Metrohm
Ion analysis

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796 Titroprocessor

Application methods

8.796.2003

99.11 bc/ac

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Titer of NaOH

Reagents

c(NaOH) = 0.1 mol/L; Dos. drive A1
free of carbonate

Sample

app. 150 mg Potassium hydrogen phthalate, dried 2 h at 105°C
in 50 mL dist. water

Electrodes

6.0232.100 combined pH glass electrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Method  NaOH.mth [o]                                              Titer of NaOH

-------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                Parameters
     ----- -------------- ------------------------- -------------------------
 1         DET_PH*        Titer determination of Sodium hydroxide
                          Reagent    NaOH           Sensor     6.0232.100
                          Concentr.      0.1 mol/L  Meas. input    A1
                          Dos. drive            A1
 2         END

================================================================================
printed: 97-07-09 13:05:31
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method NaOH.mth [o] Titer of NaOH

Parameters

```
#  1      DET_pH*   Titer determination of Sodium hydroxide
                    Reagent    NaOH          Sensor     6.0232.100
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1
```

- *Parameters

```
Start conditions
  Volume           off          Meas.val. pH     off
                                Slope            off pH/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    medium          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume       absolute         Meas.val. pH     off
  Size              10 mL       EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on
```

- EP Recognition

```
Endpoints                 all       min. EPC       5.0
Gen. lower limit   pH     min       upp. pH        max
pK/HNP Evaluation         off
```

- Display

```
Curve       Y_Axis       X_Axis
-------------------------------
Quantity    M. value         Volume
Scale           auto           auto
  begin   pH                       mL
  end     pH                       mL
Division                       2 mL/cm
Grid               off
```

- *Report

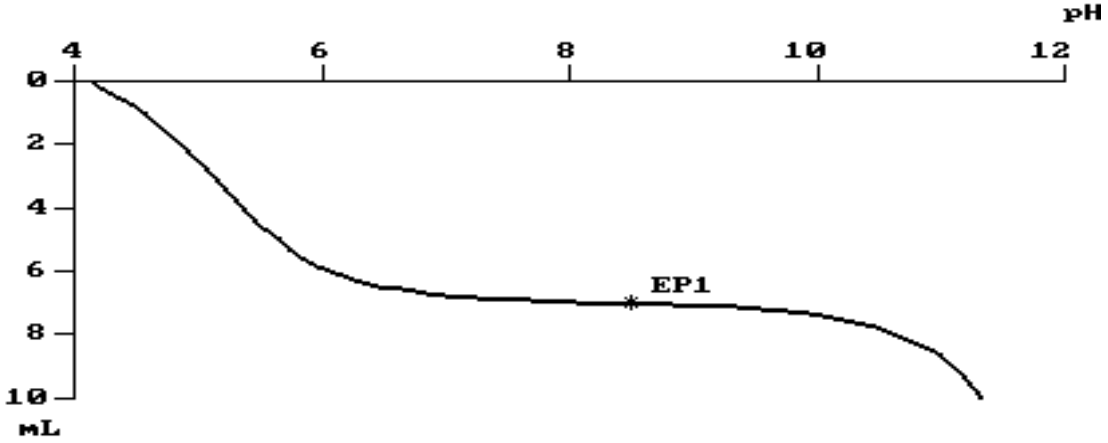
	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

- *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Titer	R1=SS*1000/C/204.23/EP1		4	stat.
2	Titer NaOH	C19=MNR1		4	normal

Curve

1 DET_pH* Titer determination of Sodium hydroxide



*Standard report

Method	Container	Lot	Size	Unit
NaOH	ME5-27	970205/1	0.1440	g

Remark

1 DET_PH* Titer determination of Sodium hydroxide

EP1	pH	8.488	7.060 mL	Titer	0.9990
				Titer NaOH	0.9985

Stop condition volume

Original data Determination time: 97-07-09 13:15:49
Data file NaOH.005 ME5-27 970205/1 NaOH

printed: 97-07-09 13:16:32

Remarks see next page

Remarks

- **Formulas**:
  Titer = titer of NaOH
  Titer NaOH = assignment of mean value to common variable C19
  1000 = calculation factor (mL ⇒ L)
  C = concentration of NaOH (mol/L)
  204.23 = molecular mass of Potassium hydrogen phthalate (g/mol)

- Mean from 5 determinations.

- For shorter titration times, a start volume may be used, see example curve.

Literature

- Metrohm Application Bulletin No. 206: Titer determination in potentiometry

Titer of HCl

Reagents

c(HCl) = 0.1 mol/L; Dos. drive A1

Sample

app. 100 mg Tris(hydroxymethyl)aminomethane, dried 2 h at 105°C in 50 mL dist. water

Electrodes

6.0232.100 combined pH glass electrode; input A1

Method documentation

```
METROHM 796 Titroprocessor  01101  5.796.0010
================================================================================

Method  HCl.mth [o]                                                Titer of HCl

-------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                 Parameters
 1         DET_PH*        Titer determination of Hydrochloric acid
                          Reagent    HCl             Sensor     6.0232.100
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive             A1
 2         END

================================================================================
printed: 97-07-09 10:12:22
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method HCl.mth [o] Titer of HCl

Parameters

```
#  1      DET_pH*   Titer determination of Hydrochloric acid
                    Reagent    HCl           Sensor     6.0232.100
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1
```

- *Parameters

```
Start conditions
  Volume      relative          Meas.val. pH     off
  Factor           50           Slope            off pH/mL
  Dos. rate       max mL/min    Pause              0 s

Titration conditions
  Adjustment    medium          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas.val. pH     2.8
  Size           99.99 mL       EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on
```

- EP Recognition

```
Endpoints                all       min. EPC       5.0
Gen. lower limit   pH    min       upp. pH        max
pK/HNP Evaluation        off
```

- Display

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin   pH                       mL
  end     pH                       mL
Division                       2 mL/cm
Grid               off
```

- *Report

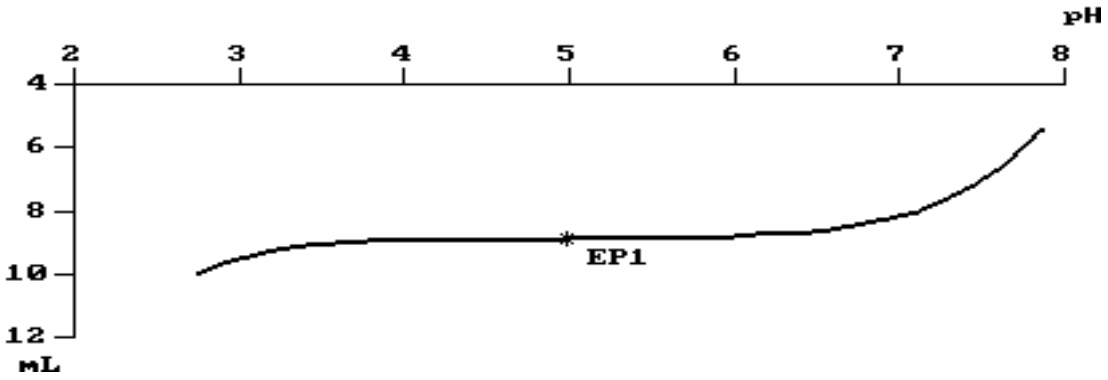
	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

- *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Titer	R1=SS*1000/C/121.14/EP1		4	stat.
2	Titer HCl	C18=MNR1		4	normal

Curve

1 DET_pH* Titer determination of Hydrochloric acid



*Standard report

Method	Container	Lot	Size	Unit
HCl	CE44-6	970312-2	0.10804	g

Remark

1 DET_PH* Titer determination of Hydrochloric acid

EP1	pH	4.989	8.907 mL	Titer	1.0013
				Titer HCl	1.0011

Stop condition Meas. val

Original data Determination time: 97-07-09 10:21:43
Data file HCl.005 CE44-6 970312-2 HCl

printed: 97-07-09 10:23:32

Remarks see next page

Remarks

- **Formulas**:
  Titer = titer of HCl
  Titer HCl = assignment of mean value to common variable C18
  1000 = calculation factor (mL ⇒ L)
  C = concentration of HCl (mol/L)
  121.14 = molecular mass of Tris(hydroxymethyl)aminomethane (g/mol)

- Mean from 5 determinations.

- To shorten the titration time, a relative start volume is used.

Literature

- Metrohm Application Bulletin No. 206: Titer determination in potentiometry

Determination of iodine

Reagents

$c(Na_2S_2O_3)$ = 0.1 mol/L; Dos. Drive A1

Sample

3 mL $c(KI_3) \cong 0.05$ mol/L
in 20 mL dist. water
add 5 mL $c(H_2SO_4)$ = 0.5 mol/L

Electrodes

6.0431.100 Pt Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   Iodine.mth                                        Iodine determination

------------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                 Parameters
     ----- -------------- -------------------------- --------------------------
 1         SHOW           Page              curve
 2         DET_U*         Determination of Iodine
                          Reagent    Na2S2O3         Sensor     6.0431.100
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END

================================================================================
printed: 1999-06-30 14:18:29
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Iodine.mth [o]

Parameters

```
#  2       DET_U*   Determination of Iodine
                    Reagent    Na2S2O3        Sensor     6.0431.100
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive             A1
```

— *Parameters

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment      slow          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume       absolute         Meas. val        off mV
  Size              5 mL       EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on
```

— EP Recognition

```
Equivalence points        all       min. EPC       5.0
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report

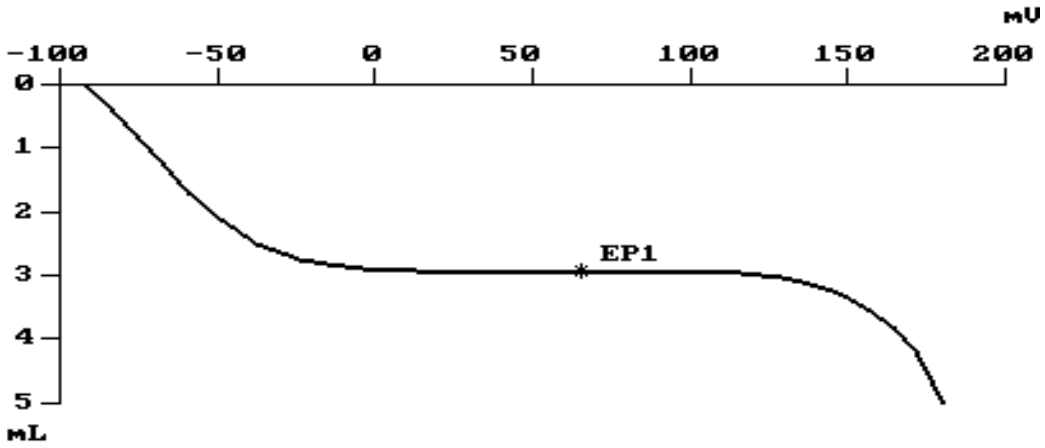
	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	c(KI3)	R1=EP1*C/2/SS	mol/L	4	normal

Curve

2 DET_U* Determination of Iodine



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Iodine				3	mL
Remark					

2 DET_U* Determination of Iodine

EP1	65.1 mV	2.956 mL	c(KI3)	0.0493 mol/L

Stop condition volume

Original data Determination time: 1999-06-30 14:13:43
Data file 99063014.002 Iodine

printed: 1999-06-30 14:17:38

Remarks

- **Determination reaction**:

  $I_2 + 2\ S_2O_3^{2-} \longrightarrow 2\ I^- + S_4O_6^{2-}$

- **Formula**:
  $c(KI_3)$ = concentration of KI_3 solution in mol/L
  C = concentration of titrant (0.1 mol/L)
  2 = factor for “normality“

- Titrate samples immediately.

Literature

Determination of chloride

Reagents

$c(AgNO_3)$ = 0.1 mol/L; Dos. Drive A1

Sample

5 mL c(NaCl) ≅ 0.1 mol/L
in 40 mL dist. water
add 2 mL $c(HNO_3)$ = 2 mol/L

Electrodes

6.0430.100 Ag Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
==============================================================================

Name   Chloride.mth                                  Determination of chloride

___________________________________________________________________ Commands

     t/s    Command         Parameters                Parameters
     ____   _____________   _______________________   _______________________
 1          SHOW            Page              curve
 2          DET_U*          Chloride
                            Reagent    AgNO3          Sensor     6.0430.100
                            Concentr.      0.1 mol/L  Meas. input    A1
                            Dos. drive            A1
 3          SHOW            Page              result
 4          END

==============================================================================
printed: 1999-06-30 17:19:01
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method Chloride.mth [o] Determination of chloride

Parameters

```
#  2       DET_U*   Chloride
                    Reagent    AgNO3          Sensor     6.0430.100
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    medium          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size          99.99 mL        EP#                1
  Fill. rate      max mL/min    Stop time        off s
                                Mpt. overflow     on
```

