PURDUE UNIVERSITY

Wine Grape Action Team
Day Camp for Small Scale Commercial Winemaking

Quality Control Basics For New Wineries

Christian E. BUTZKE
Enology Professor – Purdue University

butzke@purdue.edu 1.765.494.6500 indianaquality.org

Quality Control Basics For New Wineries

- Sugar
- Acidity
- Sulfur Dioxide

Wine Quality Control Basics

Parameter	Measurement
Sugar	Brix
Acidity	pH, T.A.
Sulfur Dioxide	Free SO_2

Wine Quality Control Basics

- Sugar as “Brix”

Why?

- Indicates fruit ripeness
- Determines alcohol in wine
- Indicates state/end of fermentation

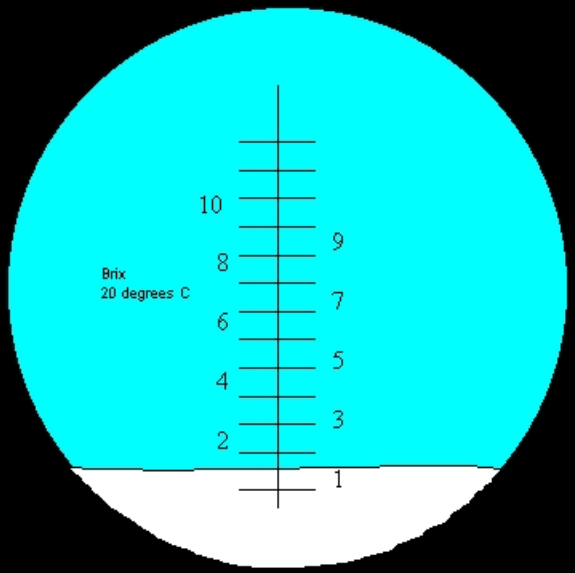
How?

- In grapes, fresh juice: Refractometer
- In fermenting juice/wine: Hydrometer

Wine Quality Control Basics

- Sugar as “Brix”

How? • In grapes, fresh juice: Refractometer



Based upon sugars’ ability to refract light

Wine Quality Control Basics

Sugar as “Brix”

- Introduced in 1870 by Adi Brix.
- A scale calibrated at a specified temperature (US: 20°C/68°F).
- Equals the weight percentage of sugar in juice/wine.
- Expressed in grams of sugar in 100 grams of juice/wine.

