Determination of Acid number and free fatty acids (FFA) in fats and oils
Use

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.

Appliances

- Titrator: TL 7000/TL 7750 M1
- Basic device
- Magnetic stirrer TM 235
- 10 mL Exchange unit WA 10, with amber glass bottle for the titrant, complete

Electrodes

- Electrode: N 6480 eth
- Electrolyte: L 5034 (LiCl/ethanol)
- Calibration: n.a.
Reagents

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

Description

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 dist. 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.

Pic. left: titer
GLP documentation

**Titrator graph**

- **mV/ml**
- **ml**

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

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

**Calculation formula**

\[ \text{Titer} = \frac{(W^*F2)/(\text{EQ1-B})^*\text{M}^*\text{F1})}{\text{M103}} \]

- **Mol (M):** 204.22000
- **Factor 1 (F1):** 1.0000
- **Factor 2 (F2):** 1000.0000

**Weight (W):** 0.1040 g
**Blank value (B):** 0.0000 ml
**Statistics:** Off
### Method data overall view

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method name:</td>
<td>Titer KOH</td>
</tr>
<tr>
<td>Method type:</td>
<td>Automatic titration</td>
</tr>
<tr>
<td>Measured value:</td>
<td>mV</td>
</tr>
<tr>
<td>Titration mode:</td>
<td>Dynamic</td>
</tr>
<tr>
<td>Dynamic</td>
<td>Steep</td>
</tr>
<tr>
<td>Measuring speed / drift:</td>
<td>Normal:</td>
</tr>
<tr>
<td>Initial waiting time:</td>
<td>0 s</td>
</tr>
<tr>
<td>Titrination direction:</td>
<td>Decrease</td>
</tr>
<tr>
<td>Prefibration:</td>
<td>Off</td>
</tr>
<tr>
<td>End value:</td>
<td>Off</td>
</tr>
<tr>
<td>EQ:</td>
<td>On (1)</td>
</tr>
<tr>
<td>Slope value:</td>
<td>Steep</td>
</tr>
<tr>
<td>Minimum holding time:</td>
<td>02 s</td>
</tr>
<tr>
<td>Maximum holding time:</td>
<td>15 s</td>
</tr>
<tr>
<td>Measuring time:</td>
<td>02 s</td>
</tr>
<tr>
<td>Drift:</td>
<td>20 mV/min</td>
</tr>
<tr>
<td>Value:</td>
<td>700</td>
</tr>
</tbody>
</table>

### 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: conversion
W: sample weight in g
Blank titration page 1: Curve and result

GLP documentation

Titratiion graph

<table>
<thead>
<tr>
<th>mV/ml</th>
<th>Solvent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.05</td>
</tr>
<tr>
<td>0</td>
<td>0.1</td>
</tr>
<tr>
<td>0</td>
<td>0.15</td>
</tr>
<tr>
<td>0</td>
<td>0.2</td>
</tr>
<tr>
<td>0</td>
<td>0.25</td>
</tr>
<tr>
<td>0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Method data

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

Titrination data

Sample ID: Solvent
Start mV: 23.2 mV
End mV: -79.3 mV

EQ: 0.099 ml / -45.3 mV
Blank: 0.099 ml

Calculation formula

Blank: EQ1 -> M02

Statistics: Off
## Method data overall view

<table>
<thead>
<tr>
<th>Method name:</th>
<th>Blank AN</th>
<th>Created at:</th>
<th>04/29/13 16:44:04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method type:</td>
<td>Automatic titration</td>
<td>Last modification:</td>
<td>04/29/13 16:46:25</td>
</tr>
<tr>
<td>Measured value:</td>
<td>mV</td>
<td>Damping settings:</td>
<td>strong</td>
</tr>
<tr>
<td>Titration mode:</td>
<td>Linear</td>
<td>Documentation:</td>
<td>GLP</td>
</tr>
<tr>
<td>Linear steps:</td>
<td>0.010 ml</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Measuring speed / drift:
- **12 s**

### Initial waiting time:
- **10 s**

### Titration direction:
- Decrease

### Pretitration:
- Off

### End value:
- Off

### EQ:
- Off

## Dosing parameter

<table>
<thead>
<tr>
<th>Dosing speed:</th>
<th>100.00 %</th>
<th>Filling speed:</th>
<th>30 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum dosing volume:</td>
<td>0.30 ml</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Unit values

<table>
<thead>
<tr>
<th>Unit size:</th>
<th>10ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit ID:</td>
<td>00072696</td>
</tr>
<tr>
<td>Reagent:</td>
<td>TBA Hydroxid</td>
</tr>
<tr>
<td>Batch ID:</td>
<td>1.0265</td>
</tr>
<tr>
<td>Concentration [mol/l]:</td>
<td>0.10350</td>
</tr>
<tr>
<td>Determined at:</td>
<td>09/21/12 22:27:50</td>
</tr>
<tr>
<td>Expire date:</td>
<td>04/12/12</td>
</tr>
<tr>
<td>Opened/compounded:</td>
<td>10/19/11</td>
</tr>
<tr>
<td>Test according ISO 8655:</td>
<td>12/01/10</td>
</tr>
<tr>
<td>Last modification:</td>
<td>09/21/12 15:28:02</td>
</tr>
</tbody>
</table>
Sample titration page 1: Curve and result

**GLP documentation**

**Titration graph**

- **mV/ml**
- **ml**

**Olive oil**

**Method data**

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

**Titration data**

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

**Calculation formula**

\[ \text{AN mg KOH/g:} \frac{(EQ1-B) \times T \times M \times F1}{(W \times F2)} \]

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

Sample titration page 2: method

### Method data overall view

<table>
<thead>
<tr>
<th>Method name:</th>
<th>Acid number</th>
<th>Created at:</th>
<th>04/29/13 16:20:59</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method type:</td>
<td>Automatic titration</td>
<td>Last modification:</td>
<td>04/29/13 16:46:51</td>
</tr>
<tr>
<td>Measured value:</td>
<td>mV</td>
<td>Damping settings:</td>
<td>strong</td>
</tr>
<tr>
<td>Titrination mode:</td>
<td>Linear</td>
<td>Documentation:</td>
<td>GLP</td>
</tr>
<tr>
<td>Linear steps:</td>
<td>0.050 ml</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 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

#### Titrination direction:

- Decrease

#### Pretitrination:

- Off

#### End value:

- Off

#### EQ:

- On (1)

#### Slope value:

- Flat
  - Value: 120

### Dosing parameter

<table>
<thead>
<tr>
<th>Dosing speed:</th>
<th>100.00 %</th>
<th>Filling speed:</th>
<th>30 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum dosing volume:</td>
<td>6.00 ml</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Unit values

<table>
<thead>
<tr>
<th>Unit size:</th>
<th>10ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit ID:</td>
<td>000725696</td>
</tr>
<tr>
<td>Reagent:</td>
<td>TBA Hydroxid</td>
</tr>
<tr>
<td>Batch ID:</td>
<td>1.0265</td>
</tr>
<tr>
<td>Concentration [mol/l]:</td>
<td>0.10350</td>
</tr>
<tr>
<td>Determined at:</td>
<td>09/21/12 22:27:50</td>
</tr>
<tr>
<td>Expire date:</td>
<td>04/12/12</td>
</tr>
<tr>
<td>Opened/compounded:</td>
<td>10/19/11</td>
</tr>
<tr>
<td>Test according ISO 8655:</td>
<td>12/01/10</td>
</tr>
<tr>
<td>Last modification:</td>
<td>09/21/12 15:28:02</td>
</tr>
</tbody>
</table>
If you have any questions on the application, you can feel free to contact us.