— EP Recognition

```
Equivalence points        all       min. EPC       5.0
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report

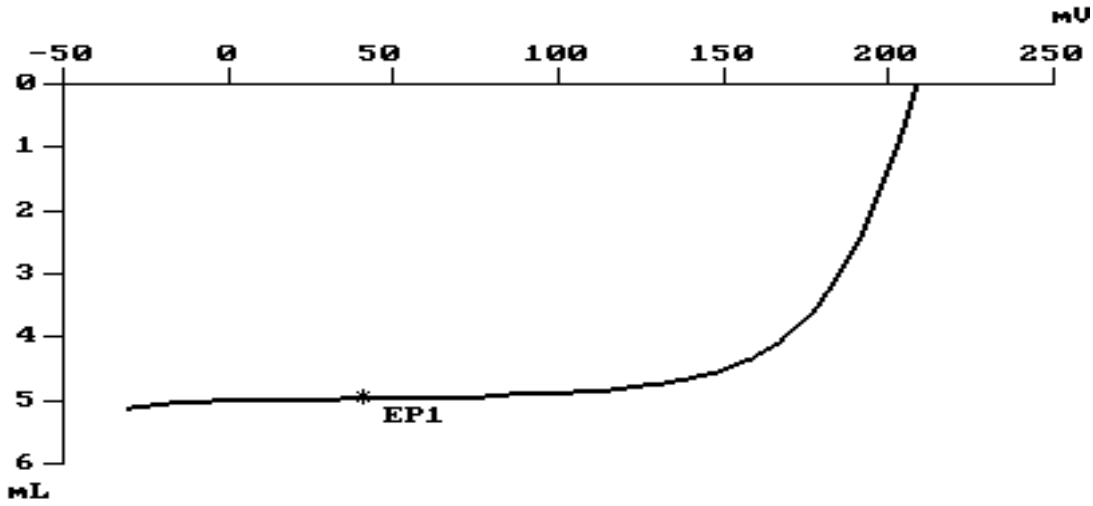
	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Chloride	R1=EP1*C*35.45*0.1/SS	%	2	normal
2	NaCl	R2=EP1*C*58.44/SS	g/L	2	normal

Curve

2 DET_U* Chloride



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Chloride				5.0	mL
Remark					

2 DET_U* Chloride

EP1	41.2 mV	4.989 mL	Chloride	0.35 %
			NaCl	5.83 g/L
Stop condition		#EP reached		

Original data Determination time: 1999-06-30 16:40:47
Data file 99063016.007 Chloride

printed: 1999-06-30 16:42:33

Remarks

- **Formulas**:
  Chloride = content of chloride in %
  NaCl = content of NaCl in g/L
  C = concentration of titrating agent (0.1 mol/L)
  35.45 = molecular mass of Cl^-
  0.1 = factor for %
  58.44 = molecular mass of NaCl

- Select the appropriate formula. The other one may be deleted. Or change the formula according to your application.

Literature

- Metrohm Application Bulletin No. 130: Chloride titrations with potentiometric end-point indication.

Determination of sulphate

Reagents

c ($Ba(ClO_4)$) = 0.005 mol/L; Dos. Drive A1
c ($HClO_4$) = 1 mol/L
w (Thorin) = 0.01 (1 %) in dist. Water
Isopropanol p.a.

Sample

100 mL aqueous sulphate solution

Electrodes

6.5501.004 Spectrode 525 nm ; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   Sulfate.mth                          photometric sulphate determination

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1         SHOW           Page              curve
 2         MET_U*         sulphate titration
                          Reagent    Ba(ClO4)2      Sensor     Spectrode 525
                          Concentr.    0.005 mol/L  Meas. input    A1
                          Dos. drive           A1
 3         SHOW           Page              result
 4         END

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printed: 1999-07-06 09:02:00
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method Sulfate.mth [o] photometric sulphate determination

Parameters

```
#  2       MET_U*   sulphate titration
                    Reagent    Ba(ClO4)2      Sensor     Spectrode 525
                    Concentr.    0.005 mol/L  Meas. input    A1
                    Dos. drive             A1
```

— *Parameters —

```
Start conditions
  Volume            off          Meas. val        off mV
                                 Slope            off mV/mL
  Dos. rate         max mL/min   Pause              0 s

Titration conditions
  Adjustment     custom          Time recording   on
  Temperature      25.0 °C

Stop conditions
  Volume       absolute          Meas. val        off mV
  Size               5 mL        EP#                9
  Fill. rate         max mL/min  Stop time        off s
                                 Mpt. overflow     on

Custom adjustments
  Volume steps     0.2 mL        Signal drift     off mV/min
  Titr. rate       max mL/min    Equilibr.time     20 s
```

— EP Recognition —

```
Equivalence points         all       min. EPC      30.0 mV
general lower limit        min mV    upp.           max mV
pK/HNP Evaluation          off
```

— Display —

```
Curve        Y_Axis        X_Axis
-------------------------------------
Quantity     M. value          Volume
Scale            auto            auto
  begin               mV              mL
  end                 mV              mL
Division                          1 mL/cm
Grid                off
```

— *Report —

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

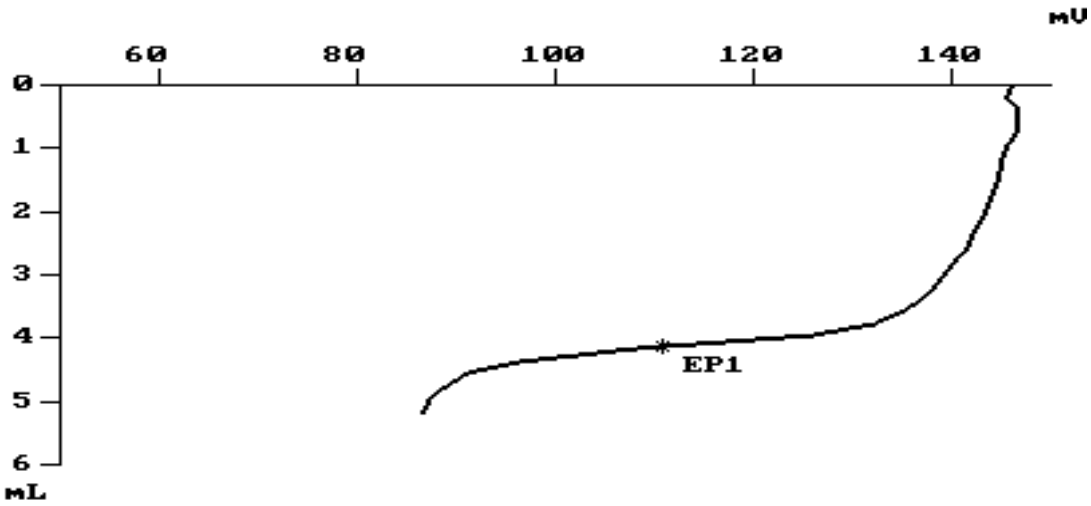
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Sulphate	R1=EP1*0.4803*1000/SS	mg/L	3	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method Sulfate.mth [o] photometric sulphate determination

Curve

2 MET_U* sulphate titration



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Sulfate				10.0	mL
Remark					

2 MET_U* sulphate titration

EP1	110.9 mV	4.164 mL	Sulphate	200.013 mg/L

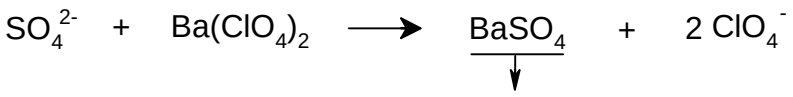
Stop condition volume

Modified data Determination time: 1999-07-06 08:32:56
Data file 99070608.001 Sulfate

printed: 1999-07-06 08:44:10

Remarks

Determination reaction*:*



- **Formula**:
  Sulphate = fraction of sulphate in mg /L
  0.4803 = sulphate equivalent / mL
  1000 = conversion factor mL ⇒ L

· The titer of the titration agent must be checked periodicaly .

· To avoid precipitation of $BaSO_4$ on the mirror of the Spectrode, the concentration of SO_4 must not be too high.

Literature

- Metrohm Application Bulletin No. 140/1: Analytical determination of sulphate

- Metrohm Application Note No. T-53: Sulphate by photometric titration

Calcium/Magnesium in tap water

Reagents

c(Na_2EDTA) = 0.05 mol/L in c(KOH) = 0.1 mol/L; Dos. drive A1
c(Acetylacetone) = 0.1 mol/L in c(Trishydroxymethylaminomethane) = 0.1 mol/L (auxiliary complexing agent, pH app. 8.5); Dos. drive A2

Sample

100 mL tap water

Electrodes

6.0504.100 Ca^{2+} sensitive indicator electrode; input A1
6.0733.100 Ag/AgCl reference electrode; electrolyte c(KCl) = 3 mol/L

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Method  CaMgTap.mth [o]                        Calcium / Magnesium in tap water

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1     10  ADD_R          Reagent    Tris-Buffer     Dos. drive     A2
                          Concentr.      0.1 mol/L   Dos. rate     max mL/min
                          Factor             0.15    Fill. rate    max mL/min
 2         DET_U*         Ca++ and Mg++ determination with Ca++ ISE
                          Reagent    Na2EDTA/KOH     Sensor     6.0504.100
                          Concentr.     0.05 mol/L   Meas. input    A1
                          Dos. drive            A1
 3         END

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printed: 1998-07-10 11:31:49
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method CaMgTap.mth [o] Calcium / Magnesium in tap water

Parameters

```
#  2       DET_U*   Ca++ and Mg++ determination with Ca++ ISE
                    Reagent    Na2EDTA/KOH    Sensor     6.0504.100
                    Concentr.     0.05 mol/L  Meas. input    A1
                    Dos. drive            A1
```

- *Parameters

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment      slow          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size             10 mL        EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on
```

- EP Recognition

```
Endpoints                 all       min. EPC       5.0
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

- Display

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin              mV             mL
  end                mV             mL
Division                        1 mL/cm
Grid               off
```

- *Report

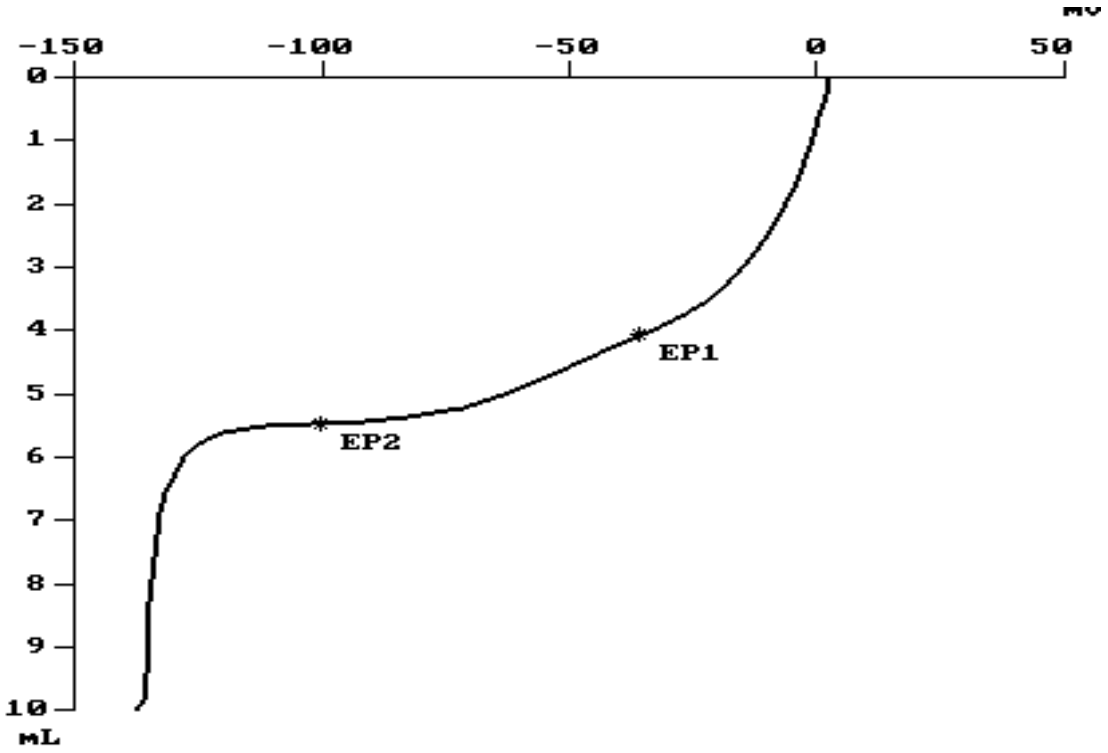
	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

- *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Ca++	R1=EP1*C*1000/SS	mmol/L	2	stat.
2	Mg++	R2=(EP2-EP1)*C*1000/SS	mmol/L	2	stat.
3	Total	R3=EP2*C*1000/SS	mmol/L	2	stat.

Curve

2 DET_U* Ca++ and Mg++ determination with Ca++ ISE



*Standard report

Method	Company	Lab.	Date	Size	Unit
CaMgTap	Metrohm	Chem.Lab.1a	10.07.97	100 ml	

Remark

2 DET_U* Ca++ and Mg++ determination with Ca++ ISE

EP1	-35.8 mV	4.087 mL	Ca++	2.04 mmol/L
EP2	-100.2 mV	5.493 mL	Mg++	0.70 mmol/L
			Total	2.75 mmol/L

Stop condition volume

Original data Determination time: 1998-07-10 11:32:47
Data file CaMgTap.003 Metrohm Chem.Lab.1a 10.07.97

printed: 1998-07-10 11:36:48

Remarks

- 1st equivalence point: Ca^{2+}
  2nd equivalence point: Mg^{2+}

- **Formulas**:
  Ca++ = calcium hardness in mmol/L
  Mg++ = magnesium hardness in mmol/L
  Total = total hardness in mmol/L
  C = concentration of Na_2EDTA (mol/L)
  1000 = conversion factor mol ⇒ mmol

- **Electrode preparation**:
  Ca electrodes should be conditioned for 10 min. in $c(CaCl_2)$ = 0.01 mol/L before use.

- If you prefer to add the Tris-Buffer solution manually, you have to delete the Command ADD_R for automatic addition first.

- The volume of auxiliary reagent can be optimised for the magnesium content. Rule of thumb: Ratio Mg/Acetylacetone app. 0.05.

Literature

- Metrohm Application Bulletin No. 125: Complexometric simultaneous determination of calcium and magnesium in water samples and beverages with the aid of an ion-selective calcium electrode

Total water hardness

Reagents

c(EDTA) = 0.05 mol/L in *c*(KOH) = 0.1 mol/L; Dos. drive A1
buffer pH 10, dissolve 54 g NH_4Cl and 300 mL *w*(NH_3) = 0.25
in 1 L dist. water; Dos. drive A2

Sample

50 mL tap water
appr. 0.1 g Mg-Complex
$MgNa_2EDTA$ monohydrate (Magnesium Disodium salt Hydrate)
spatula tip of indicator
Eriochrome black T
Pulverize 1 g Eriochrome black T and 100 g NaCl in a mortar.