Wine Quality Control Basics

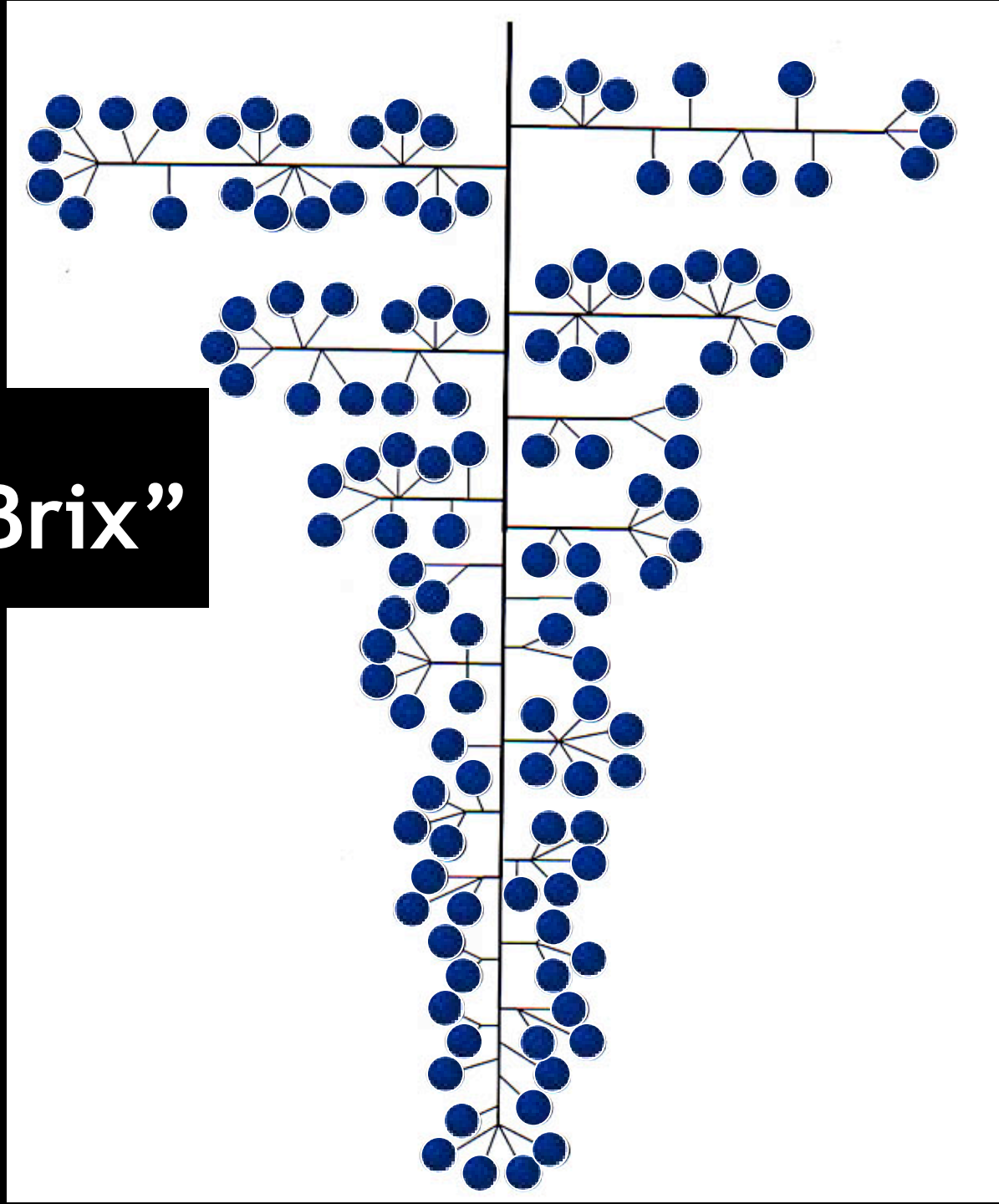
- Sugar as “Brix”

Brix Comparison:

