Determination of Acid Number and Fatty Free Acids (FFA) in Fats and Oils

SI Analytics
a xylem brand

Titration Application
M101-01

Introduction

The method is suitable for edible fats and oils such as butter, olive, palm or sunflower oil. The acid number is the quantity of base, expressed in milligrams of potassium hydroxide, that is required to neutralize all acidic constituents present in 1 g of sample. The calculation of the % FFA depends on the titrated type of sample.

Required Equipment

Apparatus

- ☐ TL 7000/TL 7750/TL 7800
- ☐ TM 235 Magnetic stirrer
- ☐ 10 mL Exchange unit (WA 10) with amber glass bottle for the titrant

Electrodes and Electrolyte

- ☐ N 6480 eth pH electrode for titrations in non-aqueous media
- ☐ L 5034 electrolyte - ethanol with 1.5 mol/l lithium chloride (LiCl/ethanol)

Solutions

- ☐ **Titrant:** KOH 0.1 mol/L in IPA (2-propanol). Also needed is KOH 0.1 mol/L in ethanol.
- ☐ **Titer determination:** Potassium hydrogen phthalate
- ☐ **Solvent:** Ethanol/diethyl ether (1:1)

Procedure

Determination of the exact concentration of the KOH titrant

We recommend ready-to-use KOH titrants. The exact concentration of the KOH 0.1 mol/L can be determined using the titrimetric standard potassium hydrogen phthalate.

In a 150 mL beaker, 0.2 g of the standard are weighed accurately and dissolved in 80 mL of distilled water with stirring. It is titrated with the 0.1 mol/L KOH solution.

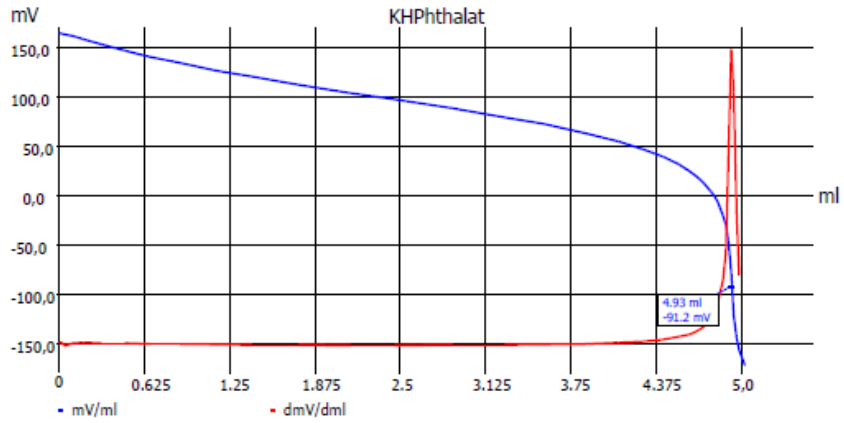
Repeat the standardization two times. The average value is stored automatically in the exchangeable unit.

Figure 1: Titer

Page 1: Curve and result: Titer determination

GLP documentation

Titration graph



Method data

Method name:	Titer KOH	Titration duration:	3 m 25 s
End date:	21.09.12	End time:	15:20:01

Titration data

Sample ID:	KHPhthalat	Weight:	0.1040 g
Start mV:	165.1 mV	End mV:	-171.7 mV
EQ:	4.933 ml / -91.2 mV	Titer:	0.1032 mol/l

Calculation formula

Titer:	(W*F2)/((EQ1-B)*M*F1) -> M103
Mol (M):	204.22000

Weight (W):	man	Factor 2 (F2):	1000.0000
Blank value (B):	0.0000 ml	Factor 1 (F1):	1.0000
Statistics:	Off		