Electrodes

6.5501.014 Spectrode, wavelength 610 nm; Input A1

Method documentation

METROHM 796 Titroprocessor 01101 5.796.0010

Name Hardness.mth total water hardness by photometric titration

Commands

	t/s	Command	Parameters		Parameters	
1		STIR_I	Meas.interface	A	State	on
2		ADD_A	Reagent	buffer pH 10	Dos. drive	A2
			Concentr.		Dos. rate	max mL/min
			Volume	10.0 mL	Fill. rate	max mL/min
3	60	WAIT				
4		MET_U*	Ca/Mg Hardness			
			Reagent	EDTA	Sensor	6.5501.014
			Concentr.	0.05 mol/L	Meas. input	A1
			Dos. drive	A1		
5		STIR_I	Meas.interface	A	State	off
6		END				

printed: 1998-06-04 08:58:00

METROHM 796 Titroprocessor 01101 5.796.0010

Method Hardness.mth [o] total water hardness by photometric titration

Parameters

4 MET_U* Ca/Mg Hardness
Reagent EDTA Sensor 6.5501.014
Concentr. 0.05 mol/L Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	4.0 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Volume steps	0.1 mL	Signal drift	20 mV/min
Titr. rate	max mL/min	Equilibr.time	auto s

— EP Recognition —

Equivalence points	all	min. EPC	30.0 mV
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*ShrtRes		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

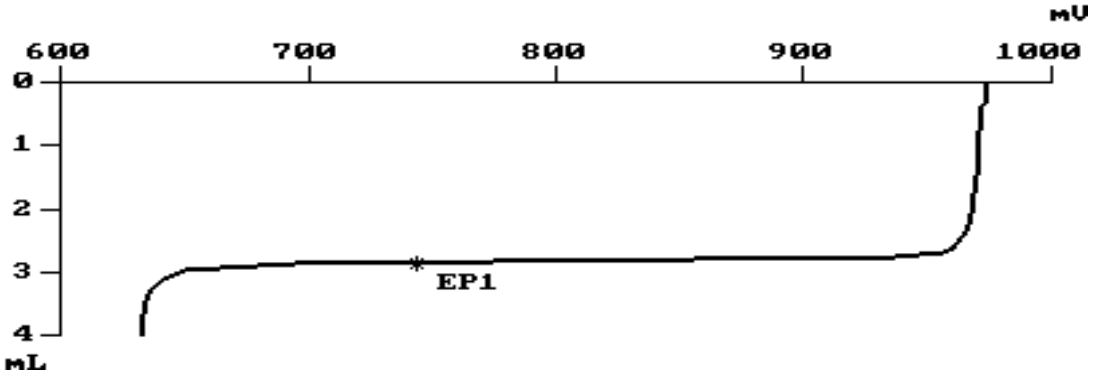
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	hardness	R01=EP1*C*1000/SS	mmol/L	3	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method Hardness.mth [o] total water hardness by photometric titration

Curve

4 MET_U* Ca/Mg Hardness



Short results

4 MET_U* Ca/Mg Hardness

hardness	2.879	mmol/L

Stop condition volume

Original data Determination time: 1998-06-04 13:15:55
Data file 98060413.009 tap water Hardness

printed: 1998-06-04 14:31:01

Remarks

Formulas:

hardness = total water hardness in mmol/L
C = concentration of titration agent in mol/L
1000 = factor for the conversion mol ⇒ mmol

general remarks:

If you prefer the addition of buffer pH 10 manually, you have to delete the Command Add A (Line 2) for automatic addition first.

Literature

- Application Note No. T-52 : Total water hardness by photometric titration.

Acid capacity in tap water

Reagents

c (NaOH) = 0.1 mol/L; Dos. Drive A1

Sample

100 mL tap water

Electrodes

6.0232.100 combined pH glass elektrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   Acidcapa.mth                                  acid capacity in tap water

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1         SHOW           Page              curve
 2         SET_PH*        capacity to pH 8.2
                          Reagent    HCl             Sensor     6.0232.100
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive            A1
 3         SET_PH*        capacity to pH 4.3
                          Reagent    HCl             Sensor     6.0232.100
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive            A1
 4         SHOW           Page              result
 5         END

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printed: 1999-07-07 11:13:42
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Acidcapa.mth [o] acid capacity in tap water

Parameters

```
#  2      SET_pH*   capacity to pH 8.2
                    Reagent    HCl            Sensor     6.0232.100
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters

```
Start conditions
  Volume           off          Pause 1            0 s
                                Pause 2            0 s
                                Extract. time      0 s

Titration conditions
  Direction       neg.          Temperature     25.0 °C
  End-point  pH    8.2          Time recording    on
  Adjustment    custom          Derivation       off
  Mpt. interval      5 s

Stop conditions
  Volume      absolute          Stop time        off s
  Size           99.99 mL       Mpt. overflow    off
  Fill. rate       max mL/min

Custom adjustments
  Dynamics  pH   2.000
  Min. rate        5.0 µL/min   Stop crit.     drift
  Max. rate      10.00 mL/min   Stop drift        20 µL/min
```

— Display

```
Curve       Y_Axis       X_Axis
Quantity    M. value           time
Scale           auto           auto
  begin   pH                        s
  end     pH                        s
Division                       30 s/cm
Grid               off
```

— *Report

	Type	Specification	print	send	FF
Reports for	T_Curve	M. value	yes	no	no
titration /			no	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	cons 8.2	X01=TST(EP1,0)	mL	5	normal

Parameters

3 SET_pH* capacity to pH 4.3

Reagent	HCl	Sensor	6.0232.100
Concentr.	0.1 mol/L	Meas. input	A1
Dos. drive	A1		

— *Parameters —

Start conditions

Volume	off	Pause 1	0 s
		Pause 2	0 s
		Extract. time	0 s

Titration conditions

Direction	neg.	Temperature	25.0 °C
End-point pH	4.3	Time recording	on
Adjustment	custom	Derivation	off
Mpt. interval	5 s		

Stop conditions

Volume	absolute	Stop time	off s
Size	99.99 mL	Mpt. overflow	off
Fill. rate	max mL/min		

Custom adjustments

Dynamics pH	3.00		
Min. rate	5.0 µL/min	Stop crit.	drift
Max. rate	10 mL/min	Stop drift	20 µL/min

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	time
Scale	auto	auto
begin	pH	s
end	pH	s
Division		30 s/cm
Grid	off	

— *Report —

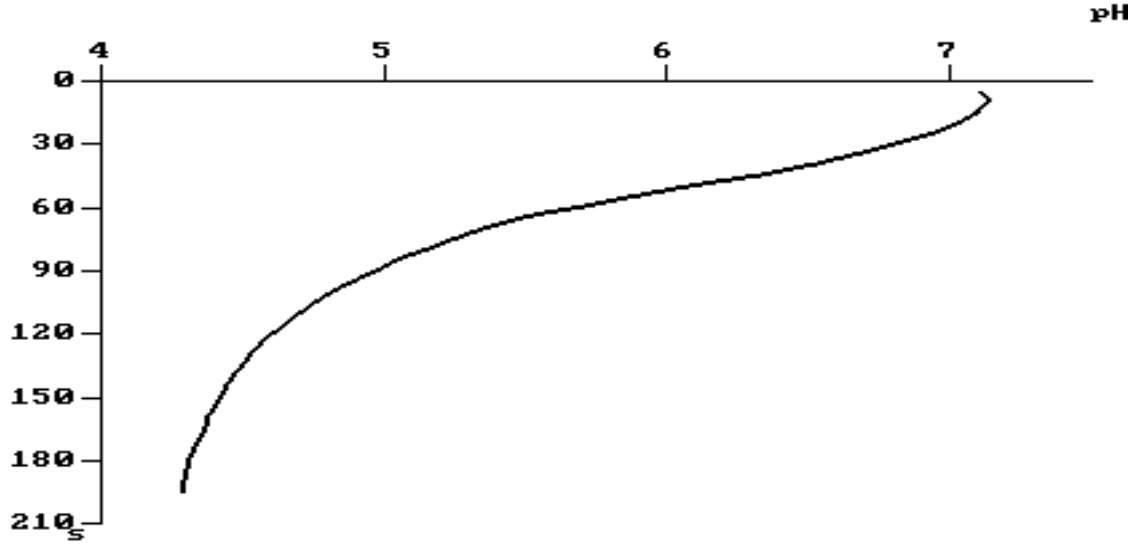
	Type	Specification	print	send	FF
Reports for titration / measuring mode	T_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Ks 8.2	R1=X01*C*10	mmol/L	2	normal
2	Ks 4.3	R2=(EP1+X01)*C*10	mmol/L	2	normal

Curve

3 SET_pH* capacity to pH 4.3



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Acidcapa				100	mL
Remark					

3 SET_PH* capacity to pH 4.3

EP	pH 4.288	5.428 mL	Ks 8.2	0.00	mmol/L
Inter.titr.time		11.0 s	Ks 4.3	5.43	mmol/L
Dosing time		198.2 s			
Stop condition		stop drift			

Original data Determination time: 1999-07-07 10:43:31
Data file 99070710.004 Acidcapa

printed: 1999-07-07 10:47:35

Remarks

- **Formulas:**
  cons 8.2 = Consumtion of titrating agent to pH 8.2
  Ks 8.2 = Acidcapacity to pH 8.2 (mmol / L H^+)
  Ks 4.3 = Acidcapacity to pH 4.3 (mmol / L H^+)
  C = concentration of titrating agent (0.1 mol/L)
  10 = factor for mmol / L (if samlpe size is 100 mL)

· Calibrate the electrode first.

Literature

- German standard methods for the examination of water
  DIN 38409 - H7 -1

p and m-Value combined with total water hardness

Reagents

c(HCl) = 0.1 mol/L; Dos. Drive A1
c(Na_2-EDTA) = 0.05 mol/L in *c*(KOH) = 0.1 mol/L; Dos. Drive A2
TRIS = *c*(Acetylacetone) = 0.1 mol/L 0.1 mol/L in *c*(Trishydroxymethylaminomethane) = 0.1mol/L (auxiliary complexing agent); Dos. Drive A3

Sample

100 ml tap water

Electrodes

6.0232.100 combined pH glass electrode; input A1
6.0504.100 Ca2+ sensitive indicator electrode ; input A2

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   Tapwater.mth                                    Total water hardness

─────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1         SHOW           Page              curve
 2      10 MEAS_PH*       pH-Value in tap water
                          Sensor     6.0232.100      Signal drift   20 mV/min
                          Meas. input        A1      Equilibr.time  auto s
                          Temperature      25.0 °C
 3         SET_PH*        p-Value in tap water
                          Reagent    HCl             Sensor     6.0232.100
                          Concentr.     0.10 mol/L   Meas. input    A1
                          Dos. drive            A1
 4         SET_PH*        m-Value in tap water
                          Reagent    HCl             Sensor     6.0232.100
                          Concentr.     0.10 mol/L   Meas. input    A1
                          Dos. drive            A1
 5      10 ADD_A          Reagent    TRIS            Dos. drive     A3
                          Concentr.      0.2 mol/L   Dos. rate     max mL/min
                          Volume           15 mL     Fill. rate    max mL/min
 6         DET_U*         Ca++ and Mg++ determination with Ca++ ISE
                          Reagent    Na2-EDTA        Sensor     6.0504.100
                          Concentr.     0.05 mol/L   Meas. input    A2
                          Dos. drive            A2
 7         SHOW           Page             result
 8         END

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printed: 1999-09-04 11:32:42
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

```
#  2     MEAS_pH*   pH-Value in tap water
                    Sensor     6.0232.100     Signal drift   20 mV/min
                    Meas. input        A1     Equilibr.time  auto s
                    Temperature      25.0 °C

      — *Parameters ——————————————————————————————————————————

      Data acquisition

        Meas. procedure     standard
        Sampling time              1 s

      — Display ——————————————————————————————————————————————

      Curve       Y_Axis       X_Axis
      ————————————————————————————————
      Quantity    M. value           time
      Scale           auto           auto
        begin   pH                      s
        end     pH                      s
      Division                      10 s/cm
      Grid               off
```

Parameters

```
#  3      SET_pH*   p-Value in tap water
                    Reagent    HCl            Sensor     6.0232.100
                    Concentr.     0.10 mol/L  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ——————————————————————————————————————————

      Start conditions
        Volume           off          Pause 1            0 s
                                      Pause 2            0 s
                                      Extract. time      0 s

      Titration conditions
        Direction       neg.          Temperature     25.0 °C
        End-point  pH    8.2          Time recording    on
        Adjustment    custom          Derivation       off
        Mpt. interval      5 s

      Stop conditions
        Volume      absolute          Stop time        off s
        Size           99.99 mL       Mpt. overflow    off
        Fill. rate      max mL/min

