

Titratable acidity in wine by automatic titration

Key words

TA, wine, must, juice, titrametric, potentiometric, AOAC 942.15, Orion 8172BNWP, Orion 8102BNUMD, Orion Star T910, Orion Star T940.

Introduction

Titratable acidity (TA), is a measure of the organic acid content in wine, juice, or must. These organic acids come from the grapes, the fermentation, and the bacterial activity. The acidity can affect the flavor, color, and stability of the wine. TA in wine, juice, or must is determined using the preprogrammed method T1A TA Wine. This method is a direct titration to a preset endpoint at pH 8.2 using 0.1M (0.1N) sodium hydroxide titrant. The method may be edited to perform titratable acidity in other samples as well.

Recommended equipment

- Thermo Scientific™ Orion Star™ T910 pH Titrator or T940 All-In-One Titrator or equivalent
- Thermo Scientific™ Orion™ ROSS™ Sure-Flow™ pH Electrode (Cat. No. 8172BNWP) or equivalent
- Orion™ Automatic Temperature Compensation (ATC) probe
- Analytical balance (for sample measurement by weight) or graduated 10 mL pipet (for sample measurement by volume)

Required reagents and solutions

- Purchased or prepared sodium hydroxide (NaOH)



standard titrant solution, 0.1 M (0.1N)

- Reagent grade water (RGW)
- pH buffers: pH 4, 7, and 10

Optional:

- Potassium hydrogen phthalate (KHP) acidimetric standard

Use suitable personal protective equipment (PPE) as recommended by the Safety Data Sheets (SDS) for the chemicals utilized during this procedure.

Titration setup

Connect the Orion pH electrode, ATC, and the stirrer probe to the titrator. If not previously done, import the T1A T1A Wine preprogrammed method into the titrator from the Methods screen¹. Rinse and fill the burette with 0.1M (0.1N) sodium hydroxide titrant. See the titrator user manual for details. If bubbles are visible in the tubing, dispense titrant (from the Burette screen) until the bubbles have been expelled. Tap tubing to dislodge bubbles that stick. Consider standardizing the titrant before titrating samples. See the following Titrant section.

T1A TA Wine Method: Preprogrammed parameters

Electrode	Parameter
Electrode Type	pH
Electrode Name	Edit as desired
Resolution	0.01
Buffer Group	USA

Titrant	Parameter
Titrant Name	NaOH
Titrant ID	Edit as desired
Conc. Input Mode	Standardization
Nominal Concentration	0.1M
Standardize Tech	Equivalence Pt.
Number of Endpoints	1
Results Units	M
Standardize Reaction Ratio	1
Standard Name	KHP
Standard Amount	Variable weight
Standard Molecular Wt	204.2
Standard Purity	100%
Pre-dose Titrant Volume	0 ml
Max. Total Titrant Volume	5 ml
Stand. Process Control	Routine
Pre-stir Duration	5 sec
Stir Speed	Medium

Titration	Parameter
Titration Technique	Preset End Pt.
Number of Endpoints	1
Endpoint Values	8.2
Titration Type	Direct
Blank Required	No
Result Units	g/L
Reaction Ratio	0.5
Sample Mol. Wt.	150.09
Sample Amount	Fixed vol, 5.0 mL
Pre-dose Titrant Volume	0 ml
Max total titrant volume	10 ml
Titration Process Control	Routine
Pre-stir Duration	5 sec
Stir Speed	Fast
Sample ID	Manual



Electrode preparation

Remove electrode from storage solution. Top up the fill solution to the bottom of the fill hole and leave the fill hole open during testing. Rinse thoroughly with RGW before and between titrations.

Sample preparation

Accurately measure 5.0 mL of wine, juice, or must into a clean 100 mL beaker. Add RGW to the 60 mL mark on the beaker. The sample is ready to titrate.

Sample titration

1. From the Home screen, select option to use a saved method, then select the T1A TA Wine reprogrammed method.
2. At the pre-titration screen, select the Calibrate option and calibrate the electrode with pH 4, 7, and pH 10 buffers.
3. After calibration, place the electrode, ATC, stirrer, and dispenser into the sample in the beaker. Ensure that the dispenser tip is inserted below the surface of the sample and start the titration.
4. When prompted, enter the exact weight of the sample.

Results

Sample	Results	RSD (n = 3)	% Recovery	Duration (min:sec)
Tartaric Acid Standard	7.563 g/L	0.25%	100.8%	2:33
Red Burgundy Wine	5.835 g/L	1.24%	NA	3:21
Red Burgundy Wine Spike	13.33 g/L	0.19%	99.9%	4:55

Range

This preprogrammed titration method covers a range of TA that may be expected in wine, juice, or must.

Method modifications

- **For other result units:** Edit the Titration section of the method and choose the desired unit.
- **For shorter titrations:** For routine titrations with well-established endpoint volumes, use a pre-dose to shorten the analysis time. Edit the pre-dose in the Titration section of the method. In general, set the pre-dose at a volume that is 0.5 mL less than the expected endpoint volume.