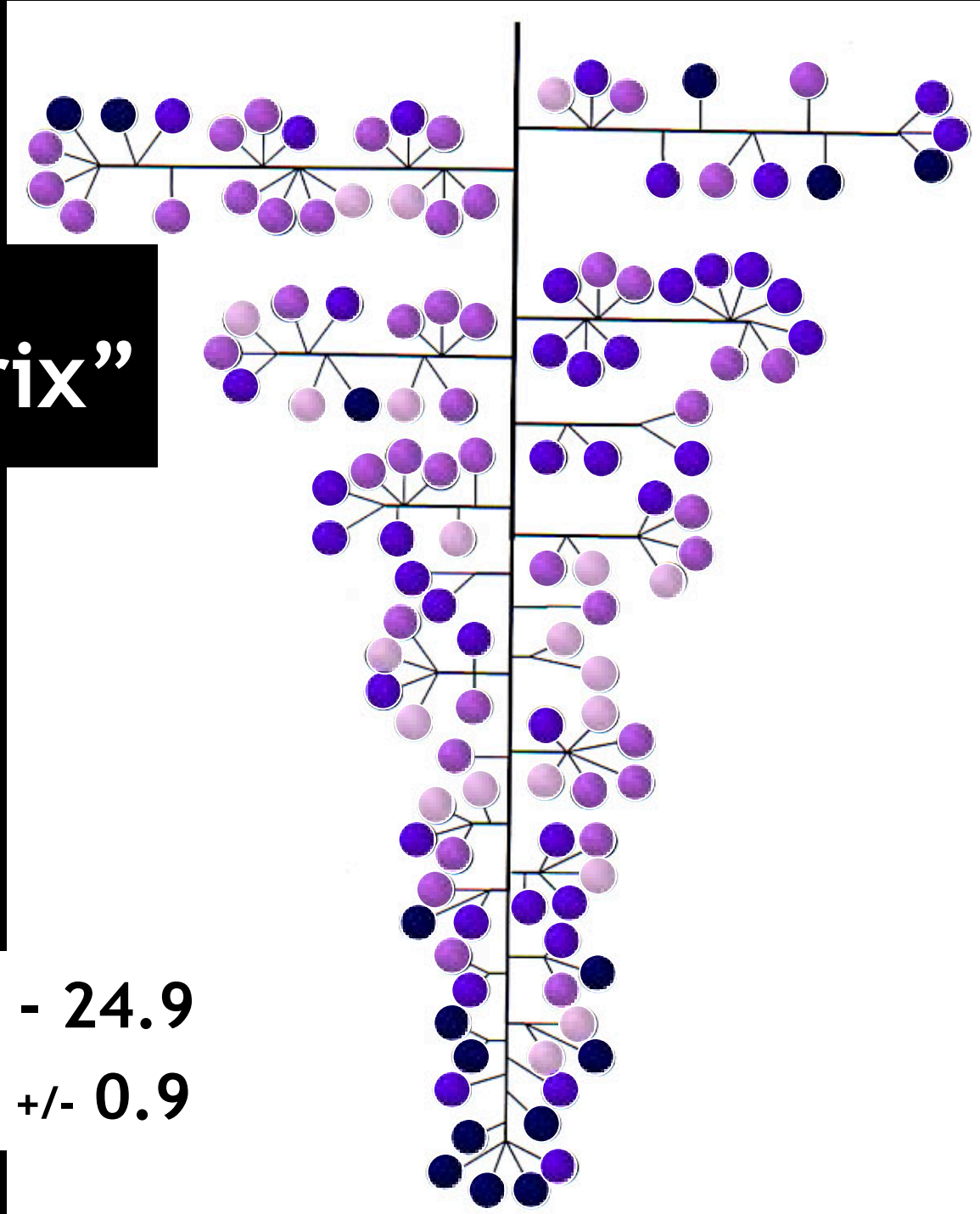
- Grape juice: 18 to 26
- Apple juice: 14
- Cola: 11
- Ginger ale: 9.5

Sugar as “Brix”

- Sugar as “Brix”



Sugar as “Brix”