Page 2: Method parameters: Titer determination

Method data overall view

Method name:	Titer KOH	Created at:	09/19/12 17:05:06
Method type:	Automatic titration	Last modification:	09/19/12 17:32:02
Measured value:	mV	Damping settings:	None
Titration mode:	Dynamic	Documentation:	GLP
Dynamic:	Steep		
Measuring speed / drift:	Normal:	minimum holding time:	02 s
		maximum holding time:	15 s
		Measuring time:	02 s
		Drift:	20 mV/min
Initial waiting time:	0 s		
Titration direction:	Decrease		
Pretitration:	Off		
End value:	Off		
EQ:	On (1)		
Slope value:	Steep	Value:	700

Dosing parameter

Dosing speed:	100 %	Filling speed:	30 s
Maximum dosing volume:	50.00 ml		

Unit values

Unit size:	10ml
Unit ID:	00072696
Reagent:	TBA Hydroxid
Batch ID:	1.0265
Concentration [mol/l]:	0.10320
Determined at:	09/20/12 0:57:27
Expire date:	04/12/12
Opened/compounded:	10/19/11
Test according ISO 8655:	12/01/10
Last modification:	09/21/12 15:13:56

Titration of the sample

Weigh the sample in a 100 mL beaker and add at least 50 mL of the solvent mixture to the sample. If necessary, heat the solution to dissolve the sample.

The sample weight should be calculated and selected that the titration amount is not more than 5 mL because of the long titration time.

For acid numbers between 0.2 and 1, the sample amount should be about 10 – 20 g.
For acid numbers between 1 and 10, the sample amount should be about 1 – 3 g.

Place the beaker on the magnetic stirrer and start the titration method. After the titration, rinse the electrode and burette tip with solvent. For each set of samples perform a blank titration with 50 mL of the titration solvent.

Result Calculation

The enclosed titration example shows the calculation of the result in mg KOH /g sample (acid number).

The calculation of the % FFA value depends on the titrated sample. For many oil and fat samples, the molecular weight of the oleic acid (282 g/mol) is used.

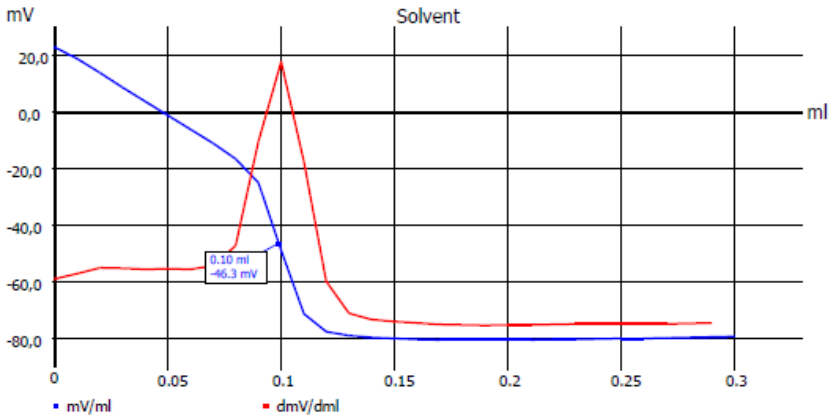
% FFA = (EQ1-B) * 282 * T *100 /(1000*W)

EQ1: mL consumption at the equivalence point
B: mL consumption for the blank titration
282: molecular weight of oleic acid in g/mol
T: concentration of the KOH titrant (e.g. 0.1 mol/L)
100: per 100 g sample
1000: conversation
W: sample weight in g

Blank titration page 1: Curve and result

GLP documentation

Titration graph



Method data

Method name:	Blank AN	Titration duration:	6 m 14 s
End date:	30.04.13	End time:	11:44:44

Titration data

Sample ID:	Solvent		
Start mV:	23.2 mV	End mV:	-79.3 mV
EQ:	0.099 ml / -46.3 mV	Blank:	0.099 ml

Calculation formula

Blank:	EQ1 -> M02		
Statistics:	Off		
		Statistics:	Off

Blank titration page 2: method

Method data overall view

Method name:	Blank AN	Created at:	04/29/13 16:44:04
Method type:	Automatic titration	Last modification:	04/29/13 16:46:25
Measured value:	mV	Damping settings:	strong
Titration mode:	Linear	Documentation:	GLP
Linear steps:	0.010 ml		
Measuring speed / drift:	12 s		
Initial waiting time:	10 s		
Titration direction:	Decrease		
Pretitration:	Off		
End value:	Off		
EQ:	Off		