      Custom adjustments
        Dynamics  pH       2
        Min. rate          5 µL/min   Stop crit.     drift
        Max. rate      10.00 mL/min   Stop drift        20 µL/min
```

— Display

Curve	Y_Axis	X_Axis
Quantity	M. value	time
Scale	auto	auto
begin	pH	s
end	pH	s
Division		30 s/cm
Grid	off	

— *Report

	Type	Specification	print	send	FF
Reports for	T_Curve	M. value	yes	no	no
titration /			no	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	cons 8.2	XO1=TST(EP1,0)	ml	5	normal

Parameters

4 SET_pH* m-Value in tap water

Reagent	HCl	Sensor	6.0232.100
Concentr.	0.10 mol/L	Meas. input	A1
Dos. drive	A1		

— *Parameters

Start conditions

Volume	off	Pause 1	0 s
		Pause 2	0 s
		Extract. time	0 s

Titration conditions

Direction	neg.	Temperature	25.0 °C
End-point pH	4.3	Time recording	on
Adjustment	custom	Derivation	off
Mpt. interval	5 s		

Stop conditions

Volume	absolute	Stop time	off s
Size	99.99 mL	Mpt. overflow	off
Fill. rate	max mL/min		

Custom adjustments

Dynamics pH	3		
Min. rate	5 µL/min	Stop crit.	drift
Max. rate	10.00 mL/min	Stop drift	20 µL/min

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	time
Scale	auto	auto
begin	pH	s
end	pH	s
Division		30 s/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for	T_Curve	M. value	yes	no	no
titration /			no	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	p-value	R01=XO1*C*10	mmol/L	2	normal
2	m-value	R02=(EP1+XO1)*C*10	mmol/L	2	normal

— Parameters

6 DET_U* Ca++ and Mg++ determination with Ca++ ISE

Reagent	Na2-EDTA	Sensor	6.0504.100
Concentr.	0.05 mol/L	Meas. input	A2
Dos. drive	A2		

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	slow	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	10 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

— EP Recognition —

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Ca++	R03=EP1*C*1000/SS	mmol/L	2	normal
2	Mg++	R04=(EP2-EP1)*C*1000/SS	mmol/L	2	normal
3	Total	R05=EP2*C*1000/SS	mmol/L	2	normal

— Determination report —

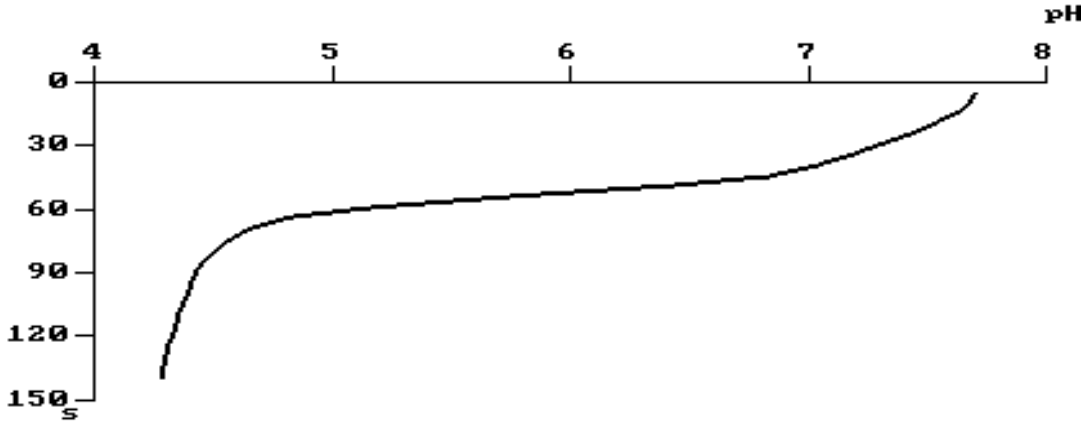
	initial	print	send	FF	final	print	send	FF
Determination reports		no	no	no	Standard	yes	no	no
		no	no	no		no	no	no
		no	no	no		no	no	no
		no	no	no		no	no	no

METROHM 796 Titroprocessor 01101 5.796.0010

Method Tapwater.mth [o] Total water hardness

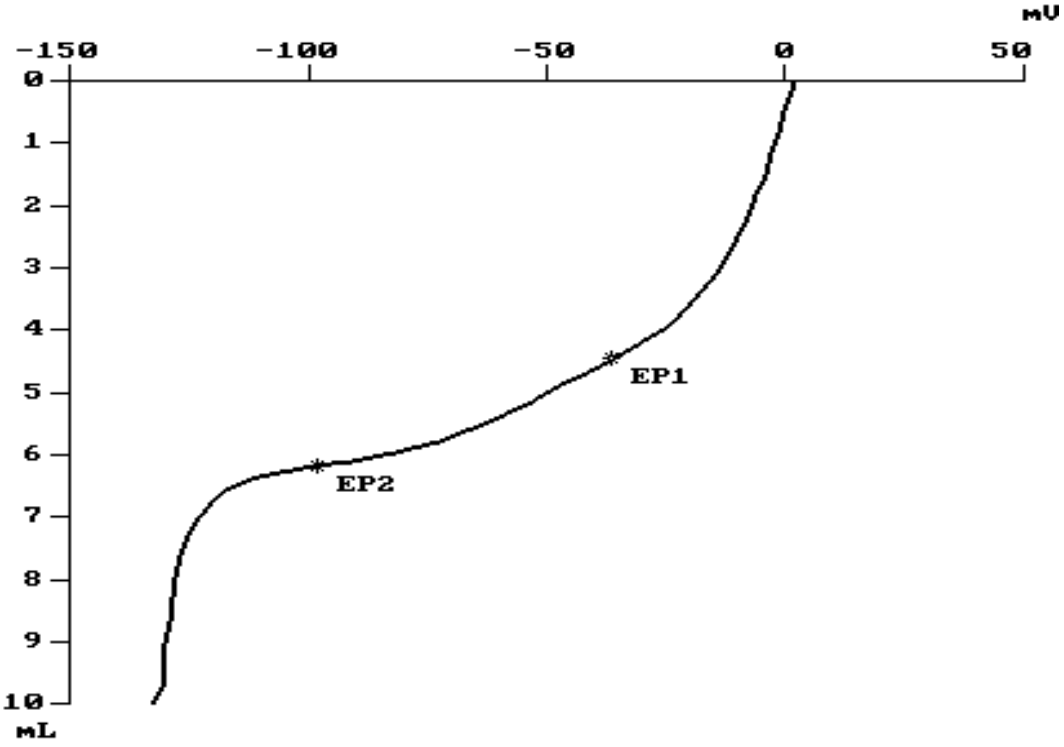
Curve

4 SET_pH* m-Value in tap water



Curve

6 DET_U* Ca++ and Mg++ determination with Ca++ ISE



```
──────────────────────────────────────────────────────────────────────── Final reports

──────────────────────────────────────────────────────────────────────── Standard report
Run number :  005

  Method    Ident1        Ident2        Ident3        Size      Unit
  Tapwater  Tap-Water     Metrohm       lab. 1b            100 ml
  Remark
  Total water hardness

──────────────────────────────────────────────────────────────────────────────

#  2     MEAS_PH*   pH-Value in tap water

  IM      pH   7.701
  CM      pH   7.702

#  3      SET_PH*   p-Value in tap water

  EP      pH   7.714        0.000 mL
  Dosing time                 6.3 s

#  4      SET_PH*   m-Value in tap water

  EP      pH   4.296        5.572 mL        p-value           0.00 mmol/L
  Inter.titr.time            11.1 s         m-value           5.57 mmol/L
  Dosing time               140.8 s

#  6       DET_U*   Ca++ and Mg++ determination with Ca++ ISE

  EP1          -36.3 mV     4.481 mL        Ca++              2.24 mmol/L
  EP2          -97.9 mV     6.198 mL        Mg++              0.86 mmol/L
                                            Total             3.10 mmol/L


Original data                          Determination time: 1999-09-04 11:27:50
Data file 99090411.005     Tap-Water Metrohm Tapwater Total water hardness
==============================================================================
printed: 1999-09-04 11:35:13
```

Remarks

- **Method p and m Value:**
  Values for the acid capacity of water
  p-value = value of Phenolphthalein (pH 8.2)
  m-value = value of Methyl orange (pH 4.3)

- **Method Ca-Mg:**
  1st equivalence point: Ca^{2+}
  2nd equivalence point: Mg^{2+}

- **Formulas:**
  cons 8.2 = Consumption of titrant to pH 8.2

  p-value = Acid capacity to pH 8.2 (mmol / L H^+)
  m-value = Acid capacity to pH 4.3 (mmol / L H^+)
  10 = factor for mmol / L (if samlpe size is 100 mL)

  Ca++ = calcium hardness in mmol/L
  Mg++ = magnesium hardness in mmol/L
  Total = total hardness in mmol/L
  1000 = conversion factor mol ⇒ mmol

  C = concentration of titrant (mol/L)

- **Electrode preparation:**
  Ca electrodes should be conditioned for 10 min in $c(CaCl_2)$ = 0.01 mol/L before use

- The volume of the auxiliary reagent can be optimised for the magnesium content. Rule of thumb: Ratio Mg/Acetylacetone app.0.05

Literature

- Metrohm Applikation Bulletin No. 125: Complexometric simultaneous determination of calcium and magnesium in water samples and beverages with the aid of an ion-selective calcium electrode.
- German standard methods for the examination of water
  DIN 38409 - H7 -1

Chloride in tap water

Reagents

c($AgNO_3$) = 0.01 mol/L (titrant); Dos. drive A1
c(HNO_3) = 2 mol/L; Dos. drive A2

Sample

100 mL tap water

Electrodes

6.0430.100 Ag Titrode (with Ag_2S coating); input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name    ClinTap.mth                                        Chloride in tap water

─────────────────────────────────────────────────────────────────────── Commands

     t/s   Command          Parameters                 Parameters
     ────  ──────────────   ────────────────────────   ────────────────────────
 1     10  ADD_A            Reagent    HNO3            Dos. drive     A2
                            Concentr.        2 mol/L   Dos. rate     max mL/min
                            Volume           0.5 mL    Fill. rate    max mL/min
 2         DET_U*           Determination of Cl- in tap water
                            Reagent    AgNO3           Sensor     6.0430.100
                            Concentr.     0.01 mol/L   Meas. input    A1
                            Dos. drive            A1
 3         END

==============================================================================
printed: 1998-07-08 07:40:03
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method ClinTap.mth [o] Chloride in tap water

Parameters

2 DET_U* Determination of Cl– in tap water
Reagent AgNO3 Sensor 6.0430.100
Concentr. 0.01 mol/L Meas. input A1
Dos. drive A1

– *Parameters

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	medium	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	99.99 mL	EP#	1
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

– EP Recognition

Endpoints	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

– Display

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

– *Report

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

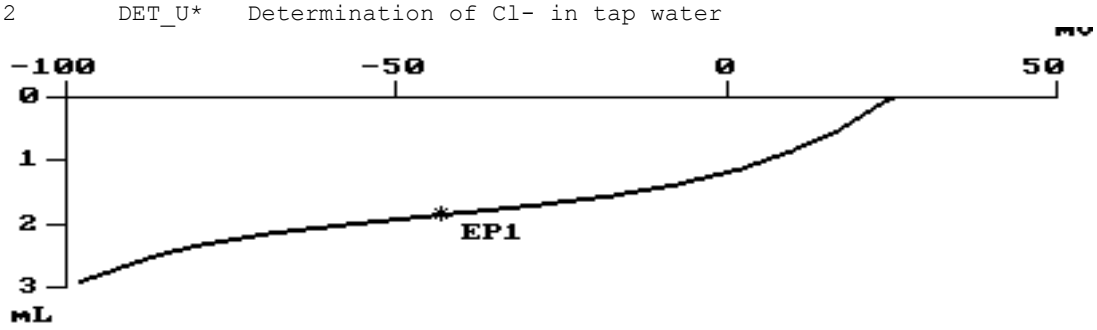
– *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Chloride	R1=EP1*C*35.45*1000/SS	mg/L	2	stat.

METROHM 796 Titroprocessor 01101 5.796.0010

Curve

2 DET_U* Determination of Cl- in tap water



*Standard report

Method	Company	Lab.	Date	Size	Unit
ClinTap	Metrohm	Chem.Lab.1a	08.07.97	100	ml

Remark

2 DET_U* Determination of Cl— in tap water

EP1	-43.1 mV	1.880 mL	Chloride	6.66 mg/L

Stop condition #EP reached

Original data Determination time: 1998-07-08 10:54:32
Data file Chloride.005 Metrohm Chem.Lab.1a 08.07.97

printed: 1998-07-08 10:56:21

Remarks see next page

Remarks

- **Formulas**:
  Chloride = fraction of chloride in mg/L
  C = concentration of titrant (mol/L)
  35.45 = molecular mass of Choride (g/mol)
  1000 = conversion factor mL⇒ L

- **Ag_2S coating of electrode**:
  Immerse Ag Titrode in alkaline solution of thioacetamide during 15 min.

- If you prefer the addition of $c(HNO_3)$ = 2 mol/L manually, you have to delete the Command ADD_A for automatic addition first.

Literature

- Metrohm Application Bulletin No. 130: Chloride titrations with potentiometric end-point indication.

Blank determination for sulphate titration

Reagents

c(EGTA)	= 0.05 mol/L; Dos. drive A1
c($BaCl_2$)	= 0.05 mol/L in *c*(HCL) = 0.1 mol/L; Dos. drive A2
buffer pH 10	Dissolve 9g NH_4Cl and 60 mL *w*(NH_3) = 0.25 (25%) in 1 L dist. water; Dos. drive A3

Sample

50 mL dist water

Electrodes

6.0504.100	Ca-ISE electrode; Input A1
6.0733.100	Reference electrode

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
=============================================================================

Name   BlankS04.mth                  Blank determination for sulphate in water

──────────────────────────────────────────────────────────────────── Commands

     t/s   Command         Parameters                Parameters
     ────  ─────────────   ───────────────────────   ─────────────────────
 1         STIR_I          Meas.interface         A  State                on
 2         ADD_A           Reagent    BaCl2          Dos. drive     A2
                           Concentr.     0.05 mol/L  Dos. rate     max mL/min
                           Volume            5.0 mL  Fill. rate    max mL/min
 3     180 WAIT            3 min. stirring
 4         ADD_A           Reagent    Puffer 10      Dos. drive     A3
                           Concentr.                 Dos. rate     max mL/min
                           Volume            5.0 mL  Fill. rate    max mL/min
 5      30 WAIT            30 sec. stirring
 6         DET_U*          Blank determination for sulphate in dest. water
                           Reagent    EGTA           Sensor     6.0504.100
                           Concentr.     0.05 mol/L  Meas. input    A1
                           Dos. drive            A1
 7         STIR_I          Meas.interface         A  State               off
 8         END

-----------------------------------------------------------------------------
printed: 1999-08-05 16:53:20
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method BlankS04.mth [o] Blank determination for sulphate in water

Parameters

6 DET_U* Blank determination for sulphate in dest. water
Reagent EGTA Sensor 6.0504.100
Concentr. 0.05 mol/L Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	8.0 mL	EP#	1
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	4	Signal drift	off mV/min
Min.increment	10 µL	Equilibr.time	20 s
Titr. rate	max mL/min		

— EP Recognition —

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

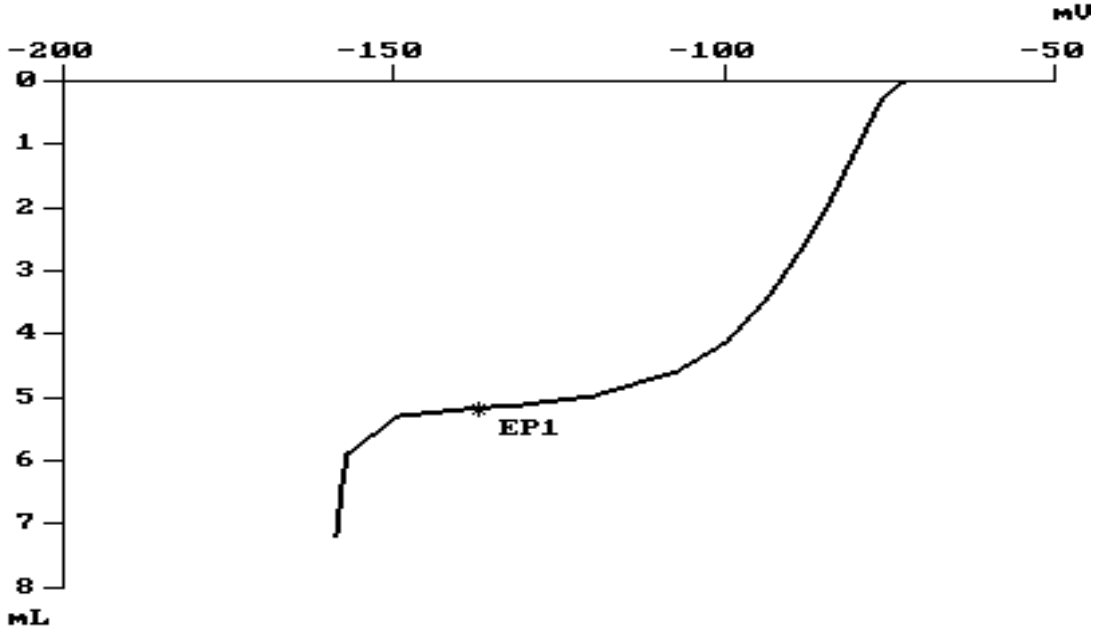
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	EP1	R01=EP1	mL	4	stat.
2	V(blank)	C16=MNR01	mL	4	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method BlankS04.mth [o] Blank determination for sulphate in water

Curve

6 DET_U* Blank determination for sulphate in dist. water



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
BlankS04	dist water			50	mL

Remark

6 DET_U* Blank determination for sulphate in dist. water

EP1	-137.1 mV	5.211 mL	EP1	5.2107 mL
			V(blank)	5.2098 mL
Stop condition		#EP reached		

Original data Determination time: 1998-06-04 17:30:52
Data file 98060417.015 dist water BlankS04

printed: 1998-06-04 17:41:15

Remarks

Formulas:

EP1 = mL EGTA for the blank
C16 = V(blank); mean value of EP1

General remarks
If you prefer the addition of $BaCl_2$ and buffer manually, you have to delete the Command Add A (Line 2), Command Wait 180 sec (Line 3), Command Add A (line 4) and Command Wait 30 sec (Line 5) for automatic addition first.

Sample determination
see Application No. 2.5.2

Literature

- Metrohm Application Bulletin No. 140: Sulphate determination

Sulphate in water samples

Reagents

c(EGTA)	= 0.05 mol/L; Dos. drive A1
c($BaCl_2$)	= 0.05 mol/L in *c*(HCL) = 0.1 mol/L; Dos. drive A2
buffer pH 10	Dissolve 9g NH_4Cl and 60 mL *w*(NH_3) = 0.25 in 1 L dist. water; Dos. drive A3

Sample

20...50 mL sample
The blank is determined in the same way (use dist. water as sample), see Application No. 2.5.1

Electrodes

6.0504.100	Ca-ISE electrode; Input A1
6.0733.100	Reference electrode

Method documentation

METROHM 796 Titroprocessor 01101 5.796.0010

Name Sulphate.mth Sulphate in water samples

Commands

	t/s	Command	Parameters		Parameters	
1		STIR_I	Meas.interface	A	State	on
2		ADD_A	Reagent	BaCl2	Dos. drive	A2
			Concentr.	0.05 mol/L	Dos. rate	max mL/min
			Volume	5.0 mL	Fill. rate	max mL/min
3	180	WAIT	3 min. stirring			
4		ADD_A	Reagent	buffer 10	Dos. drive	A3
			Concentr.		Dos. rate	max mL/min
			Volume	5.0 mL	Fill. rate	max mL/min
5	30	WAIT	30 sec. stirring			
6		DET_U*	Determination of sulphate		in water	
			Reagent	EGTA	Sensor	6.0504.100
			Concentr.	0.05 mol/L	Meas. input	A1
			Dos. drive	A1		
7		STIR_I	Meas.interface	A	State	off
8		END				

printed: 1999-08-05 17:25:07

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method Sulphate.mth [o] Sulphate in water samples

Parameters

