Titration Application Note

Total Titratable Acidity (TTA) of Bread

Quality and Taste Indicator

The acidity in bread depends on its formulation including the amount and type of ingredients, additives and preservatives. Yeast and lactobacilli produce acids during the fermentation process leading to different acidity of the dough at different production stages. Directly after the leavening process the acidity reaches its maximum and decreases afterwards during the baking process. As acidity influences the taste, it is not only an important process parameter but also an important quality indicator of the finished bread.

Herein we describe a titration method to determine the total acidity of white bread using an acid-base titration to end point (EP) pH 8.5.

Picture 1: Loaf of bread

METTLER TOLEDO

Sample Preparation and Procedures

- Pluck the bread into pieces of around 1 cm^3.
- Add approx. 10 g of bread pieces into a 100 mL titration beaker.
- Add 10 mL of acetone and 60 mL of deionized water into the beaker. The sample needs to be fully covered with liquid.
- Put the beaker onto the titration stand and start method M846.

Before the EP titration starts, the sample is stirred vigorously for 3 min in order to obtain a fine slurry.

Chemistry

$HA + NaOH \rightarrow NaA + H_2O$

Solutions and Chemicals

Titrant: aq. NaOH, c = 0.1 mol/L.
Sample: White bread (soft part).
Analyte: Organic acids i.a. lactic acid.
Calibration: Linear 3-point calibration with METTLER TOLEDO pH buffers: 4.01, 7 and 9.21.
Standard: Potassium hydrogen phthalate, KHP, M = 204.222 g/mol.
Additional reagents: Acetone, deion. water.

Instruments and Accessories

- Excellence Titrator T5 (30252672), T7 (30252675) or T9 (30252676)
- Burette 10 mL DV1010 (51107501)
- DGi111-SC pH electrode (51109500)
- XPR603 SN Precision balance (303164469)
- InMotion Flex 100 mL autosampler

Picture 2: T5 Titration Excellence

Results and Discussion

The acidy was determined as 0.207(6)% lactic acid with a repeatability of s_{rel} = 2.7%.

	Acidity [% lactic acid]
1	0.199
2	0.212
3	0.209
4	0.201
5	0.207
6	0.212
Mean	0.207
s	0.006
s_{rel}	2.7%

Remarks

The pH electrode needs to be calibrated prior to the sample titration using the calibration method template.

The titer of 0.1 mol/L sodium hydroxide is determined using potassium hydrogen phthalate as primary standard (M435).

With minor modifications of the method, the analysis can be performed using a G20S Compact titrator (30252669).

Waste Disposal and Safety Measures

After the titration, discard the content of the beakers into the aq. basic waste.

Wear safety goggles, a lab coat and gloves during the sample preparation, titration and waste disposal.

