Acids Education Series: Measuring Titratable Acidity (TA)

Materials/Equipment

- pH meter & probe
- 0.1N NaOH solution
- Distilled water
- Volumetric or graduated pipette
- 25 mL titration burette with 0.1 mL markings

- Ring stand and burette clip
- 250 mL glass beaker
- Stir plate & stir bar
- 10 mL volumetric pipette
- Degassed sample(s) to test
- Plastic pipette (optional)

Procedure

Set Up:

1. Ensure that the pH meter has been calibrated (See: Measuring pH)
2. If needed, degas the samples to be tested (review FAQs for removal options).
3. Fill the titration burette with 0.1N NaOH.
4. Dispense a few milliliters of solution through the end of the burette into a waste beaker to remove any bubbles in the stopcock assembly.
5. Fill the 250 mL beaker with ~100 mL of distilled water, add the stir bar and place on the stir plate.
6. Position the beaker so that the pH meter is submerged within the solution but not touching the sides, bottom, or stir bar and there is a direct path for solution to flow from the opening in the titration burette into the sample beaker.
7. Add a few milliliters of juice or wine to the beaker. There is no need to measure here, it is just to add buffering to the water.
8. Adjust the pH of the solution to 8.2 with dropwise addition of NaOH. Use juice/wine to adjust back if too much NaOH is added.
9. Refill the burette with 0.1N NaOH.

Titration:

1. Record the initial volume of 0.1N NaOH in the burette. Make sure that there is enough NaOH to complete the titration. Typical juice samples usually require 12-15 mL. Wine samples may require 8-12 mL.
2. Using a volumetric pipette, add 10 mL of juice/wine to the solution in the beaker. If a volumetric pipette is not available, use a graduated pipette.
3. Begin titration by dispensing 0.1N NaOH solution from the titration burette into the beaker. As the solution approaches 6.0, slow the flow rate to a dropwise addition until a pH of 8.2 +/- 0.1 is reached. It may take a few seconds for the pH to equilibrate, so proceed slowly when close to pH of 8.2.
4. Record the final volume of NaOH in the burette.

5. Calculate the "titre value" by taking the difference between the final and initial burette volume. Then multiply this value by 0.75 to determine titratable acidity (g/L). For example:

> Initial volume = 0.2 mL   Final volume = 9.3 mL
> Titre value = 9.3 - 0.2 = 9.1 mL
> Titratable acidity = 9.1 mL x 0.75 = 6.83 g/L

6. The solution in the beaker can be re-used for the next sample once it is returned to 8.2 +/ 0.1. If more than 3 samples are run with the same solution, pour off added volume to return to 100 mL.

7. Repeat titration steps 1-5 for the remaining samples.

Frequently Asked Questions

How do I know if my measurement is accurate?
Before you start testing samples, you can run a standard. The titratable acidity of box wine will remain stable for up to a year. Purchase a box wine from the store and have it tested at a trusted service lab. Before you start running TAs for the day, run a sample of box wine. Record this value so you can test your accuracy and precision over time. If the result from the box wine is out of bounds, you may need to troubleshoot the pH calibration or concentration of NaOH.

I found some NaOH in the cupboard from the previous winemaker. Is there any problem if I use it?
Unfortunately, NaOH will degrade with time, leading to an overestimation of TA values. If you do not know how old the solution is, it is safer to discard this bottle and start with a new batch. To prevent waste in the future, always note on the bottle when solutions are received and when they are opened.

Chemical supply companies list the shelf life of unopened 0.1 M NaOH as 36 months, and 12 months after opening. To slow down degradation, store your NaOH in the refrigerator after opening. NaOH solution can be made from reagent grade pellets, but the solution must be standardized before use. (Contact Joy or Beth for a protocol.)

I added more NaOH to my burette than I need today. I don't want to waste it. Can I leave it until tomorrow, or put it back in the stock solution?
Because NaOH degrades in the presence of CO_2 in the atmosphere, you should always drain the NaOH from the burette at the end of the day and discard it. Never return reagents to the bottle of stock solution. This may contaminate or dilute the stock.

Why does my post-fermentation sample have a higher TA than the juice did?
CO_2 from fermentation interacts with water to form carbonic acid, which will temporarily raise the TA of the wine. To get a more accurate reading of what TA will be once CO_2 leaves the wine, you will need to degas the sample. Common degassing methods include vacuum, short duration boiling, and shaking. (Contact Joy or Beth for specific instructions.)

Do I have to use distilled water?
Always use distilled water to rinse your pH probe and to make your own NaOH solution. The 100 mL of water in the beaker can be tap water.

I've noticed that if I step away from the titrated solution, the pH value decreases enough that more NaOH would need to be added to return the solution to 8.2. Should I consider this when recording the final burette volume of the previous sample?
It is not necessary to add more NaOH for titration purposes, the pH has decreased because of the absorption of CO_2 from the atmosphere which forms carbonic acid and lowers the pH. However, if you plan to use the same solution for your next sample, you will want to return the solution to 8.2.