```
#  6       DET_U*   Determination of sulphate in water
                    Reagent    EGTA          Sensor     6.0504.100
                    Concentr.     0.05 mol/L Meas. input    A1
                    Dos. drive            A1
```

— *Parameters —

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size           10.0 mL        EP#                2
  Fill. rate      max mL/min    Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Meas.pt.density    4          Signal drift     off mV/min
  Min.increment     10 µL       Equilibr.time     20 s
  Titr. rate      max mL/min
```

— EP Recognition —

```
Equivalence points        all       min. EPC       5.0
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display —

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin              mV             mL
  end                mV             mL
Division                        1 mL/cm
Grid               off
```

— *Report —

```
                Type      Specification  print  send  FF
Reports for     V_Curve   M. value       yes    no    no
titration /     *Stand                   yes    no    no
measuring mode                           no     no    no
                                         no     no    no
                                         no     no    no
                                         no     no    no
```

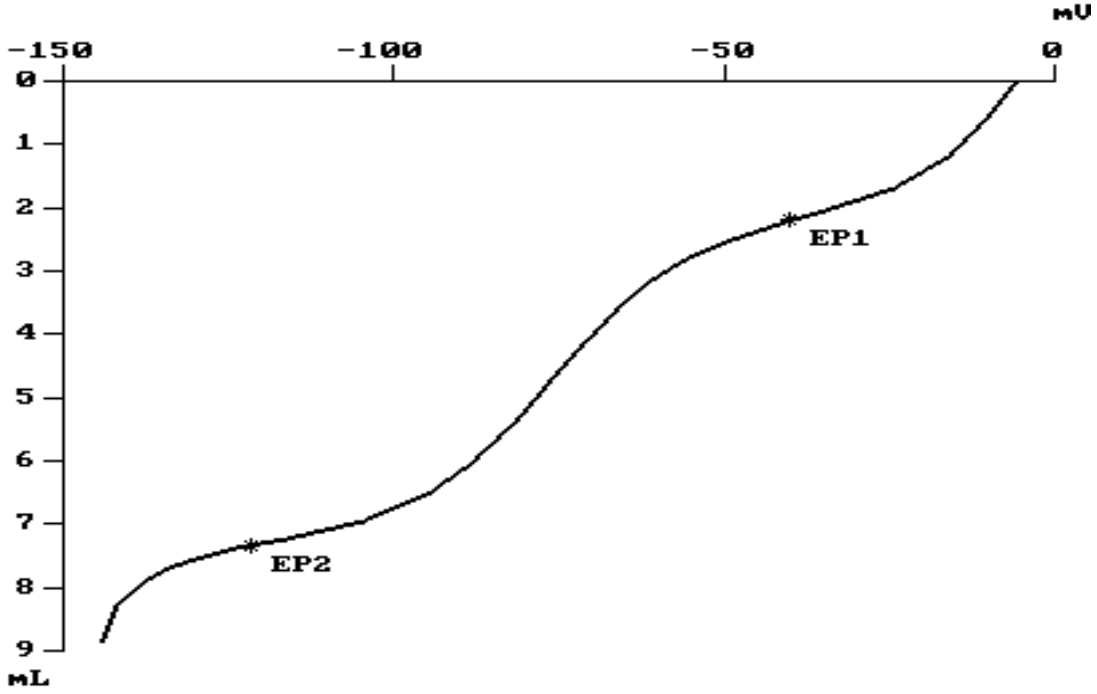
— *Formula —

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	V(Sample)	R01=EP2-EP1	mL	4	normal
2	V(blank)	R02=C16	mL	4	normal
3	Sulphate	R03=(C16-R01)*4.803*1000/SS	mg/L	3	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method Sulphate. mth [o] Sulphate in water samples

6 DET_U* Determination of sulphate in water



*Standard report

Methode	Ident1	Ident2	Ident3	Size	Unit
Sulphate	tap water			50	mL

Remark
sulphate determination

6 DET_U* Determination of sulphate in water

EP1	-40.2 mV	2.235 mL	V(Sample)	5.1300 mL
EP2	-121.7 mV	7.365 mL	V(blank)	5.2098 mL
			Sulphate	7.663 mg/L

Stop condition #EP reached

Original data Determination time: 1998-06-04 09:31:23
Data file 98060409.006 tap water sulphate sulphate determination

printed: 1998-06-04 10:59:35

Remarks

Formulas

The titration curve shows two equivalence points. The first EP corresponds to the Ca, the difference between the second and first EP to the Ba. If no Ca is present, Ca^{++} must be added before titration.

V(Sample) = consumption of titrant for sample
V(blank) = consumption of titrant for blank
Sulphate = concentation of sulphate in mg / L
4.803 = SO_4 equivalent
1000 = conversion factor mL ⇒ L

general remarks

Alkaline samples have to be acidified with HCl to pH = 4 before $BaCl_2$ is added.

If you prefer the addition of BaCl2 and buffer manually, you have to delete the Command Add A (Line 2), Command Wait 180 sec (Line 3), Command Add A (line 4) and Command Wait 30 sec (Line 5) for automatic addition first.

Blank determination

see Application No. 2.5.1

Literature

Metrohm Application Bulletin No. 140: Sulphate determination

Blank determination of Oxidizability

Reagents

$c(KMnO_4)$ = 0.002 mol/L; Dos. Drive A1
$c(Na_2C_2O_4)$ = 0.005 mol/L; Dos. Drive A2

Sample

25 mL dist. water
add 5 mL $c(H_2SO_4)$ = 1 mol/L,
5 mL $c(KMnO_4)$ = 0.002 mol/L,
5 mL $c(Na_2C_2O_4)$ = 0.005 mol/L

Electrodes

6.0431.100 Pt Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   Oxiblank.mth                                  Blank of Oxidizability

-------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                 Parameters
 1         ADD_A          Reagent    Na2C2O4         Dos. drive     A2
                          Concentr.    0.005 mol/L   Dos. rate     max mL/min
                          Volume           5.0 mL    Fill. rate    max mL/min
 2      10 WAIT
 3         MET_U*         blank
                          Reagent    KMnO4           Sensor     6.0431.100
                          Concentr.    0.002 mol/L   Meas. input    A1
                          Dos. drive           A1
 4         ADD_A          Reagent    Na2C2O4         Dos. drive     A2
                          Concentr.    0.005 mol/L   Dos. rate     max mL/min
                          Volume           5.0 mL    Fill. rate    max mL/min
 5         MET_U*         content
                          Reagent    KMnO4           Sensor     6.0431.100
                          Concentr.    0.002 mol/L   Meas. input    A1
                          Dos. drive           A1
 6         END

================================================================================
printed: 1999-07-13 17:33:54
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

```
#  3       MET_U*   blank
                    Reagent    KMnO4          Sensor     6.0431.100
                    Concentr.    0.002 mol/L  Meas. input    A1
                    Dos. drive             A1
```

— *Parameters —

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size               2 mL       EP#                1
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Volume steps    0.05 mL       Signal drift      20 mV/min
  Titr. rate       max mL/min   Equilibr.time   auto s
```

— EP Recognition —

```
Equivalence points        all       min. EPC       100 mV
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— *Report —

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no

— *Formula —

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	blank	C15=EP1-0.5	mL	3	normal
2	surplus	X01=CV-EP1	mL	5	normal

Parameters

```
#  5       MET_U*   content
                    Reagent    KMnO4          Sensor     6.0431.100
                    Concentr.    0.002 mol/L  Meas. input    A1
                    Dos. drive             A1

— *Parameters ——————————————————————————————————————————

Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size               7 mL       EP#                1
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Volume steps     0.1 mL       Signal drift      20 mV/min
  Titr. rate       max mL/min   Equilibr.time   auto s

— EP Recognition ——————————————————————————————————————

Equivalence points        all       min. EPC       100 mV
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off

— *Report ——————————————————————————————————————————————
```

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no

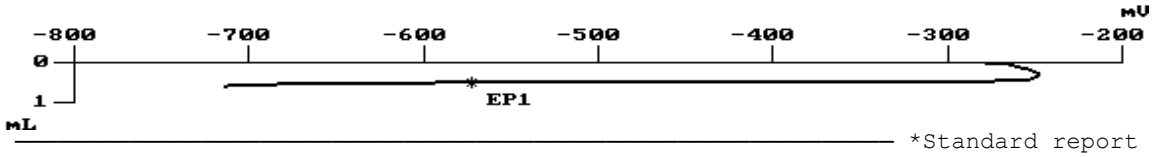
— *Formula —

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	content	C14=EP1+X01	mL	3	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Curve

3 MET_U* blank



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
blank				25	mL

Remark

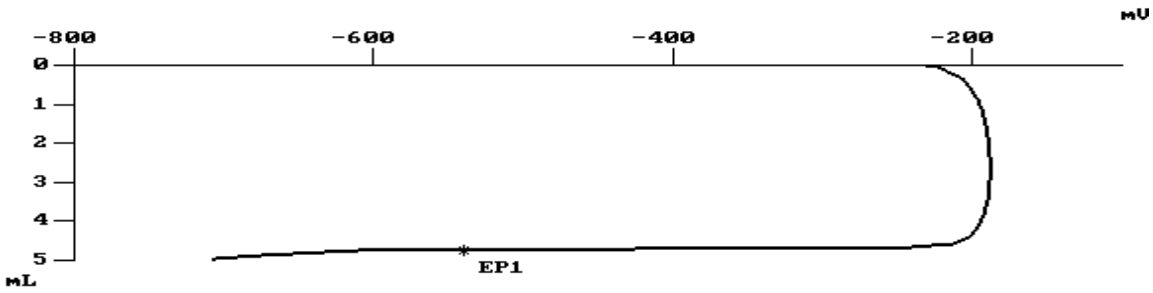
3 MET_U* blank

EP1	-572.7 mV	0.547 mL	blank	0.047 mL

Stop condition #EP reached

Curve

5 MET_U* content



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Oxiblank				25	mL

Remark

5 MET_U* content

EP1	-539.4 mV	4.780 mL	content	4.884 mL

Stop condition #EP reached

Original data Determination time: 1999-07-13 17:06:51
Data file 99071317.017 Oxiblank

printed: 1999-07-13 17:31:35

Remarks

- **Formula**:
  blank = consumption of titrant for blank
  surplus = surplus of the blank-titration
  content = consumption of titrant for content

· titrate at minimum 80 ° C.

