Winemaking and Residual Sugar

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Outline:

Residual Sugar

Verifying end of alcoholic fermentation.
Quick & reasonably accurate determination using *Clinitest* tablets.
Stabilization of "sweet" wines using potassium sorbate.
(*Caveat emptor*: Friendly warning about commercial "wine conditioner")

Residual Sugar (RS)

- **Definition**
  The concentration of sugar remaining after fermentation is allowed to “finish”.

- A “dry” table wine will finish with 0.1-0.3% RS
- It’s considered to be “dry” because the residual sugars are non-fermentable (i.e., pentose sugars)

Residual Sugar

Categories of Wine Sweetness

Dry White	0.1 – 0.2%	1-2 g/L
Dry Red	0.2 – 0.3%	2-3 g/L ***
Off-Dry	1.0 – 3.0%	10-30 g/L
Sweet	> 3%	> 30 g/L
Port/Sherry	5-15%	50-150 g/L
Dessert/ Ice wines	10-20%	100-200 g/L

Risk of Refermentation in the Bottle

- If fermentable sugars (~0.5% or greater) and yeast remain in your wine, a second fermentation is likely to occur (Unexpected fizzy, yeasty wine upon opening).

- Viable yeast populations in “finished” wine are highly variable and require careful microscopic analysis to quantify (Usually unavailable to the small winemaking operation).

- Filtration at 1 micron (or smaller; absolute) is necessary to remove 99% of viable yeast. This is difficult to achieve without expensive filtration equipment.

Accurate Measurement of Residual Sugar Level

- The estimates of sugar remaining at the end of fermentation obtained via hydrometer or refractometer are NOT ACCURATE ENOUGH for the determination of trace amounts of residual sugar that could lead to an unwanted refermentation.

- **Clinitest Tablets** (developed for testing the sugar content of urine in diabetics) provide a fast, inexpensive and accurate means for measuring residual sugar levels of wine. The tablets contain copper and self-heating compounds that react with sugar. The color of the product produced by this reaction is related to the amount of sugar in the wine sample.

- Precision level = 0.1% RS

Clinitest Procedure

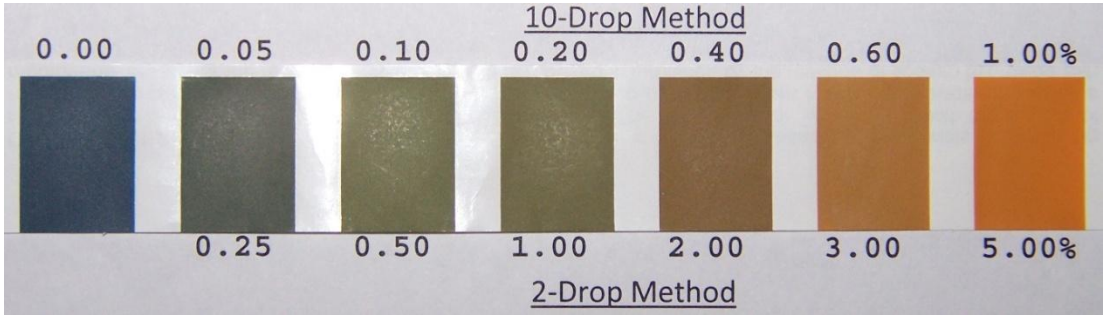
- **Apparatus**: Clinitest tablets, large-format test tube, eye dropper, Clinitest color chart (,distilled water).

- **Procedure**:
  1) Add 10 drops (0.5 ml) of wine sample to a test tube
  2) Drop 1 Clinitest tablet into the same test tube.
  3) Observe heat-producing reaction and wait for it to finish. (Gently shaking in circular motion) (Caution: HOT)
  4) Match final color of test tube contents to Clinitest color chart to determine %sugar level.

  (If brownish “pass thru” occurs the %sugar exceeds 1% and you must retest using a 1:5 dilution)

Clinitest Procedure

Clinitest Color Chart (Facsimile)



Warning: Don't use photocopied, scanned or online copies of the Clinitest chart since the colors will probably not be accurately reproduced. An accurate chart is supplied with each bottle of Clinitest tablets.

See http://www.moundtop.com/sugar/ResidualSugar-procedure.pdf for details.

Potassium Sorbate
Stabilization of Sweet Wines

- If residual sugar exceeds the “dry” level, any viable yeast cells remaining in the wine can be inhibited using sorbic acid.
- Obviously, “back sweetened” wines will need to be stabilized with a yeast inhibitor also.
- Amateur winemakers can add sorbic acid to their wine via a granular white compound called potassium sorbate (aka K-Sorbate).
- Sorbic acid does NOT kill viable yeast cells. Instead, it INHIBITS their reproduction by interfering with their ability to “bud off” daughter cells.
- Sorbic acid does not kill most forms of bacteria. Hence, it is NOT A SUBSTITUTE FOR FREE SO_2

Potassium Sorbate Stabilization

- The amount of potassium sorbate needed to inhibit yeast reproduction depends upon several factors, including **pH** and **%alcohol** level.

- Increases in **pH** from 3.0 to 3.7 are accompanied by a reduction in the proportion of “molecular” sorbic acid from 98 to 93%, respectively.

- Hence, the role of **pH** can be ignored for wines with pH <= 3.7

Potassium Sorbate Stabilization

The amount of molecular sorbic acid available for yeast inhibition increases significantly as **%alcohol** increases from 10 to 14%. Hence, the minimum required sorbate dosage is highly dependent upon the level of alcohol.

Alcohol (%)	**Sorbic Acid Req'd (mg/L)**
10	150
11	125
12	100
13	75
14	50

(Source: Peynaud, 1980)

Potassium Sorbate Dosage

- K-Sorbate contains **74% sorbic acid** (by weight) when dissolved in water.
- **K-Sorbate req'd (mg) = (Sorbic acid req'd (mg/L) * gallons of wine * 3.785 L/gal) / 0.74**
- The sensory threshold ("bubble gum") for sorbic acid is approximately 150 mg/L (Margalit, 1996).
- Legal max. = 300 mg/L.
- Caution: "Geranium leaf" fault if MLF occurs in a sorbated wine.

- Warning: Avoid the use of "**Wine Conditioner**" products (sugar confound; limited shelf-life)

K-Sorbate Case Study

Clinitest assessment of a **10 gallon** batch of white wine reveals that it has **0.7% residual sugar**. The %alcohol of the wine, based upon "potential alcohol" calculated from the prefermentation Brix level, indicates that the wine contains **11% alcohol** by volume. How much potassium sorbate must be added to this wine to inhibit a secondary yeast fermentation?

Step 1.
Minimum sorbic acid requirement for 11% alcohol is 125 mg/L. (See Table)

Step 2.
K-Sorbate (mg) = (125 mg/L * 10 gallons * 3.785 L/gal) / 0.74
= 6395 mg

Step 3.
Dissolve 6.4 g of potassium sorbate in a small amount of water and thoroughly stir into wine.