



**Overview**

The concentration of malic acid in the Apple Juice Concentrate is determined using the first derivative titration technique on the ORION 960 Titrator with sodium hydroxide as the titrant and an Orion ROSS Combination pH electrode.

<b>Market</b>	Food and Beverage	<b>Species Measured</b>	Malic acid
<b>Sample</b>	Apple Juice Concentrate	<b>Sample Size</b>	1 g
		<b>Typical Concentration</b>	1.0 - 6.0 % w/w
<b>Technique #</b>	6 First Derivative	<b>Electrode</b>	Ross Combination pH 8102BN
<b>Solutions</b>	0.1M Sodium hydroxide; Orion 810007 pH Electrode Filling solution; Deionized water		
<b>Solutions preparation:</b>	To prepare 0.1N sodium hydroxide, weigh 4.0 g of reagent grade NaOH and dissolve in DI water in 1L volumetric flask.		
<b>Titrant standardization</b>	Titrate 3.0 mL of 0.1N potassium hydrogen phthalate standard solution diluted to 50 mL with DI. Use technique 11 and reaction ratio of 1.		
<b>Sample Prep</b>	Accurately weigh about 1 g of sample into a sample beaker. Add 45 mL of deionized water, mix well until sample is completely dissolved.		
 <b>Statistics</b>			
<b># of Trials</b>	3	<b>Mean</b>	1.8% w/w
		<b>%CV</b>	1.0%
		<b>Analysis Time</b>	10 minute(s)
<b>Comments</b>	Rinse the electrodes, stirrer, and dispenser probe thoroughly between measurements with deionized water.		

**Method Parameters**

<b>Sample Volume/Weight</b>	1 g	<b>Timed or Stability Readings</b>	5.0 second(s) timed
<b>Constant Increment</b>	10.0 mV	<b>Number of Endpoints</b>	1
<b>Max Titrant Volume</b>	10 mL	<b>Desired Units</b>	% w/w
<b>Molecular weight</b>	134.09	<b>Predose</b>	0
<b>Prestir</b>	1 sec.	<b>Additional Parameters</b>	
<b>Reaction Ratio</b>	0.5000		



# Thermo SCIENTIFIC

Potentiometric Titration Application Notes

Applications Log # 704

## Results

METHOD SUMMARY

SAMPLE ID NUMBER: 37 *est #3*

TEST: *Apple Juice Conc.*

SITE: *Apple Juice Conc.*

ANALYST:

03:47 01-07-00 ELECTRODE: 2pH

TECHNIQUE:  $\delta$  FIRST DERIVATIVE

SAMPLE WEIGHT: 1.02910 g

TITRANT: 1000 M *NaOH*

CONST INCREMENT: 10.0 mV

MAX TITRANT VOL: 10.000 mL

TIMER READINGS: 3.0 sec

PRESTIR: 1.0 sec

CONTINUOUS STIRRING

REACTION RATIO: 0.5000

MOLECULAR WEIGHT: 134.09

CAL CONSTANT: 1.00000

electrode check: +/- 0.2 mV  
ok

0	v = 0.000 mL	E = 179.3 mV	pH = 3.85
1	v = 0.550 mL	E = 180.7 mV	pH = 4.21
2	v = 0.900 mL	E = 140.3 mV	pH = 4.39
3	v = 1.000 mL	E = 139.8 mV	pH = 4.33
4	v = 1.250 mL	E = 129.9 mV	pH = 4.72
5	v = 1.500 mL	E = 116.1 mV	pH = 4.91
6	v = 1.750 mL	E = 106.7 mV	pH = 5.10
7	v = 1.950 mL	E = 96.5 mV	pH = 5.28
8	v = 2.150 mL	E = 84.4 mV	pH = 5.49
9	v = 2.500 mL	E = 72.7 mV	pH = 5.69
10	v = 2.400 mL	E = 42.3 mV	pH = 5.87
11	v = 2.450 mL	E = 55.8 mV	pH = 5.98
12	v = 2.500 mL	E = 47.8 mV	pH = 6.12
13	v = 2.950 mL	E = 38.1 mV	pH = 6.29
14	v = 2.600 mL	E = 25.3 mV	pH = 6.31
15	v = 2.650 mL	E = 8.3 mV	pH = 6.81
16	v = 2.700 mL	E = -12.8 mV	pH = 7.17
17	v = 2.750 mL	E = -39.6 mV	pH = 7.63
18	v = 2.800 mL	E = -70.3 mV	pH = 8.17