Literature

- German standard methods for the examination of water
  EN ISO 8467:1995

Oxidizability of waste water

Reagents

$c(KMnO_4)$ = 0.002 mol/L; Dos. Drive A1
$c(Na_2C_2O_4)$ = 0.005 mol/L; Dos. Drive A2

Sample

25 mL waste water
add 5 mL $c(H_2SO_4)$ = 1 mol/L,
5 mL $c(KMnO_4)$ = 0.002 mol/L,
5 mL $c(Na_2C_2O_4)$ = 0.005 mol/L

Electrodes

6.0431.100 Pt Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Name   oxi.mth                                  Oxidizability of waste water

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
 1         ADD_A          Reagent    Na2C2O4         Dos. drive     A2
                          Concentr.    0.005 mol/L   Dos. rate     max mL/min
                          Volume           5.0 mL    Fill. rate    max mL/min
 2      10 WAIT
 3         MET_U*         KMnO4-Index
                          Reagent    KMnO4           Sensor     6.0431.100
                          Concentr.    0.002 mol/L   Meas. input    A1
                          Dos. drive          A1
 4         END

═══════════════════════════════════════════════════════════════════════════
printed: 1999-07-14 09:29:12
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Method  oxi.mth [o]                              Oxidizability of waste water

──────────────────────────────────────────────────────────────────── Parameters
#  3       MET_U*   KMnO4-Index
                    Reagent    KMnO4          Sensor     6.0431.100
                    Concentr.    0.002 mol/L  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ──────────────────────────────────────────────────────

      Start conditions
        Volume           off          Meas. val        off mV
                                      Slope            off mV/mL
        Dos. rate        max mL/min   Pause              0 s

      Titration conditions
        Adjustment    custom          Time recording   on
        Temperature     25.0 °C

      Stop conditions
        Volume      absolute          Meas. val        off mV
        Size               7 mL       EP#                1
        Fill. rate       max mL/min   Stop time        off s
                                      Mpt. overflow     on

      Custom adjustments
        Volume steps     0.1 mL       Signal drift      20 mV/min
        Titr. rate       max mL/min   Equilibr.time   auto s

      — EP Recognition ───────────────────────────────────────────────────

      Equivalence points        all       min. EPC       100 mV
      general lower limit       min mV    upp.           max mV
      pK/HNP Evaluation         off

      — Display ──────────────────────────────────────────────────────────

      Curve       Y_Axis       X_Axis
      ──────────────────────────────
      Quantity    M. value         Volume
      Scale           auto           auto
        begin              mV             mL
        end                mV             mL
      Division                        0.5 mL/cm
      Grid               off

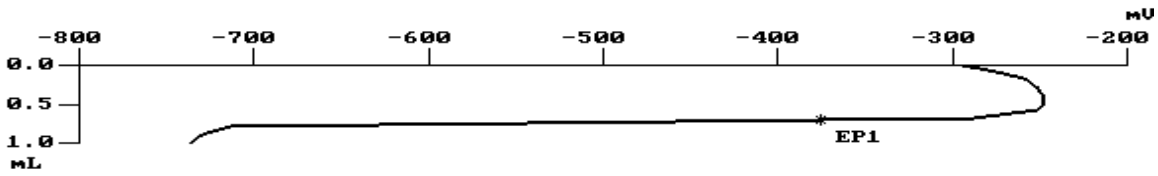
      — *Report ──────────────────────────────────────────────────────────

                      Type      Specification  print  send  FF
                      ────────  ─────────────  ─────  ────  ────
      Reports for     V_Curve   M. value       yes    no    no
      titration /     *Stand                  yes    no    no
      measuring mode                          no     no    no
                                              no     no    no

      — *Formula ─────────────────────────────────────────────────────────

      #  Comment      Formula (R$$, C##, X$$, EP# ..)      Unit    Dec  Type
      ── ──────────── ──────────────────────────────────── ─────── ──── ──────
       1 MnO4-Index   R1=(EP1-C15)/C14*16                  mg/L    2    normal
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════
──────────────────────────────────────────────────────────────────── Curve
#  3       MET_U*   KMnO4-Index
```




```
──────────────────────────────────────────────────────────── *Standard report

  Method    Ident1        Ident2        Ident3        Size      Unit
  oxi                                                      25 mL
  Remark

──────────────────────────────────────────────────────────────────────────
#  3       MET_U*   KMnO4-Index

  EP1          -376.0 mV     0.720 mL        MnO4-Index         2.21 mg/L

  Stop condition            #EP reached

Original data                           Determination time: 1999-07-14 08:02:56
Data file 99071408.001       oxi
═══════════════════════════════════════════════════════════════════════════
printed: 1999-07-14 08:18:13
```

Remarks

- **Formula:**
  MnO_4-Index = oxygen demand in mg/L
  C15 = consumption of titrant for blank
  C14 = consumption of titrant for content
  16 = molecular mass of oxygen

- titrate at minimum 80 ° C

Literature

- German standard methods for the examination of water
  EN ISO 8467:1995

Oxygen in water

Reagents

c ($Na_2S_2O_3$) = 0.01 mol/L; Dos. Drive A1

Sample

Tap water in a oxygen flask

Iodine-azide	= 35 g NaOH , 30 g KI , 1 g NaN_3 / 100 mL
Manganese sulphate	= 34 g / 100 mL
$w(H_2SO_4)$	≅ 0.60 (60%)

Electrodes

6.0431.100 Pt Titrode ; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
══════════════════════════════════════════════════════════════════════════════

Name   Oxygen.mth                                               oxygen in water

────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ───   ─────────────  ─────────────────────────  ─────────────────────────
 1         SHOW           Page              curve
 2         DET_U*         Oxygen
                          Reagent    Na2S2O3         Sensor     6.0431.100
                          Concentr.     0.01 mol/L   Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END

==============================================================================
printed: 1999-07-21 07:40:26
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Oxygen.mth [o] oxygen in water

Parameters

```
#  2       DET_U*   Oxygen
                    Reagent    Na2S2O3        Sensor     6.0431.100
                    Concentr.     0.01 mol/L  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size          99.99 mL        EP#                1
  Fill. rate      max mL/min    Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Meas.pt.density    2          Signal drift     off mV/min
  Min.increment     10 µL       Equilibr.time     10 s
  Titr. rate      max mL/min
```

— EP Recognition