Brix

- 20.0 - 21.1
- 21.1 - 22.1
- 22.1 - 23.0
- 23.0 - 24.9

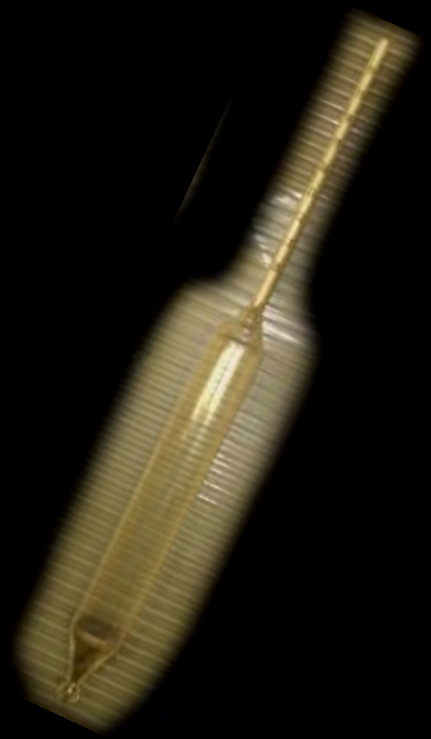
Range: 20.0 - 24.9

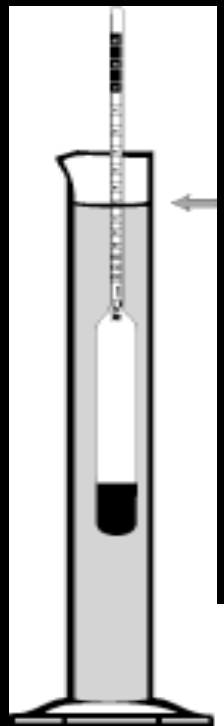
Mean: 22.1 +/- 0.9

Wine Quality Control Basics

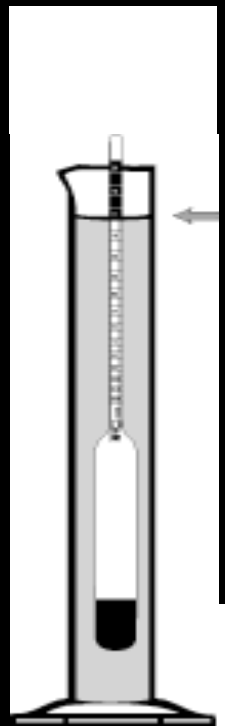
- Sugar as “Brix”

How? • In fermenting juice/wine: Hydrometer

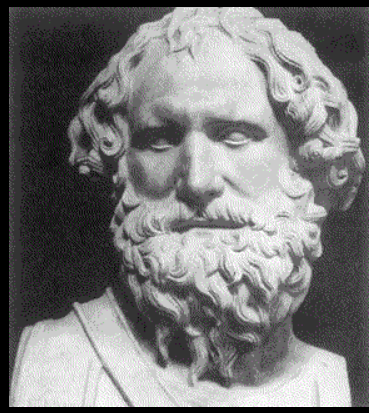




Start

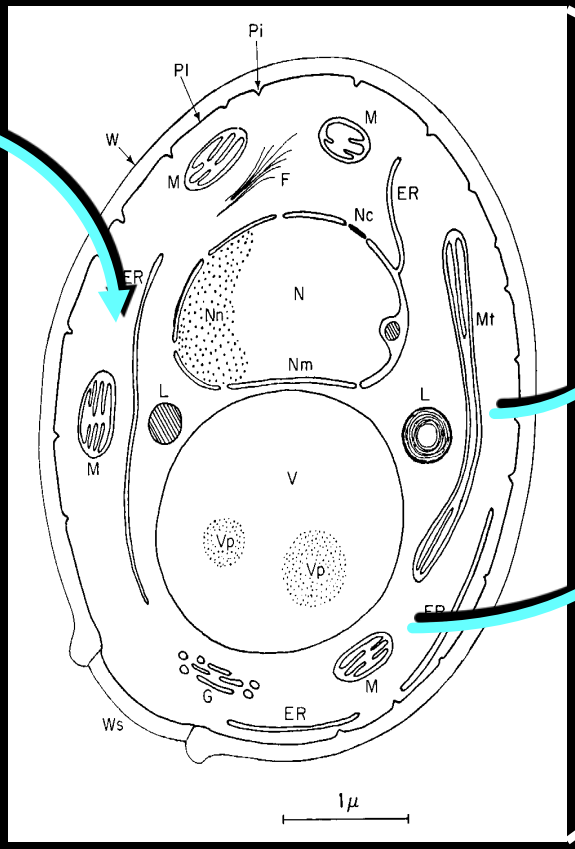


Finish



Alcoholic Fermentation

SUGAR



CO_2

+

ALCOHOL

human hair

WINE YEAST *(Saccharomyces cerevisiae)*

Alcoholic Fermentation

- Sugar as “Brix”

Conversion of sugar to alcohol

% Alcohol = (Brix - 3) * (0.58 to 0.66)

Example: 22 Brix => 11.0 - 12.5

Average: 11.8 ± 0.8

Alcoholic Fermentation

- Sugar as “Brix”

Addition of sugar (“Chaptalization”)

1 Brix adds 0.62% Alcohol

1 Brix = 41 grams of sugar/gallon

Alcoholic Fermentation

- Residual Sugar "R.S."

