

1. A properly conditioned, cleaned, calibrated, and highly accurate **pH** meter is essential to measuring the **TA** of the must/wine. Get a good **pH** meter & throw your color change indicator away.

2. Use a large (30+ml) homogenous must/wine sample when testing the **TA**. If the must is or has been fermenting, make sure to microwave the sample just to a boil & to stir well before the titration.

3. Place your measured sample in a clear, glass container which allows for easy swirling. A small wine glass is perfect.

4. Before starting a titration, make sure that your **pH** meter is conditioned, cleaned, & calibrated. For more information on these procedures, see either Joe Sallo's fine **pH** FAQ, or <http://www.eutechinst.com/techtips/tech-tips3.htm>

5. Immerse the **pH** electrode in the sample. It will read the sample's **pH**. Make note of the **pH**. Also, keep in mind that the electrode should remain immersed throughout the entire titration.

6. Using FRESH sodium hydroxide (**NaOH**), slowly add this alkaline solution to the sample, while all of the time swirling. (Note: Having an extra hand to keep the probe steady & immersed is a great help here).

7. Note the raise in **pH** & the exact amount of **NaOH** which you add.

8. As the **pH** of the combination sample/**NaOH** solution approaches 7.00, the **pH** will begin to climb quite quickly. From this point on, add the **NaOH** in very small volumes.

9. When the **pH** of the combination sample/**NaOH** solution reaches a **pH** of 8.20, you have reached the "end-point" & the titration is complete. Note the exact total amount of **NaOH** you have added to the sample & immediately clean the **pH** meter's electrode with either a commercial probe cleaning solution or a contact lens cleaning solution.

10. Calculate the **TA** of the sample using the following formula:

$$\text{TA} = (\text{ml NaOH} \times \text{Conc. NaOH} \times 0.75) / \text{ml sample}$$

TA = Total titratable acidity in g/L [grams per liter] as tartaric acid.
(Note: 7.5 g/L = 0.75% = 7.5ppt).

ml **NaOH** = the volume, in ml, of **NaOH** which was required to bring the **pH** of the combination sample/**NaOH** solution to 8.20.

Concentration of **NaOH** = the strength of your **NaOH** solution. Most commercial solutions are either "0.1 normal" (which equals 10%) or "0.2" or "1/5 normal" (which equals 20%).

ml sample - the initial sample size in ml. The larger the initial sample size, the easier & the more accurate the titration. However, having a large

sample also means that you will need to use a larger volume of **NaOH** to reach your end-point.

11. Example:

Zinfandel wine is being made from grapes from California's Central Valley.

The grapes are crushed & the must is stirred well. Using a funnel with a straining screen in the neck, some juice is drawn off of the must & is placed in a testing jar.

While the juice is in the jar, a thermometer & a narrow range (16-24 Brix) hydrometer are used to determine the sample's temperature & density.

Next, 30ml of the sample are placed in a small wine glass. A **pH** meter is immersed in the sample and the **pH** is measured at 3.70.

Next, with the **pH** meter's electrode remaining immersed in the sample throughout, small amounts of 0.10 normal (10%) **NaOH** solution are added until the **pH** meter reads 8.20.

When the **pH** meter reaches 8.20, the winemaker notes that he/she has added exactly 21.0ml of the 10% **NaOH**.

Now, the winemaker is ready to calculate the **TA** of the sample:

$$\text{TA (g/L)} = (\text{ml NaOH} \times \text{Conc NaOH} \times 0.75) / \text{ml sample.}$$

$$\text{TA (g/L)} = (21 \times 10 \times 0.75) / 30$$

$$\text{TA (g/L)} = 157.5 / 30$$

$$\text{TA (g/L)} = 5.25 \text{ g/L.}$$

Finally, since the winemaker wants an initial **TA** of ~7.0 g/L & an initial **pH** of no higher than 3.40, he/she measures out 1.75 grams of tartaric acid per liter of must (5.25 g/L + 1.75 g/L = 7.00 g/L). The tartaric acid is dissolved in a small quantity of hot water, and is thoroughly mixed into the must.

After the acid addition, the must is again tested for **TA** & **pH**. This time the must tests out to a **pH** of 3.40 & a **TA** of 7.0 g/L.

Satisfied with the new chemistry, and more importantly with the taste of the adjusted must, the winemaker commences fermentation.

Miscellaneous Thoughts:

12. If you are comfortable with neither the titration process, nor evaluation of the must with taste, adjust the must for **pH** only. Ignore the **TA**. When doing this, one would simply start all white fermentations with a **pH** of 3.25 - 3.35, & would start all red fermentations with a **pH** of 3.30 -

3.40. **pH** alone is an excellent guide for measuring acidity. Consider the following **pH** benchmarks:

- Before fermentation: 3.20 - 3.40
- After all fermentations (sugar & ML): 3.45 - 3.55
- Before cold stabilization: 3.55 or less.
- After cold stabilization & at bottling: 3.35 - 3.50

13. It is better to have an initially high **TA** (say 8 - 10 g/L), than to have an initially high **pH** (say 3.55+). Acid can always be removed through MLF & cold stabilization. A high **pH** can plague the wine forever.

14. Several things can give the winemaker odd **TA** readings. These include:

- CO₂ in the sample (false high readings)
- Old, oxidized, & weak **NaOH** solution (false high readings)
- Non-homogenous initial samples (false high or low readings)
- Poorly conditioned, cleaned, or calibrated **pH** meter (false high or low readings)
- Extreme sample temperatures [if meter is not self-adjusting for temperature] (false high or low readings)
- Testing during or immediately after an active fermentation. The evolution of a wine's acid concentration during fermentation is very complex.

Acids on the magnitude of 2 - 2.5 g/L are created during the fermentation. Additionally, tartaric acid, on the magnitude of 2 - 2.5 g/L, is lost throughout & after fermentation. Since the timing of these acid additions & depletions can not be predicted, acid titration during or immediately after fermentation has a margin of error of about +/- 4 to 5 g/L!!

15. Finally: don't sweat the **TA** too much. As TomS has said, evaluate acidity using your taste, backed-up by the **pH**. Wise advice.

Hope this helps.

Prosit:
Ed