20	v = 2.900 mL	E = -113.4 mV	pH = 8.60
21	v = 2.950 mL	E = -127.8 mV	pH = 8.91
22	v = 3.000 mL	E = -139.1 mV	pH = 9.16
23	v = 3.050 mL	E = -148.8 mV	pH = 9.35
24	v = 3.100 mL	E = -156.7 mV	pH = 9.52
25	v = 3.200 mL	E = -169.3 mV	pH = 9.87
26	v = 3.300 mL	E = -178.8 mV	pH = 10.04
27	v = 3.450 mL	E = -189.4 mV	pH = 10.22
28	v = 3.650 mL	E = -199.4 mV	pH = 10.39
29	v = 3.950 mL	E = -210.6 mV	pH = 10.58
30	v = 4.330 mL	E = -219.8 mV	pH = 10.75
31	v = 4.950 mL	E = -230.0 mV	pH = 10.92
32	v = 5.800 mL	E = -240.0 mV	pH = 11.10
33	v = 7.050 mL	E = -250.1 mV	pH = 11.27
34	v = 8.850 mL	E = -260.2 mV	pH = 11.45
35	v = 10.050 mL	E = -265.2 mV	pH = 11.53

0.9 min

### FIRST DERIVATIVE ANALYSIS

0	dE/dv = -37.3	d2E/dv2 = -2.4
1	dE/dv = -38.7	d2E/dv2 = -5.7
2	dE/dv = -42.0	d2E/dv2 = -9.2
3	dE/dv = -42.9	d2E/dv2 = -3.1
4	dE/dv = -43.4	d2E/dv2 = -3.4
5	dE/dv = -44.6	d2E/dv2 = -9.2
6	dE/dv = -48.0	d2E/dv2 = -24.8
7	dE/dv = -55.8	d2E/dv2 = -30.0
8	dE/dv = -68.0	d2E/dv2 = -91.0
9	dE/dv = -87.6	d2E/dv2 = -178.7
10	dE/dv = -112.7	d2E/dv2 = -396.0
11	dE/dv = -147.0	d2E/dv2 = -663.3
12	dE/dv = -177.0	d2E/dv2 = -780.0
13	dE/dv = -225.0	d2E/dv2 = -1210.0
14	dE/dv = -298.0	d2E/dv2 = -1560.0
15	dE/dv = -381.0	d2E/dv2 = -1810.0
16	dE/dv = -479.0	d2E/dv2 = -1960.0
17	dE/dv = -577.4	d2E/dv2 = -820.0
18	dE/dv = -561.0	d2E/dv2 = 1480.0
19	dE/dv = -429.0	d2E/dv2 = 2400.0
20	dE/dv = -321.0	d2E/dv2 = 1720.0

21	dE/dv = -257.0	d2E/dv2 = 1110.0
22	dE/dv = -210.0	d2E/dv2 = 810.0
23	dE/dv = -176.0	d2E/dv2 = 733.3
24	dE/dv = -136.7	d2E/dv2 = 436.7
25	dE/dv = -110.5	d2E/dv2 = 281.3
26	dE/dv = -86.4	d2E/dv2 = 206.6
27	dE/dv = -58.9	d2E/dv2 = 112.0
28	dE/dv = -41.2	d2E/dv2 = 59.4
29	dE/dv = -29.1	d2E/dv2 = 30.3
30	dE/dv = -20.0	d2E/dv2 = 15.2
31	dE/dv = -13.9	d2E/dv2 = 7.2
32	dE/dv = -9.6	d2E/dv2 = 3.5
33	dE/dv = -6.6	d2E/dv2 = 1.3
34	dE/dv = -5.1	d2E/dv2 = 0.8
35	dE/dv = -4.3	d2E/dv2 = 0.7

SAMPLE = 1.02910 g (100% w/w)

END POINT VOL = 2.760 mL (-51.5 mV) (pH 7.84)

Excess Titre = 7.232 mL

Signal/Noise = 7