What's dry?

Recognition threshold sweetness	> 5 g/L (0.5%)
To *smoothen* a wine	1 to 4 g/L
Very acidic wine styles (incl. sparkling)	15 g/L R.S.
Microbial stability (no growth/carbonation)	< 1 g/L (0.1%)
If measuring *all* reducing sugars	< 2 g/L (0.2%)
Brettanomyces yeast or ML bacteria	< 2 g/L
Visible *Brettanomyces* haze	0.1 g/L *(pentoses)*
500 mg/L CO_2	1 g/L
Spritz at 800 mg/L CO_2	> 1.6 g/L R.S.
Pushing of corks at 1,400 mg/L (68˚F)	> 2.8 g/L R.S.

Alcoholic Fermentation

PURDUE UNIVERSITY

The Indiana Wine Grape Council

Residual Sugar in Wine

1 sugar test tablet + 10 drops of wine; read after 15 s

NEGATIVE	¼ %	½ %	¾ %	1 %	2+ %
NEGATIVE	2.5 g/L	5 g/L	7.5 g/L	10 g/L	20+ g/L

"dry"

CEB 2005

Wine Quality Control Basics

- Acidity as pH

Why?

- Determines anti-microbial activity of sulfur dioxide
- Influences aging reactions
- Impacts protein and color stability

How?

- pH Meter

Wine Quality Control Basics

- Acidity as T.A.

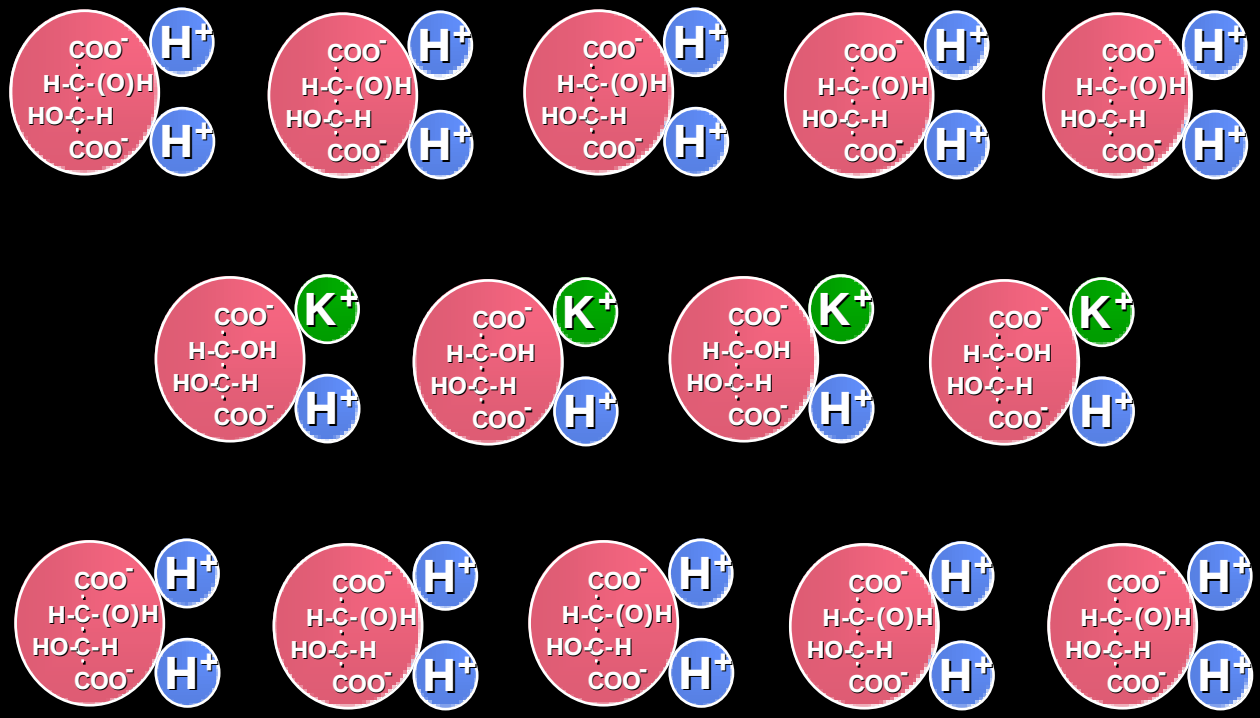
Why?