```
Equivalence points        all       min. EPC       5.0
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin              mV             mL
  end                mV             mL
Division                        1 mL/cm
Grid               off
```

— *Report

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

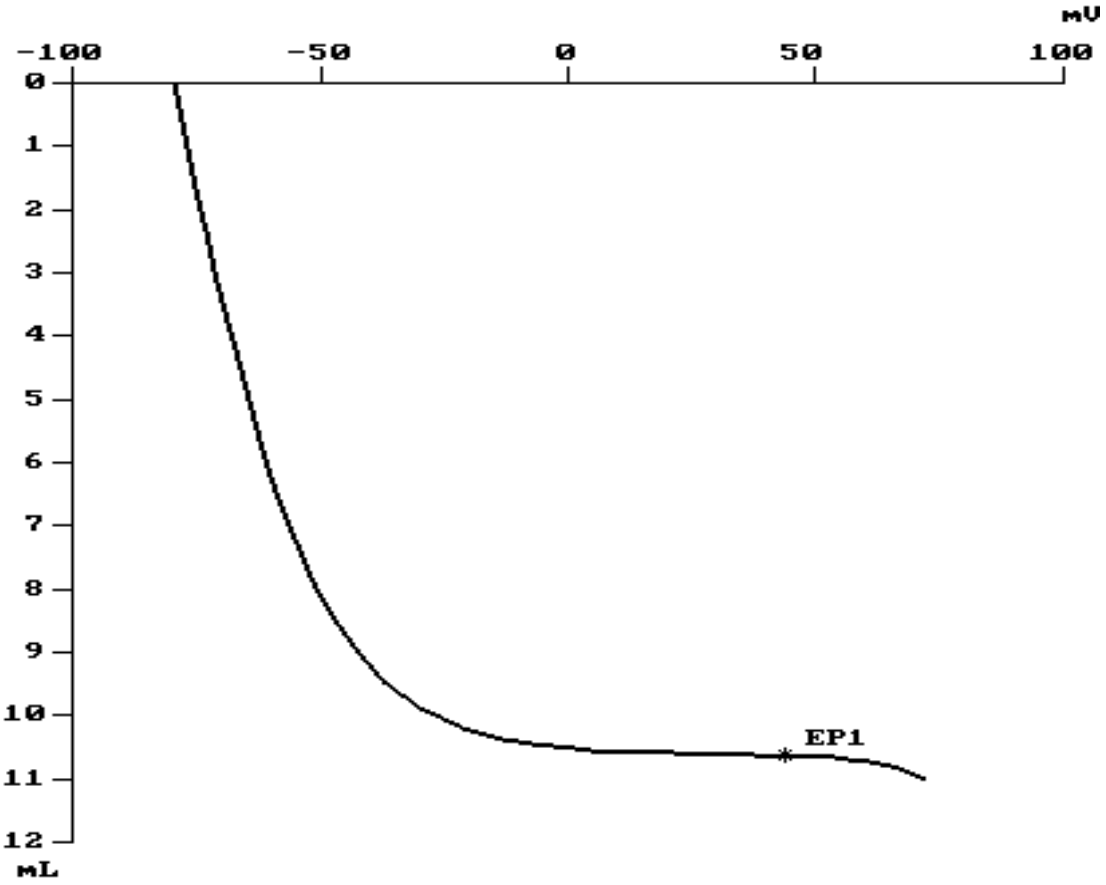
— *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	X01	X01=32*EP1*(C*1000)*(ID1/(ID1-3))		1	normal
2	Oxygen	R1=X01/4/SS	mg/L	1	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Curve

2 DET_U* Oxygen



*Standard report

Method	Flaskvolume	Ident2	Ident3	Size	Unit
Oxygen	119.3			119.3	mL

Remark

2 DET_U* Oxygen

EP1	44.0 mV	10.667 mL	Oxygen	7.3 mg/L

Stop condition #EP reached

Original data Determination time: 1999-07-20 14:56:19
Data file 99072014.014 Oxygen

printed: 1999-07-21 07:27:42

Remarks

- **Formula**:
  X01 = Intermediate result
  Oxygen = content of oxygen in mg / L
  32 = molecular mass of oxygen
  C = molarity of titrant in mol/L
  ID1 = volume of the oxygen flask
  3 = total volume of added reagent for precipitation of oxygen

- Titrate samples immediately after addition of H_2SO_4.

Literature

- German standard methods for the examination of water
  EN 25813:1992

Total Acid Number (TAN)

Reagents

c(TBAOH) = 0.1 mol/L in Isopropanol/Methanol; Dos. Drive A1
TBAOH = Tetrabutyl ammonium hydroxide

Sample

app. 1.5 g of used motor oil
50 ml solvent: 500 ml Toluene, 495 ml Isopropanol, 5 ml H_2O

Electrodes

6.0229.100 Solvotrode; input A1
Electrolyte: Tetraethylammoniumbromide *c*(TEA-Br) = 0.4 mol/L in Ethylenglycol (Metrohm No: 6.2320.000)

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   TAN.mth                                              Total Acid Number

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1         SHOW           Page              curve
 2         DET_U*         TAN
                          Reagent    TBAOH          Sensor     6.0229.100
                          Concentr.      0.1 mol/L  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END
---------------------------------------------------------------------------
printed: 1999-08-25 11:29:26
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

2 DET_U* TAN
Reagent TBAOH Sensor 6.0229.100
Concentr. 0.1 mol/L Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	50 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	5 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	2	Signal drift	10 mV/min
Min.increment	100 µL	Equilibr.time	20 s
Titr. rate	max mL/min		

— EP Recognition —

Equivalence points	last	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

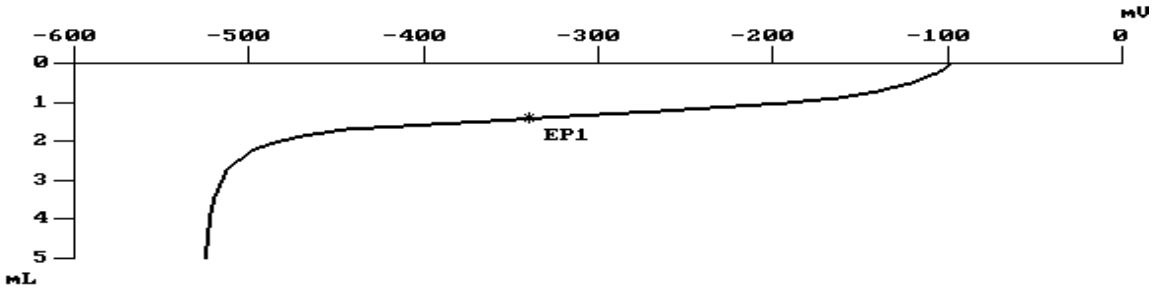
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	TAN	RS1=(EP1-0)*C*0.995*56.106/SS	mg/g	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method TAN.mth [o] Total Acid Number

Curve

2 DET_U* TAN



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
TAN	Oil	Metrohm	lab.1b	1.463	g

Remark
Total Acid Number

2 DET_U* TAN

EP1	-339.5 mV	1.455 mL	TAN	5.55 mg/g

Stop condition volume

Original data Determination time: 1999-09-17 12:08:02
Data file 99091712.005 Oil Metrohm TAN Total Acid Number

printed: 1999-09-17 12:17:26

Remarks

- **Formula:**
  TAN = calculated as mg KOH per g of sample
  0 = blank value, consumption of titrant by solvent mixture
  C = concentration of titrant
  0.995 = titer of titrant
  56.106 = molecular mass of KOH (g/mol)

- **Electrode preparation:**
  When not in use, keep the Solvotrodes in electrolyte solution.

Literature

- Metrohm Applikation Bulletin No. 80: Determination of acid / base number in petroleum products (TAN/TBN).
- ASTM D 4739-87; 2896-88; 664-89
- ISO 3771: 1994

Total Base Number (TBN)

Reagents

$c(HClO_4)$ = 0.1 mol/L in acetic acid; Dos. Drive A1

Sample

app. 1.5 g of used motor oil
50 ml solvent (Toluene : Acetic acid = 1:1)

Electrodes

6.0229.100 Solvotrode; input A1
Electrolyte: LiCl sat. In Ethanol (Metrohm No: 6.2312.000)

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   TBN.mth                                                Total Base Number
──────────────────────────────────────────────────────────────────-- Commands

     t/s   Command        Parameters                Parameters
     ─────  ─────────────  ────────────────────────  ────────────────────────

 1         SHOW           Page              curve
 2         DET_U*         TBN
                          Reagent    HClO4          Sensor     6.0229.100
                          Concentr.      0.1 mol/L  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         End
------------------------------------------------------------------------------
printed: 1999-09-10 09:59:26
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

2 DET_U* TBN

Reagent	HClO4	Sensor	6.0229.100
Concentr.	0.1 mol/L	Meas. input	A1
Dos. drive	A1		

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	50 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	10 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	2	Signal drift	10 mV/min
Min.increment	100 µL	Equilibr.time	20 s
Titr. rate	max mL/min		

— EP Recognition —

Equivalence points	last	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

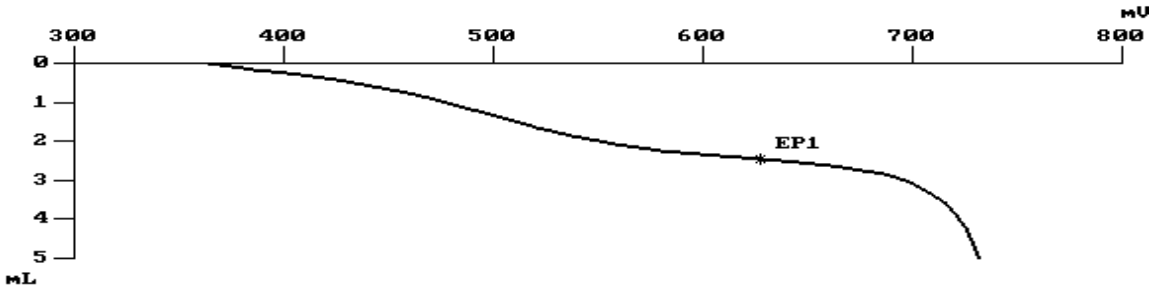
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Base-Number	RS1=(EP1-0)*C*0.993*56.106/SS	mg/g	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method TBN.mth [o] Total Base Number

Curve

2 DET_U* TBN



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
TBN	Motor oil			1.296	g

Remark

2 DET_U* TBN

EP1	627.4 mV	2.494 mL	Base-Number	10.72 mg/g

Stop condition volume

Original data Determination time: 1999-09-18 09:18:52
Data file 99091809.002 Motor oil TBN Total Base Number

printed: 1999-09-18 09:33:10

Remarks

- **Formulas:**
  TBN = Total Base Number, calculated as mg KOH per g of sample
  0 = blank value, consumption of titrant by solvent mixture
  C = concentration of titrant
  0.993 = titer of titrant

- **Electrode preparation:**
  When not in use, keep the Solvotrodes in electrolyte solution.

Literature

- Metrohm Applikation Bulletin No. 80: Determination of acid / base number in petroleum products (TAN/TBN).
- ASTM D 4739-87; 2896-88; 664-89
- ISO 3771: 1994

Bromine Index

Reagents

c(1/6 $KBrO_3$) = 0.02 mol/L (also containing 2.04 g/L KBr);
Dos. Drive A1

Sample

20 mg w(cyclohexene) = 0.1(10%) in solvent

Electrodes

6.0308.100 double Pt electrode; input Apol

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   BromineI.mth                                          Bromine Index

──────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                Parameters
     ─────  ─────────────  ────────────────────────  ──────────────────────────
 1          SHOW           Page              curve
 2          MET_IPOL*      Bromine Index
                           Reagent    1/6 KBrO3        Sensor     6.0308.100
                           Concentr.     0.02 mol/L    Meas. input  Apol
                           Dos. drive            A1
 3          SHOW           Page              result
            END
---------------------------------------------------------------------------
printed: 1999-08-25 11:18:54
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

2 MET_IPOL* Bromine Index
Reagent 1/6 KBrO3 Sensor 6.0308.100
Concentr. 0.02 mol/L Meas. input Apol
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C	I(pol)	1 µA

Stop conditions

Volume	absolute	Meas. val	1 mV
Size	5 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Volume steps	0.05 mL	Signal drift	off mV/min
Titr. rate	max mL/min	Equilibr.time	20 s

— EP Recognition —

Equivalence points greatest min. EPC 30.0 mV
general lower limit min mV upp. max mV

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

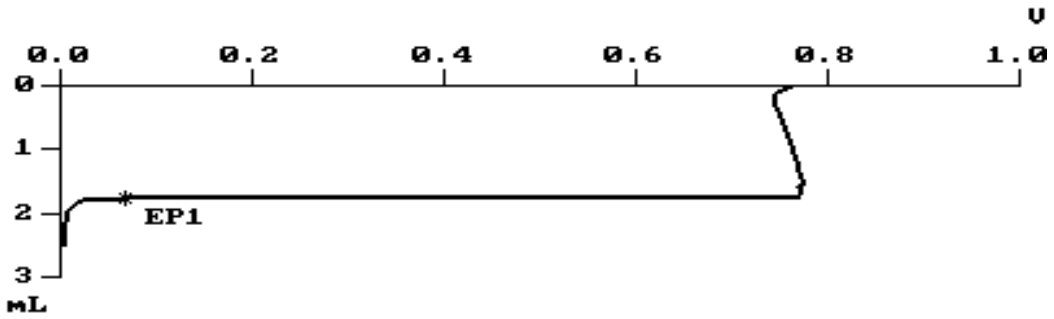
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Br-Index	RS1=(EP1-0)*C*79.904*100/SS	mg	1	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method BromineI.mth [o] Bromine Index

Curve

2 MET_IPOL* Bromine Index



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
BromineI	Cyclohexene	Metrohm	lab. 1b	0.020	g

Remark
Bromine Index

2 MET_IPOL* Bromine Index

EP1	66.6 mV	1.800 mL	Br-Index	14380.7 mg	

Stop condition manual

Original data Determination time: 1999-08-25 08:41:42
Data file 99082508.002 Cyclohexene Metrohm BromineI Bromine Index

printed: 1999-08-25 09:00:25

Remarks

- Bromine Index is the number of mg of bromine consumed per 100 g of sample

- **Solvent**:
  714 mL acetic acid
  134 mL CCl_4
  134 mL CH_3OH
  18 mL $w(H_2SO_4) = 0.2$ (20%)

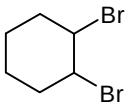
- **Titrant:**
  Dissolve 0.556 g $KBrO_3$ and 2.04 g KBr in dist. water and add up to 1 liter.

- **Titer determination of BrO_3^-/Br^- titrant:**
  Determination reaction:
  $3\ Br_2 + 6\ S_2O_3^{2-} \longrightarrow 6\ Br^- + 3\ S_4O_6^{2-}$

  Calculation of the molarity:
  RS1 = EP1*C/SS molarity of titrant (1/6 $KBrO_3$)
  C = concentration of titrant ($S_2O_3^{2-}$) in mol/L
  SS = ml of (1/6$KBrO_3$) solution

- **Determination reaction for Bromine Index:**

  $BrO_3^- + 5\ Br^- + 6\ H^+ \longrightarrow 3\ Br_2 + 3\ H_2O$

  $3\ Br_2$ + 3  → 3 

- **Formulas for Bromine Index:**
  Br-Index = Bromine Index
  C = molarity of the titrant
  0 = consumption of blank sample (0 mL)
  79.904 = molecular mass of Br
  100 = factor for mg/100g sample

Literature

- Metrohm Application Bulletin No. 177: Determination of the Bromine index and / or Brom number in petroleum products acc. to ASTM D1491-71, D 2710-72, D 1159-84, ISO 3839: 1996

Bromine Number

Reagents

c(1/6 $KBrO_3$) = 0.5 mol/L(also containing 51.0 g/L KBr); Dos. Drive A1

Sample

50 mg w(cyclohexene) = 0.1 (10%) in solvent

Electrodes

6.0308.100 double Pt electrode; input Apol

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   BromineN.mth                                          Bromine Number

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                Parameters
     ────  ─────────────  ──────────────────────    ──────────────────────
 1         SHOW           Page              curve
 2         KFT_IPOL*      Bromine Number
                          Reagent       1/6 KBrO3   Sensor     6.0308.100
                          Concentr.      0.5 mol/L  Meas. input  Apol
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END
---------------------------------------------------------------------------
printed: 1999-08-25 11:24:52
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

2 KFT_IPOL* Bromine Number
Reagent 1/6 KBrO3 Sensor 6.0308.100
Concentr. 0.5 mol/L Meas. input Apol
Dos. drive A1

— *Parameters —

Start conditions
Volume off
Pause 1 0 s
Pause 2 0 s
Extract. time 0 s

Titration conditions
Direction neg.
End-point at 500 mV
Adjustment custom
Mpt. interval 2 s
Temperature 25.0 °C
Time recording on
Derivation off
I(pol) 10 µA

Stop conditions
Volume absolute
Size 99.99 mL
Fill. rate max mL/min
Stop time off s
Mpt. overflow off

Custom adjustments
Dynamics 500 mV
Min.increment min µL
Max. rate 5 mL/min
Stop crit. time
t(delay) 30 s

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	time
Scale	auto	auto
begin	mV	s
end	mV	s
Division		30 s/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

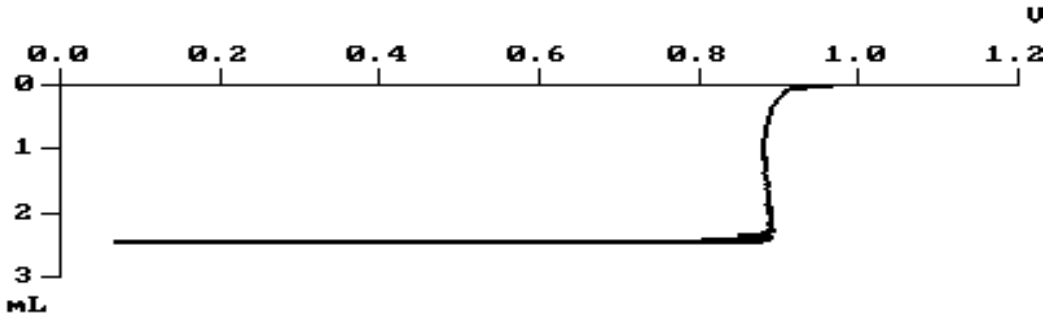
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Br-Number	RS1=(EP1-0)*C*79.904*0.1/SS	g/100g	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method BromineN.mth [o] Bromine Number

Curve

2 KFT_IPOL* Bromine Number



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
BromineN	Cyclohexene	Metrohm	lab. 1b	0.050	g

Remark
Bromine Number

2 KFT_IPOL* Bromine Number

EP	120.4 mV	2.475 mL	Br-Number	197.76 g/100g
Dosing time		303.3 s		

Stop condition stop time

Original data Determination time: 1999-08-25 11:15:14
Data file 99082511.007 Cyclohexene Metrohm BromineN Bromine Number

printed: 1999-08-25 11:20:29

Remarks

- Bromine Number is the amount of bromine consumed in g per 100 g of sample.

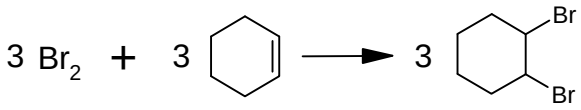
- **Solvent**:
  714 mL Acetic acid
  134 mL 1,1,1-Trichlorethan
  134 mL Methanol
  18 mL $w(H_2SO_4) = 0.2$ (20%)

- **Titrant:**
  Dissolve 13.92 g $KBrO_3$ and 51.0 g KBr in dist. water and add up to 1 liter.

- **Titer determination of BrO_3^-/Br^- titrant:**
  Determination reaction:
  $3\ Br_2 + 6\ S_2O_3^{2-} \longrightarrow 6\ Br^- + 3\ S_4O_6^{2-}$

  Calculation of the molarity:
  RS1 =EP1*C/SS molarity of titrant (1/6 $KBrO_3$)
  C = concentration of titrant ($S_2O_3^{2-}$) in mol/L
  SS = ml of (1/6 $KBrO_3$) solution

- **Determination reaction for bromine number:**
  $BrO_3^- + 5\ Br^- + 6\ H^+ \longrightarrow 3\ Br_2 + 3\ H_2O$



- **Formulas for Bromine Number:**
  Br-Number = Bromine Number
  C = molarity of titrant as calculated above
  0 = consumption of blank sample
  0.1 = factor for g /100 g sample

Literature

- Metrohm Application Bulletin No. 177: Determination of the Bromine index and / or Brom number in petroleum products acc. to ASTM D1491-71, D 2710-72, D 1159-84, ISO 3839: 1996

H_2S and mercaptans in petroleum products

Reagents

c(AgNO3) = 0.01 mol/L ; Dos. Drive A1

Sample

1 - 50 mL sample, dilute in 100 mL solvent

Electrodes

6.0430.100 Ag-Titrode coated with Ag_2S; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   H2S.mth                                                H2S and Mercaptans
                                                                        Commands

     t/s   Command          Parameters                 Parameters

 1         SHOW             Page               curve
 2         MET_U*           Mercaptan
                            Reagent    AgNO3           Sensor     6.0430.100
                            Concentr.     0.01 mol/l   Meas. input    A1
                            Dos. drive            A1
 3         SHOW             Page              result
 4         END

--------------------------------------------------------------------------------
printed: 1999-08-25 11:24:52
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

```
#  2       MET_U*   Mercaptan
                    Reagent    AgNO3          Sensor     6.0430.100
                    Concentr.     0.01 mol/l  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ——————————————————————————————————————————

      Start conditions
        Volume           off          Meas. val        off mV
                                      Slope            off mV/mL
        Dos. rate        max mL/min   Pause              0 s

      Titration conditions
        Adjustment    custom          Time recording   on
        Temperature     25.0 °C

      Stop conditions
        Volume       absolute         Meas. val        off mV
        Size              10 mL       EP#                9
        Fill. rate        max mL/min  Stop time        off s
                                      Mpt. overflow     on

      Custom adjustments
        Volume steps     0.1 mL       Signal drift     off mV/min
        Titr. rate       max mL/min   Equilibr.time     10 s

      — EP Recognition ———————————————————————————————————————

      Equivalence points        all       min. EPC        40 mV
      general lower limit       min mV    upp.           max mV
      pK/HNP Evaluation         off

      — Display ——————————————————————————————————————————————

      Curve       Y_Axis       X_Axis
      ————————————————————————————————
      Quantity    M. value         Volume
      Scale           auto           auto
        begin              mV             mL
        end                mV             mL
      Division                        1 mL/cm
      Grid               off

      — *Report ——————————————————————————————————————————————

                      Type      Specification  print  send  FF
                      ————————  ———————————————  —————  ————  ————
      Reports for     V_Curve   M. value       yes    no    no
      titration /     *Stand                  yes    no    no
      measuring mode                          no     no    no
                                              no     no    no
                                              no     no    no
                                              no     no    no

