



# Thermo SCIENTIFIC

Potentiometric Titration Application Notes

Applications Log # 703

## Overview

The concentration of citric acid in Cranberry-Raspberry Juice 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>	Citric acid
<b>Sample</b>	Cranberry-Raspberry Juice	<b>Sample Size</b>	5 mL
		<b>Typical Concentration</b>	0.4 - 0.5% w/v
<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 pipette 5 mL of sample into titration beaker. Add 45 mL of the DI into the beaker.		
<b>Statistics</b>			
<b># of Trials</b>	3	<b>Mean</b>	0.46 % w/v
		<b>%CV</b>	0.2
		<b>Analysis Time</b>	9 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>	5 mL	<b>Timed or Stability Readings</b>	5.0 sec timed
<b>Constant Increment</b>	10.0 mV	<b>Number of Endpoints</b>	1
<b>Max Titrant Volume</b>	5 mL	<b>Desired Units</b>	%w/v
<b>Molecular weight</b>	192.12	<b>Predose</b>	0
<b>Prestir</b>	1.0 sec.	<b>Additional Parameters</b>	
<b>Reaction Ratio</b>	0.3333		



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## Results

METHOD B SUMMARY  
 =====  
 SAMPLE ID NUMBER: 15  
 TEST: *Prism - Rubeomycin*  
 SITE: *Test #2*  
 ANALYST:  
 04:41 01-10-00 ELECTRODE: 2:pH  
 TECHNIQUE  $\delta$  FIRST DERIVATIVE  
 SAMPLE VOLUME 5.000 mL  
 TITRANT .1000 M of *NaOH*  
 CONST INCREMENT 10.0 mV  
 MAX TITRANT VOL 5.000 mL  
 TIMER READINGS 5.0 sec  
 MASTIR 1.0 sec  
 CONTINUOUS STIRRING  
 REACTION RATIO 0.3333  
 MOLECULAR WEIGHT 192.12  
 GR. CONSTANT 1.00631

electrode check: +/- 0.0 mV  
ok

0	v= 0.000 mL	E= 229.4 mV	pH= 3.07
1	v= 0.453 mL	E= 215.9 mV	pH= 3.30
2	v= 0.805 mL	E= 203.9 mV	pH= 3.51
3	v= 1.057 mL	E= 194.2 mV	pH= 3.68
4	v= 1.308 mL	E= 183.9 mV	pH= 3.85
5	v= 1.560 mL	E= 173.1 mV	pH= 4.04
6	v= 1.761 mL	E= 164.1 mV	pH= 4.19
7	v= 1.962 mL	E= 154.8 mV	pH= 4.35
8	v= 2.164 mL	E= 145.7 mV	pH= 4.51
9	v= 2.365 mL	E= 136.9 mV	pH= 4.70
10	v= 2.516 mL	E= 126.8 mV	pH= 4.94
11	v= 2.717 mL	E= 114.5 mV	pH= 5.05
12	v= 2.868 mL	E= 103.5 mV	pH= 5.24
13	v= 2.969 mL	E= 95.1 mV	pH= 5.38
14	v= 3.069 mL	E= 86.9 mV	pH= 5.50
15	v= 3.170 mL	E= 73.2 mV	pH= 5.76
16	v= 3.220 mL	E= 66.4 mV	pH= 5.88
17	v= 3.270 mL	E= 59.1 mV	pH= 6.00
18	v= 3.321 mL	E= 51.2 mV	pH= 6.14

19	v= 3.371 mL	E= 42.8 mV	pH= 6.29
20	v= 3.421 mL	E= 33.3 mV	pH= 6.45
21	v= 3.472 mL	E= 22.4 mV	pH= 6.64
22	v= 3.522 mL	E= 8.4 mV	pH= 6.88
23	v= 3.572 mL	E= -11.4 mV	pH= 7.22
24	v= 3.623 mL	E= -47.8 mV	pH= 7.85
25	v= 3.673 mL	E= -90.5 mV	pH= 8.58
26	v= 3.723 mL	E= -117.6 mV	pH= 9.05
27	v= 3.774 mL	E= -135.0 mV	pH= 9.35
28	v= 3.824 mL	E= -147.2 mV	pH= 9.50
29	v= 3.874 mL	E= -156.1 mV	pH= 9.71
30	v= 3.975 mL	E= -168.7 mV	pH= 9.93
31	v= 4.076 mL	E= -177.4 mV	pH= 10.08
32	v= 4.226 mL	E= -187.3 mV	pH= 10.25
33	v= 4.428 mL	E= -196.5 mV	pH= 10.41
34	v= 4.730 mL	E= -206.4 mV	pH= 10.58
35	v= 4.981 mL	E= -212.6 mV	pH= 10.69

9.4 min

FIRST DERIVATIVE ANALYSIS

0	dE/dv= -29.8	d2E/dv2= -4.1
1	dE/dv= -31.7	d2E/dv2= -7.6
2	dE/dv= -33.9	d2E/dv2= -13.4
3	dE/dv= -39.7	d2E/dv2= -11.9
4	dE/dv= -41.9	d2E/dv2= -7.9
5	dE/dv= -43.7	d2E/dv2= -7.8
6	dE/dv= -45.5	d2E/dv2= -4.9
7	dE/dv= -45.7	d2E/dv2= -9.9
8	dE/dv= -49.4	d2E/dv2= -19.0
9	dE/dv= -53.7	d2E/dv2= -28.1
10	dE/dv= -57.9	d2E/dv2= -34.7
11	dE/dv= -65.9	d2E/dv2= -54.5
12	dE/dv= -77.1	d2E/dv2= -107.5
13	dE/dv= -92.9	d2E/dv2= -157.5
14	dE/dv= -108.8	d2E/dv2= -147.3
15	dE/dv= -122.5	d2E/dv2= -207.4
16	dE/dv= -140.1	d2E/dv2= -283.1
17	dE/dv= -151.0	d2E/dv2= -217.3
18	dE/dv= -162.0	d2E/dv2= -266.8

19	dE/dv= -177.9	d2E/dv2= -404.4
20	dE/dv= -202.7	d2E/dv2= -691.6
21	dE/dv= -247.4	d2E/dv2= -632.8
22	dE/dv= -135.9	d2E/dv2= -309.0
23	dE/dv= -158.5	d2E/dv2= -447.3
24	dE/dv= -786.0	d2E/dv2= -1383.3
25	dE/dv= -93.6	d2E/dv2= 341.6
26	dE/dv= -442.2	d2E/dv2= 396.9
27	dE/dv= -294.1	d2E/dv2= 231.0
28	dE/dv= -209.7	d2E/dv2= 150.7
29	dE/dv= -142.4	d2E/dv2= 688.0
30	dE/dv= -103.8	d2E/dv2= 340.0
31	dE/dv= -73.9	d2E/dv2= 205.0
32	dE/dv= -54.2	d2E/dv2= 102.0
33	dE/dv= -38.0	d2E/dv2= 50.0
34	dE/dv= -29.1	d2E/dv2= 24.0
35	dE/dv= -24.6	d2E/dv2= 17.0

SAMPLE = 0.4658 mV as Critical  
 END POINT VOL= 3.633 mL (-59.0 mV)  
 (pH 8.04)  
 Excess Titre= 1.348 mL

Signal/Noise= 7