- Indicates fruit ripeness
- Determines perceived tartness of a wine

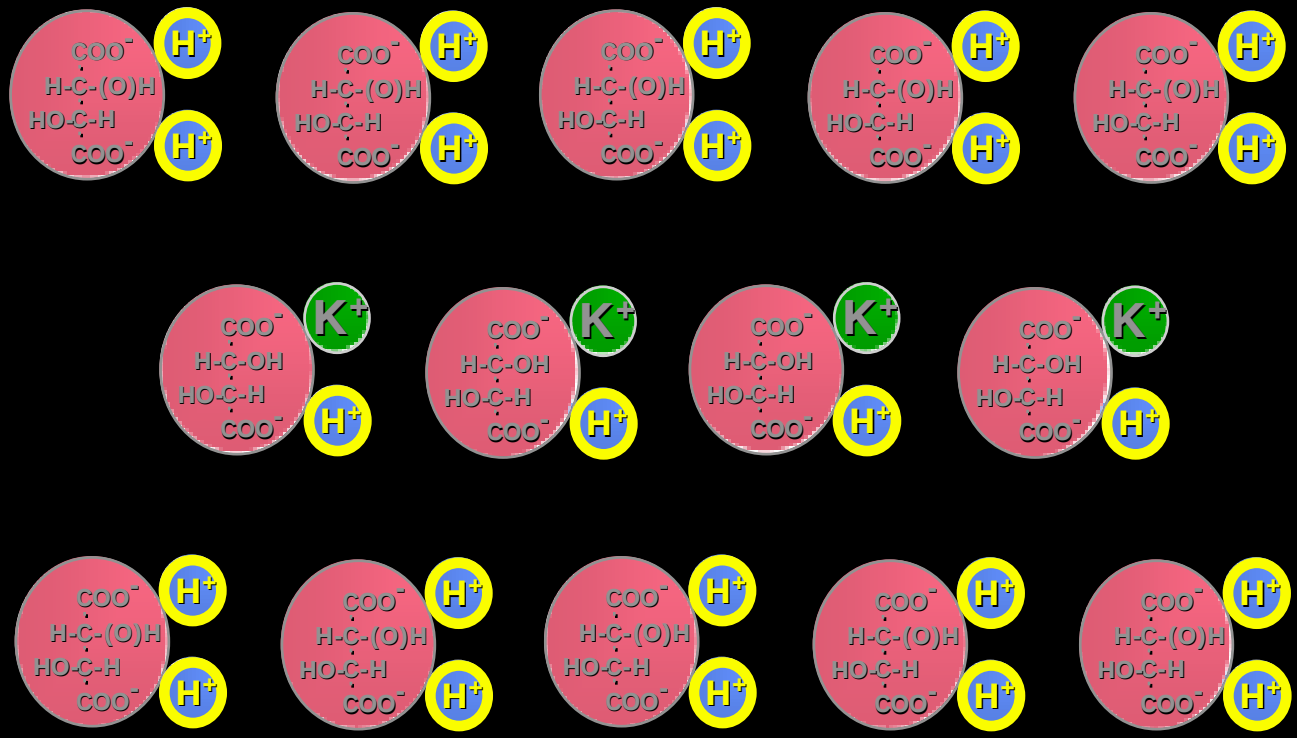
How?