Titrant

Over time, standard titrant solutions age and can change concentration. For higher accuracy, determine the exact concentration by standardizing the titrant. It is common to standardize on a weekly basis, but other standardization frequencies may be suitable.

1. Standardizing the Titrant

- a. Weigh about 0.05 g KHP into a clean 100 or 150 mL beaker. Record the exact weight to the nearest 0.0001g. Repeat twice more for a total of three beakers of KHP. Add RGW to the 60 mL mark on each beaker and stir for about 2 minutes or so until the KHP is completely dissolved.
- b. If the KHP purity is not 100%, edit the Titrant section of the method to enter the actual purity
- c. Select the Titratable Acidity preprogrammed method on the titrator.
- d. At the pre-titration screen, select the Standardize option and follow the prompts to standardize the titrant.
- e. The new standardized titrant concentration will automatically be saved and used for subsequent T1A TA method titrations.

2. Certified Standardized Titrant Solutions

- a. Some customers may prefer not to standardize their titrant, instead choosing to purchase and use certified standardized titration solutions. In this case, edit the Titrant section of the method and enter the certified concentration and titrant ID (i.e., lot number, if desired).

Titrator and electrode care

Refer to the titrator and electrode user manuals for details on cleaning, storage, and maintenance recommendations to keep the titrator and electrode performing well. Main points for care are summarized as follows.

Daily Care	Weekly or Biweekly Care	As Needed
<ul style="list-style-type: none">• If bubbles are visible in the titrator tubing, dispense titrant until bubbles have been expelled• Top up the electrode fill solution and leave the fill hole open during measurement• Rinse electrode well with RGW between titration cycles• Cover the fill hole and store electrode in storage solution overnight	<ul style="list-style-type: none">• Drain and replace the fill solution of the electrode.• Change the storage solution in the electrode storage bottle• Consider standardizing the titrant on a weekly basis	<ul style="list-style-type: none">• For slow or drift response, soak 15 minutes in 1% laboratory detergent while stirring. Rinse well with RGW afterwards• If still slow or drift, use Orion pH cleaning solution D per instructions• See the user manuals for maintenance details

Notes

¹Refer to the user manual for detailed instructions, if desired.

To purchase Thermo Scientific laboratory products, please contact your local equipment distributor and reference the part numbers listed below:

Product	Description	Cat. No.
Titrator kits	Thermo Scientific™ Orion Star™ T910 Titrator Standard Kit with 8102BNUWP Thermo Scientific™ Orion™ ROSS Ultra™ pH Electrode and ATC Probe	START9101
	Thermo Scientific™ Orion Star™ T910 pH Titrator Sure-Flow™ Kit with 8172BNWP ROSS™ Sure-Flow™ pH Electrode and ATC Probe	START9102
	Thermo Scientific™ Orion Star™ T940 All-In-One Titrator Standard Kit with 8102BNUWP ROSS™ Ultra pH Electrode and ATC Probe	START9401
	Thermo Scientific™ Orion Star™ T940 All-In-One Titrator Sure-Flow™ Kit with 8172BNWP ROSS™ Sure-Flow™ pH Electrode and ATC Probe	START9402
Titrators	Thermo Scientific™ Orion Star™ T910 pH Titrator without electrode	START9100
	Thermo Scientific™ Orion Star™ T940 All-In-One titrator without electrode	START9400
Electrodes	Thermo Scientific™ Orion™ ROSS™ Sure-Flow™ pH Electrode	8172BNWP
	Thermo Scientific™ Orion™ ROSS Ultra™ pH Electrode	8102BNUWP
	Automatic Temperature Compensation (ATC) Probe	927007MD
pH Buffers	Orion pH 4.00 Buffer, NIST traceable, 475 ml	910104
	Orion pH 7.00 Buffer, NIST traceable, 475 ml	910107
	Orion pH 10.00 Buffer, NIST traceable, 475 ml	910110
Reagent Grade Water	Thermo Scientific™ Barnstead™ Smart2Pure™ 12 UV Water Purification System	50129890*
Reagents	0.1M (0.1N) Sodium Hydroxide Titrant	
	Potassium Hydrogen Phthalate, primary or acidimetric standard grade	
Accessories	100 or 150 mL beakers	

*Please contact your local Thermo Scientific representative for support on ordering water quality products. For more information, visit thermofisher.com/waterquality.

References

- Acidity (Titratable) of Fruit Products, Method 942.15. Official Methods of Analysis (OMA). AOAC International, 2275 Research Blvd, Ste 300, Rockville, MD 20850-3250. USA.
- Patrick Iland et al. (2004). Titratable Acidity. In: Chemical analysis of grapes and wine: techniques and concepts, 2nd ed. Patrick Iland Wine Promotions PTY LTD, pp. 39 - 43.

Find out more at thermofisher.com/titrator

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