Dosing parameter

Dosing speed:	100.00 %	Filling speed:	30 s
Maximum dosing volume:	0.30 ml		

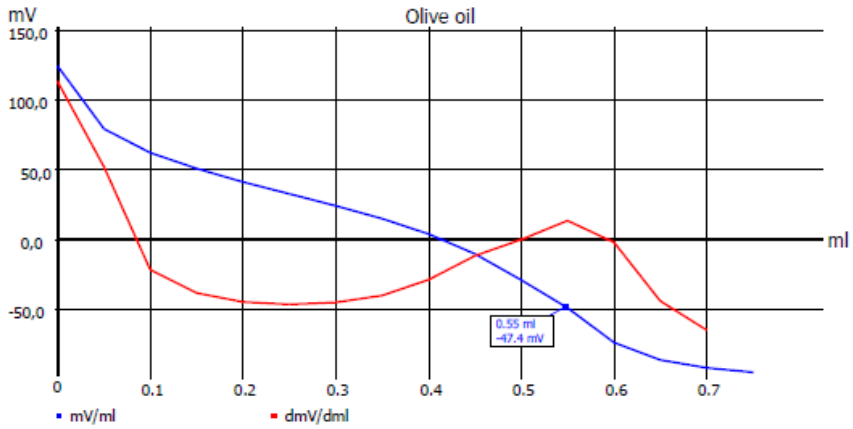
Unit values

Unit size:	10ml
Unit ID:	00072696
Reagent:	TBA Hydroxid
Batch ID:	1.0265
Concentration [mol/l]:	0.10350
Determined at:	09/21/12 22:27:50
Expire date:	04/12/12
Opened/compounded:	10/19/11
Test according ISO 8655:	12/01/10
Last modification:	09/21/12 15:28:02

Sample titration page 1: Curve and result

GLP documentation

Titration graph



Method data

Method name:	Acid number	Titration duration:	3 m 33 s
End date:	30.04.13	End time:	12:19:19

Titration data

Sample ID:	Olive oil	Weight:	10.03650 g
Start mV:	123.5 mV	End mV:	-94.6 mV
EQ:	0.548 ml / -47.4 mV	AN mg KOH/g:	0.260

Calculation formula

AN mg KOH/g:	(EQ1-B)*T*M*F1/(W*F2)	Mol (M):	56.10000
Blank value (B):	0.0990 ml (M02)	Titre (T):	0.10350000 (a)
Factor 1 (F1):	1.0000	Weight (W):	10.03650 g (m)
Factor 2 (F2):	1.0000	Statistics:	Off

Sample titration page 2: method

Method data overall view

Method name:	Acid number	Created at:	04/29/13 16:20:59
Method type:	Automatic titration	Last modification:	04/29/13 16:46:51
Measured value:	mV	Damping settings:	strong
Titration mode:	Linear	Documentation:	GLP
Linear steps:	0.050 ml		
Measuring speed / drift:	User-defined:	minimum holding time:	07 s
		maximum holding time:	20 s
		Measuring time:	04 s
		Drift:	10 mV/min
Initial waiting time:	10 s		
Titration direction:	Decrease		
Pretitration:	Off		
End value:	Off		
EQ:	On (1)		
Slope value:	Flat	Value:	120

Dosing parameter

Dosing speed:	100.00 %	Filling speed:	30 s
Maximum dosing volume:	6.00 ml		

Unit values

Unit size:	10ml
Unit ID:	00072696
Reagent:	TBA Hydroxid
Batch ID:	1.0265
Concentration [mol/l]:	0.10350
Determined at:	09/21/12 22:27:50
Expire date:	04/12/12
Opened/compounded:	10/19/11
Test according ISO 8655:	12/01/10
Last modification:	09/21/12 15:28:02

Contact Information

Please contact our titration experts if you have any application or product questions. Thanks!

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