- Titration of acids/salts against base

Juice / Wine Acids & Salts



TITRATABLE Acidity (T.A.)



Wine Quality Control Basics

- Sulfur Dioxide as Free SO_2

Why?

1. Microbial stability
2. Inhibition of browning enzymes
3. Binding of acetaldehyde
4. Antioxidant

How?

- Aeration/Oxidation method

"Small Scale" Winemaking

IMPORTANT: Volume-to-Surface Ratios

		cm^2/L	
Carboy	5 gal	206	4
Barrel	60 gal	92	2
Tank	500 gal	48	1

"CONTAINS SULFITES"

Sulfur Dioxide

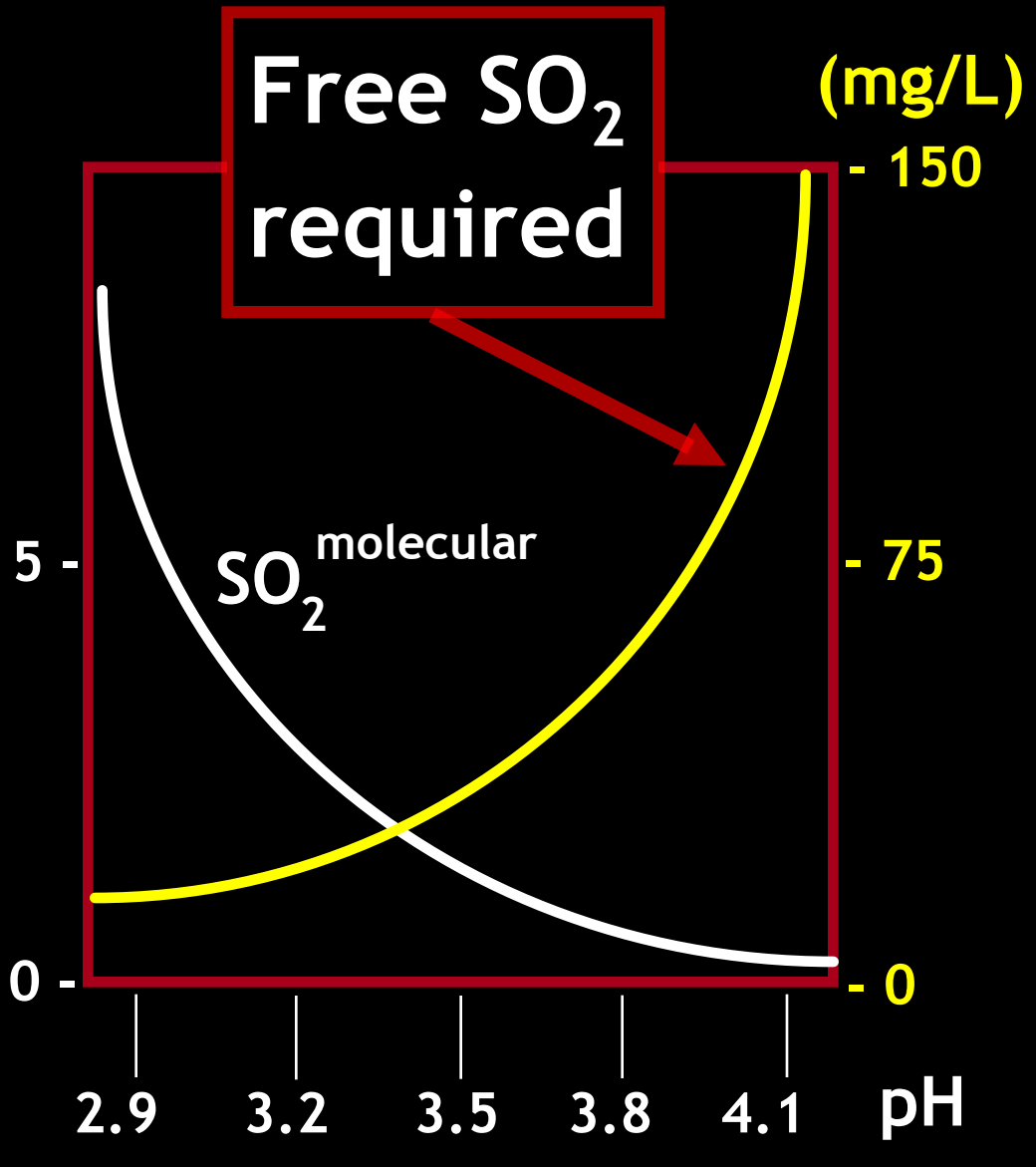
- Total SO_2 allowed: 350 mg/L (why?)
- Labeling required: ≥ 10 mg/L
- Commercial average: 74 mg/L
- Produced by yeast: 1 - 14 mg/L

