24	0.0894	0.1537	58	0.2159	0.3714	91	0.3388	0.5827
25	0.0931	0.1601	59	0.2197	0.3778	92	0.3425	0.5891
26	0.0968	0.1665	60	0.2234	0.3842	93	0.3462	0.5955
27	0.1005	0.1729	61	0.2271	0.3906	94	0.3500	0.6019
28	0.1042	0.1793	62	0.2308	0.3970	95	0.3537	0.6083
29	0.1080	0.1857	63	0.2345	0.4034	96	0.3574	0.6147
30	0.1117	0.1921	64	0.2383	0.4098	97	0.3611	0.6211
31	0.1154	0.1985	65	0.2420	0.4162	98	0.3649	0.6275
32	0.1191	0.2049	66	0.2457	0.4226	99	0.3686	0.6340
33	0.1229	0.2113	67	0.2494	0.4290	100	0.3723	0.6404
34	0.1266	0.2177						
1 All weights are bases upon: 1 gallon of wine = 8.2 lbs.								

Proceedings of New York Wine Industry Workshop, March 4 and 5
New York State Agricultural Experiment Station, Dept. of Food Science and Technology

CALCULATING ACID ADDITIONS

Desired – Actual (acid level) = Grams of Tartaric to add
If adding malic acid, multiply grams by .067/.075 = **.894**
If adding citric acid, multiply grams by .064/.075 = **.853**

Example
Your wine has an acidity of .585 grams/100mls.
You would like an acidity of .705 grams/100mls.

.705 - .585 = .12grams/100mls. Multiply by 10 to get grams/liter.
So you would add .12 x 10 = 1.2 grams/liter

1.2 x .894 = 1.07 grams malic acid
1.2 x .853 = 1.02 grams citric acid

Source: Bonnie Abrams, *American Wine Society Journal*

ACID ADDITIONS											
TARTARIC				MALIC				CITRIC			
TA INCREASE	LBS./ 1000	MLS/ 100ML	MLS/ 500ML	TA INCREASE	LBS./ 1000	MLS/ 100ML	MLS/ 500ML	TA INCREASE	LBS./ 1000	MLS/ 100ML	MLS/ 500ML
0.0125	1.04	.013	0.65	0.0125	0.93	0.12	0.58	0.0125	0.89	0.11	0.56
0.0250	2.08	0.26	1.30	0.0250	1.86	0.23	1.16	0.0250	1.78	0.22	1.11
0.0375	3.13	0.39	1.95	0.0375	2.79	0.35	1.75	0.0375	2.67	0.33	1.67
0.0500	4.17	0.52	2.60	0.0500	3.72	0.47	2.33	0.0500	3.56	0.44	2.22
0.0625	5.21	0.65	3.26	0.0625	4.65	0.58	2.91	0.0625	4.44	0.56	2.78
0.0750	6.25	0.78	3.91	0.0750	5.59	0.70	3.49	0.0750	5.33	0.67	3.33
0.0875	7.29	0.91	4.56	0.0875	6.52	0.81	4.07	0.0875	6.22	0.78	3.89
0.1000	8.33	1.04	5.21	0.1000	7.45	0.93	4.65	0.1000	7.11	0.89	4.44
0.1125	9.38	1.17	5.86	0.1125	8.38	1.05	5.24	0.1125	8.00	1.00	5.00
0.1250	10.42	1.30	6.51	0.1250	9.31	1.16	5.82	0.1250	8.89	1.11	5.55
0.1375	11.46	1.43	7.16	0.1375	10.24	1.28	6.40	0.1375	9.78	1.22	6.11
0.1500	12.50	1.56	7.81	0.1500	11.17	1.40	6.98	0.1500	10.67	1.33	6.67
0.1625	13.54	1.69	8.46	0.1625	12.10	1.51	7.56	0.1625	11.55	1.44	7.22
0.1750	14.58	1.82	9.11	0.1750	13.03	1.63	8.15	0.1750	12.44	1.56	7.78
0.1875	15.63	1.95	9.77	0.1875	13.96	1.75	8.73	0.1875	13.33	1.67	8.33
0.2000	16.67	2.08	10.42	0.2000	14.89	1.86	9.31	0.2000	14.22	1.78	8.89
0.2125	17.71	2.21	11.07	0.2125	15.83	1.98	9.89	0.2125	15.11	1.89	9.44
0.2250	18.75	2.34	11.72	0.2250	16.76	2.09	10.47	0.2250	16.00	2.00	10.00
0.2375	19.79	2.47	12.37	0.2375	17.69	2.21	11.05	0.2375	16.89	2.11	10.55
0.2500	20.83	2.60	13.02	0.2500	18.62	2.33	11.64	0.2500	17.78	2.22	11.11
0.2625	21.88	2.73	13.67	0.2625	19.55	2.44	12.22	0.2625	18.66	2.33	11.67
0.2750	22.92	2.86	14.32	0.2750	20.48	2.56	12.80	0.2750	19.55	2.44	12.22
0.2875	23.96	2.99	14.97	0.2875	21.41	2.68	13.38	0.2875	20.44	2.56	12.78
0.3000	25.00	3.13	15.63	0.3000	22.34	2.79	13.96	0.3000	21.33	2.67	13.33
0.3125	26.04	3.26	16.28	0.3125	23.27	2.91	14.55	0.3125	22.22	2.78	13.89
0.3250	27.08	3.39	16.93	0.3250	24.20	3.03	15.13	0.3250	23.11	2.89	14.44
0.3375	28.13	3.52	17.58	0.3375	25.13	3.14	15.71	0.3375	24.00	3.00	15.00
0.3500	29.17	3.65	18.23	0.3500	26.06	3.26	16.29	0.3500	24.89	3.11	15.55
0.3625	30.21	3.78	18.88	0.3625	27.00	3.37	16.87	0.3625	25.78	3.22	16.11
0.3750	31.25	3.91	19.53	0.3750	27.93	3.49	17.45	0.3750	26.66	3.33	16.66
0.3875	32.29	4.04	20.18	0.3875	28.86	3.61	18.04	0.3875	27.55	3.44	17.22
0.4000	33.33	4.17	20.83	0.4000	29.79	3.72	18.62	0.4000	28.44	3.56	17.78