Further Information

www.mt.com/analytical_instruments

Measured Data

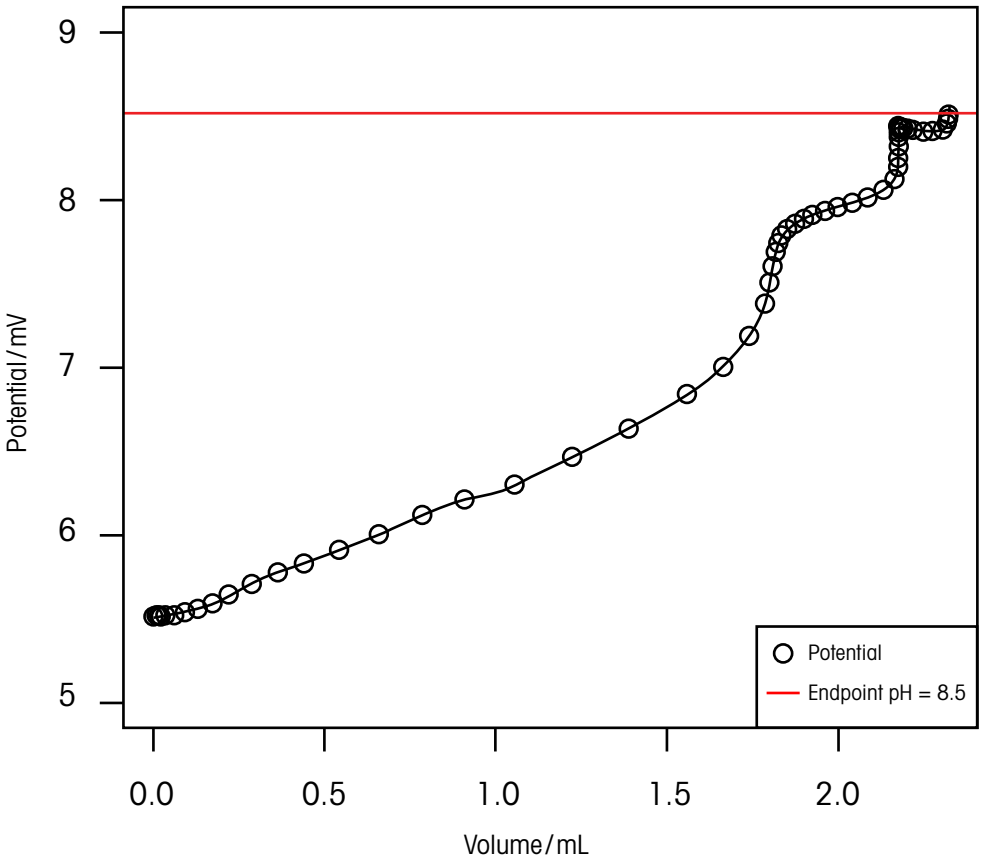

Figure1: Titration curve and first derivative of the titration curve of sample 3/6

Volume [mL]	dV/dt [mL/s]	Potential [mV]	Time [s]
0	NaN	5.498	0
0.0005	0.0005	5.498	1
0.002	0.0015	5.498	2
0.005	0.0025	5.497	3
0.0085	0.003	5.498	4
…	…	…	…
2.179	0.001	8.43	52
2.181	0.0015	8.428	53
2.184	0.0025	8.425	54
2.1885	0.004	8.42	55
2.195	0.006	8.416	56
2.204	0.0075	8.413	57
2.2165	0.0105	8.411	58
2.2335	0.014	8.411	59
2.258	0.0225	8.414	60
2.284	0.0235	8.422	61
2.3125	0.026	8.435	62
2.3185	0.005	8.455	63
2.3185	0	8.483	64
2.3185	0	8.502	65

Method M846

001 Title	
Type	General Titration
Compatible with	T9, T90, T7, T70, T5, T50
ID	M846
Title	Acidity in Bread

002 Sample	
Sample type	Sample
Number of IDs	1
ID1	Bread
Entry type	Weight
Lower limit	5 g
Higher limit	15 g
Density	1 g/mL
Correction factor	1.0
Temperature	25.0 °C
Entry	Arbitrary
InMotion reader	None
Number of sample factors	0

003 Titration Stand	
Type	Manual Stand
Titration stand	Manual Stand 1

004 Stir	
Speed	80%
Duration	300 s

005 Titration (EP) [1]	
Titrant	
Titrant	NaOH
Concentration	0.1 mol/L
Sensor	
Type	pH
Sensor	DG111-SC
Unit	pH
Temperature acquisition	No
Stir	
Speed	30%
Predispense	
Mode	None
Wait time	0 s
Control	
Endpoint type	Absolute
Tendency	Positive
Endpoint value	8.5 pH
Control band	2 pH
Dosing rate (max)	10 mL/min
Dosing rate (min)	10 µL/min
Termination	
At EP	Yes
Termination delay	0 s
At Vmax	10 mL
Max. time infinite	Yes
Accompanying stating	No

006 Calculation R1	
Result	Content
Result unit	% Lactic acid
Formula	R1= Q*C/m
Constant	C = M/(10*z)
M	M[Lactic Acid]
Decimal places	3
Result limits	No
Extra statistical func.	No
Send to buffer	No
Condition	No

007 Record	
Report template	Titration report
Print	No

METTLER TOLEDO Group
Marketing Titration/MarCom Analytical
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