Microbial Stability and SO_2

SO_2 sensitivity:

- Saccharomyces? NO!
- Malolactic bacteria? YES!
- Candida/Kloeckera? YES!
- Brettanomyces? YES!

Microbial Stability, pH and SO_2



pH and Molecular SO_2

$$\text{Free } SO_2 \text{ REQUIRED} = 0.85 \bullet (1 + 10^{pH - 1.83})$$

- Decrease pH by 0.1 => use ≈ 20% less SO_2
- Decrease pH by 0.3 => use ≈ 50% less SO_2

pH and SO_2

For Professionals Only

PURDUE UNIVERSITY

The Indiana Wine Grape Council

Free SO_2 required at Wine pH (mg/L)

3.0		3.1		3.2		3.3		3.4		3.5		3.6		3.7		3.8		3.9	
3.00	13	3.10	16	3.20	20	3.30	25	3.40	32	3.50	40	3.60	50	3.70	63	3.80	79	3.90	100
3.01	13	3.11	16	3.21	20	3.31	26	3.41	32	3.51	41	3.61	51	3.71	64	3.81	81	3.91	102
3.02	13	3.12	17	3.22	21	3.32	26	3.42	33	3.52	42	3.62	52	3.72	66	3.82	83	3.92	105
3.03	13	3.13	17	3.23	21	3.33	27	3.43	34	3.53	43	3.63	54	3.73	68	3.83	85	3.93	107
3.04	14	3.14	17	3.24	22	3.34	28	3.44	35	3.54	44	3.64	55	3.74	69	3.84	87	3.94	110
3.05	14	3.15	18	3.25	22	3.35	28	3.45	35	3.55	45	3.65	56	3.75	71	3.85	89	3.95	112
3.06	14	3.16	18	3.26	23	3.36	29	3.46	36	3.56	46	3.66	57	3.76	72	3.86	91	3.96	115
3.07	15	3.17	19	3.27	23	3.37	29	3.47	37	3.57	47	3.67	59	3.77	74	3.87	93	3.97	117
3.08	15	3.18	19	3.28	24	3.38	30	3.48	38	3.58	48	3.68	60	3.78	76	3.88	95	3.98	120
3.09	15	3.19	19	3.29	25	3.39	31	3.49	39	3.59	49	3.69	62	3.79	78	3.89	98	3.99	123
3.10	16	3.20	20	3.30	25	3.40	32	3.50	40	3.60	50	3.70	63	3.80	79	3.90	100	4.00	126

Molecular SO_2 : 0.85 mg/L

CEB 2005

PURDUE UNIVERSITY

Wine Grape Action Team

Winemaking Ethics

- Stay with TTB permitted ingredients !
- Do quality control on your grapes, juice and wine !
- Don’t add more chemicals than needed !
- Make wine as naturally and pure as possible !
- Don’t falsify or artificially enhance your wine !
- Use locally grown fruit as much as possible !