Table courtesy of Robert Distler, Taylor Wine Co.

DISTRIBUTION OF FREE SO_2 AS A FUNCTION OF pH				
pH	**% SO_2 (Molecular)**	**% HSO_3**	**% SO_3^2**	**Free SO_2 to Obtain 0.8 ppm Molecular SO_2**
2.9	7.5	92.5	0.009	11 ppm
3.0	6.1	93.9	0.012	13 ppm
3.1	4.9	95.1	0.015	16 ppm
3.2	3.9	96.1	0.019	21 ppm
3.3	3.1	96.8	0.024	26 ppm
3.4	2.5	97.5	0.030	32 ppm
3.5	2.0	98.0	0.038	40 ppm
3.6	1.6	98.4	0.048	50 ppm
3.7	1.3	98.7	0.061	63 ppm
3.8	1.0	98.9	0.077	79 ppm
3.9	0.8	99.1	0.097	99 ppm
4.0	0.6	99.2	0.122	125 ppm

Table courtesy of Clark Smith, *Enology Briefs*, Vol. 1 No. 1, February/March 1982. University of California Davis.

CONCENTRATION (%) OF ACTIVE SORBIC ACID AS A FUNCTION OF pH																
pH	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.2	4.3	4.8
% Undissociated Sorbic Acid	99.0	98.9	98.4	98.0	97.5	96.9	96.2	95.2	94.1	92.6	90.9	88.8	86.3	79.9	76.0	50.0

Bonnie Abrams, *American Wine Society Journal*

SOME COMMONLY USED WINE TREATMENT MATERIALS AND CORRESPONDING THEORETICAL LEVEL INCREASES

POTASSIUM SORBATE (regulatory limit = 1000 ppm) 27 CFR 240.1051

Grams of Potassium Sorbate – (.005092 x gals wine) = sorbate level (ppm)

Example:

22.43 lbs. of potassium sorbate added to 10,000 gals of wine.

22.43 lbs. = 10,183 grams (454 grams per lb.)
10,183 / (0.005092 x 10,000 gals.)
10,183 / 50.92 = 199.7 ppm (sorbate level)
2 mls per gal. = 250 - 300 ppm liquid sorbate

SULFUR DIOXIDE (regulatory limit = 350 ppm) 27 CFR 4.22 (b) (1)

1. Wine

    a) 1 lb. potassium metabisulfite/1000 gals. wine = 69 ppm SO_2

    b) 1 lb. sodium bisulfite/ 1000 gals. wine = 74 ppm SO_2

    c) 1 lb. liquid sulfur dioxide/ 1000 gals. wine = 120 ppm SO_2

2. Tons of Grapes

    a) 1 oz. of potassium metabisulfite / tons grapes = 18 ppm SO_2

    b) 1 oz. of sodium bisulfite / ton grapes = 19 ppm SO_2

    c) 1 oz. of tank (liquid) sulfur dioxide / ton = 30 ppm SO_2

ACIDULANTS (regulatory limit for correction of acid deficient wines = 8 ppt)
27 CFR 240.364

a) 1 lb. citric acid / 1000 gals. wine = TA increase of 0.13 ppt

b) 1 lb. malic acid / 1000 gals. wine = TA increase of 0.125 ppt

c) 1lb. tartaric acid per 1000 gals. wine = TA increase of 0.11 ppt

CONVERSION FACTORS
1 lb. = 454 grams
1 kg = 1000 grams
1 kg = 2.2 lbs.
1 gal. = 3.8 liters
1 ppt = 1 g/l or 0.1 g/100mls
1 ppm = 1 mg/l