      — *Formula —————————————————————————————————————————————

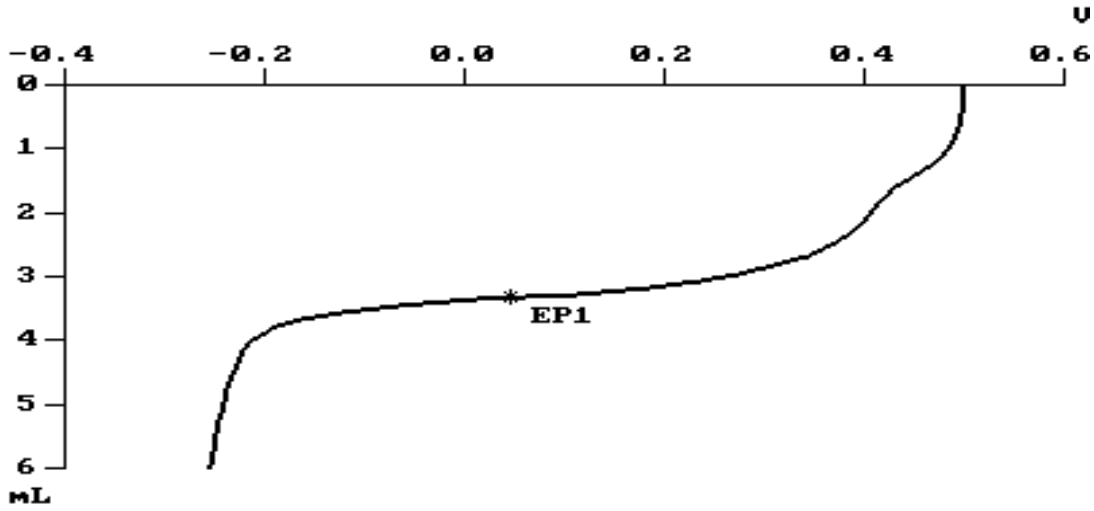
      #  Comment      Formula (R$$, C##, X$$, EP# ..)      Unit    Dec  Type
      —— ————————————  ———————————————————————————————————  ——————  ———  ——————
       1 H2S          RS1=EP1*C*0.992*16.03*1000/SS        mg/kg   2    normal
       2 Intermediat  X01=C*0.992*32.06*1000/SS                    5    normal
       3 R-SH         RS2=(TST(EP2,0)-EP1)*X01*EF2         mg/kg   2    normal
       3 R-SH (S)     RS3=(TST(EP3,0)-EP1)*X01*EF3         mg/kg   2    normal
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method H2S.mth [o] H2S and Mercaptans

Curve

2 MET_U* Mercaptan



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
H2S	Petro	Metrohm	lab. 1b	1.52	g

Remark
H2S and Mercaptans

2 MET_U* Mercaptan

EP1	46.8 mV	3.362 mL	H2S	351.70 mg/kg
			R-SH	0.00 mg/kg
Stop condition		volume	R-SH (S)	0.00 mg/kg

Original data Determination time: 1999-09-07 08:38:11
Data file 99090708.003 Petro Metrohm H2S H2S and Mercaptans

printed: 1999-09-10 08:22:36

Remarks

- **Solvent**:
  solvent for high molecular mercaptans:
  2.7 g $CH_3COONa*3H_2O$ dissolved in 25 mL H_2O added to 975 mL isopropanol and 4.6 mL acetic acid

  solvent for low molecular mercaptans:
  2.7 g $CH_3COONa*3H_2O$ dissolved in 25 mL H_2O added to 975 mL isopropanol and 10 mL *w*(NH3) = 25 %

- **Titrant:**
  100 mL *c*($AgNO_3$) = 0.1 mol/L mixed with 80 mL H_2O and filled up with ethanol or isopropanol to 1000mL
  Titer of titrant against *c*(KCl) = 0.1000 mol/L (Metrohm 6.2301.060)

- **Important:**
  Titrate under nitrogen. Otherwise ambient oxygen will oxidate the H_2S and the mercaptans.

- **Formulas:**
  H_2S = content of H_2S
  R-SH = mercaptans
  R-SHS = mercaptans in presence of sulphur
  C = concentration of titrating agent
  16.03 = molecular mass of ½ S (g/mol)
  32.06 = molecular mass of Sulphur (g/mol)
  0.992 = titer of titrant
  1000 = conversion factor of g ⇒ kg

Literature

- Metrohm Application Bulletin No. 135: Determination of H_2S and mercaptans in petrol products.
- ASTM D 3227-83
- ISO 3012: 1991; 6326-3: 1989
- UOP-Method 163-67; 209-83; 212-77
- IP 272/71 (1985)

Formaldehyde Number in fruit juices

Reagents

c(NaOH) = 0.1 mol/L; Dos.drive A1
w(HCHO) = 0.35 (35%), adjusted to pH = 8.5 with NaOH; Dos. drive A2

Sample

25 mL sample (orange juice)

Electrodes

6.0232.100 combined pH glass electrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   Formol.mth                          Formaldehyde Number in fruit juices

-------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                 Parameters
     ----- -------------- -------------------------  -------------------------
 1         SET_PH*        Adjust pH to 8.5
                          Reagent    NaOH            Sensor     6.0232.100
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive            A1
 2         ADD_A          Reagent    Formaldehyde    Dos. drive     A2
                          Concentr.       35 %       Dos. rate     max mL/min
                          Volume             15 mL   Fill. rate    max mL/min
 3      60 WAIT           Reaction time
 4         SET_PH*        Determination of Formaldehyde Number
                          Reagent    NaOH            Sensor     6.0232.100
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive            A1
 5         END

================================================================================
printed: 1998-07-10 17:28:20
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Name    Formol.mth                          Formaldehyde Number in fruit juices

──────────────────────────────────────────────────────────────────── Parameters
#  4      SET_pH*   Determination of Formaldehyde Number
                    Reagent    NaOH           Sensor     6.0232.100
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ——————————————————————————————————————————————————

      Start conditions
        Volume           off          Pause 1            0 s
                                      Pause 2            0 s
                                      Extract. time      0 s

      Titration conditions
        Direction       pos.          Temperature     25.0 °C
        Endpoint   pH    8.5          Time recording    on
        Adjustment    custom          Derivation       off
        Mpt. interval      1 s

      Stop conditions
        Volume      absolute           Stop time        off s
        Size           99.99 mL        Mpt. overflow    off
        Fill. rate       max mL/min

      Custom adjustments
        Dynamics  pH     1.0
        Min. rate      25.00 µL/min    Stop crit.     drift
        Max. rate      10.00 mL/min    Stop drift        20 µL/min

      — Display ——————————————————————————————————————————————————

      Curve       Y_Axis       X_Axis
      ──────────────────────────────────
      Quantity      Volume           Time
      Scale           auto           auto
        begin              mL             s
        end                mL             s
      Division                        30 s/cm
      Grid               off

      — *Report ——————————————————————————————————————————————————

                      Type      Specification  print  send  FF
                      ──────    ─────────────  ─────  ────  ──
      Reports for     T_Curve   Volume         yes    no    no
      titration /     CalData                  yes    no    no
      measuring mode  *Stand                   yes    no    no
                                               no     no    no
                                               no     no    no
                                               no     no    no

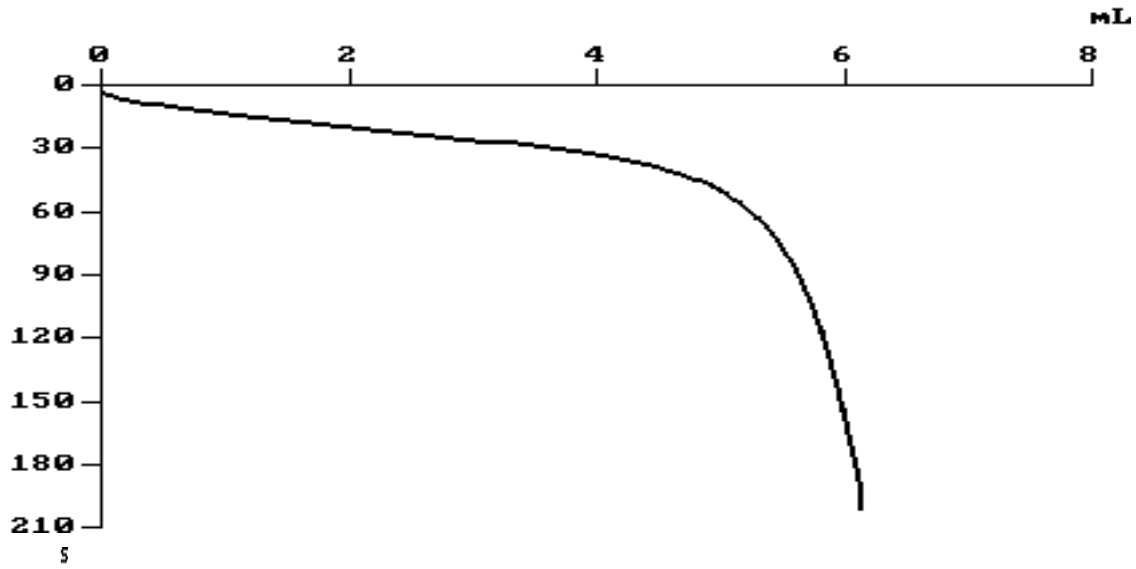
      — *Formula —————————————————————————————————————————————————

      #  Comment      Formula (R$$, C##, X$$, EP# ..)      Unit    Dec  Type
      ── ──────────   ──────────────────────────────────   ──────  ───  ────
       1 Formol No.   R1=TST(EP1,$LV)*4                           1    live
```

METROHM 796 Titroprocessor 01101 5.796.0010

Curve

4 SET_pH* Determination of Formaldehyde Number



Calibration data

Meas. input	A1
Cal. sensor	6.0232.100
Cal. method	manually
Cal. date	98-07-10
Cal. time	17:11:08
Temperature	25.0 °C
pH(as)	7.000
Slope	0.985

*Standard report

Method	Product	Lot	Size	Unit
Formol	Orange juice	1220.23	25	ml

Remark

4 SET_PH* Determination of Formaldehyde Number

EP	pH 8.502	6.135 mL	Formol No.	24.5
Inter.titr.time		73.4 s		
Dosing time		200.1 s		
Stop condition		stop drift		

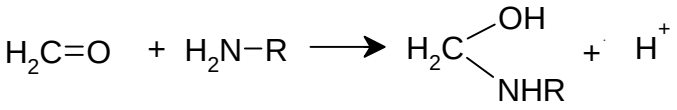
Original data Determination time: 1998-07-10 17:28:30

Data file Formol.006 Orange juice 1220.229

printed: 1998-07-10 17:31:28

Remarks

- **Determination reaction**:



  Amino groups of amino acid react according to the above reaction.

- **Formulas**:
  Formol No. = formol number as mL NaOH = 0.1 mol/L for 100 mL sample solution
  4 = factor for 100 mL sample solution

- Calibrate the electrode for the SET titrations.

- The parameters are the same for both SET-titrations.

Literature

- Metrohm Application Bulletin No. 180: Automatic determination of the formol number in fruit and vegetable juices

Peroxide Number

Reagents

$c(Na_2S_2O_3)$ = 0.01 mol/L; Dos.drive A1
prepared daily from c = 0.1 mol/L

Sample

app. 5 g sunflower oil
in 50 mL glacial acetic acid / chloroform 3:2
add 1 mL KI saturate
add 100 mL dist. water

Electrodes

6.0431.100 Pt Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name    Peroxide.mth                                          Peroxide Number

-------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                 Parameters
     ----- -------------- -------------------------- --------------------------
 1         DET_U*         Determination of peroxide number
                          Reagent    Na2S2O3         Sensor     6.0431.100
                          Concentr.     0.01 mol/L   Meas. input    A1
                          Dos. drive             A1
 2         END

================================================================================
printed: 1998-07-11 07:36:15
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Peroxide.mth [o] Peroxide Number

Parameters

```
#  1       DET_U*   Determination of peroxide number
                    Reagent    Na2S2O3        Sensor     6.0431.100
                    Concentr.     0.01 mol/L  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    medium          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume       absolute         Meas. val        off mV
  Size            99.99 mL      EP#                1
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on
```

— EP Recognition

```
Endpoints                 all       min. EPC       5.0
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin              mV             mL
  end                mV             mL
Division                        0.5 mL/cm
Grid               off
```

— *Report

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

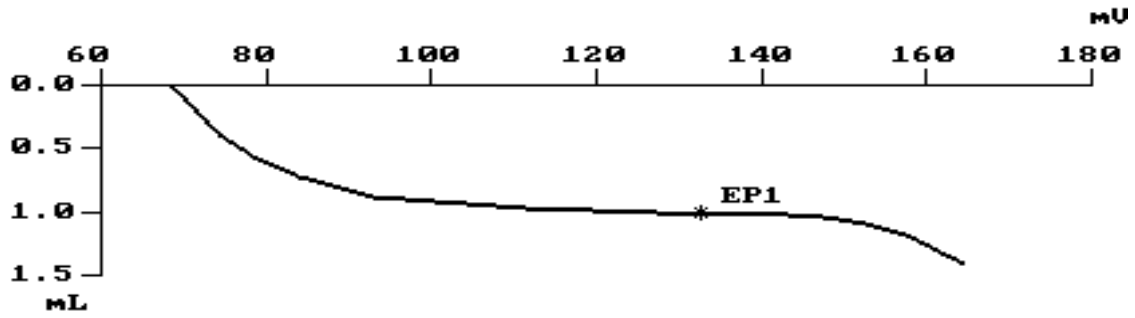
— *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	PeroxideNo.	R1=(EP1—0)*C*1000/SS	meq/kg	2	stat.

METROHM 796 Titroprocessor 01101 5.796.0010

Method Peroxide.mth [o] Peroxide Number Curve

1 DET_U* Determination of peroxide number



*Standard report

Method	Product	Lot	Size	Unit
Peroxide	Sunfloweroil	1898232	5.1956	g

Remark

1 DET_U* Determination of peroxide number

EP1 132.6 mV 1.020 mL PeroxideNo. 1.96 meq/kg

Stop condition #EP reached

Original data Determination time: 1998-07-11 07:36:38
Data file Peroxide.005 Sunfloweroil 1898232 Peroxide

printed: 1998-07-11 07:37:38

Remarks see next page

Remarks

- **Formulas**:
  PeroxideNo. = peroxide number in meq O_2/kg
  0 = consumption of blank sample (mL)
  C = concentration of titrant
  1000 = conversion factor g ⇒ kg

- **Sample preparation**:
  Weigh out accurately 5 g sample in an Erlenmeyer flask and add 50 mL of the glacial acetic acid / chloroform mixture. Add 1 mL of the KI solution and shake for 5 s. Now allow the mixture to stand for about 1 min. in a dark place. After this, rinse out the contents of the Erlenmeyer flask with 100 mL dist. water into a beaker and immediately back-titrate the iodine thus liberated using sodium thiosulphate titrant.
  A blank control sample should be prepared and treated in the same way. Enter the blank value in the formula.

- The sample must be stirred well during the titration, in order to obtain a good emulsion.

Literature

- Metrohm Application Bulletin No. 141: Analysis of edible oils and fats.

Iodine Number

Reagents

$c(Na_2S_2O_3)$ = 0. 1 mol/L; Dos. Drive A1

Sample

app. 0.5 g sunflower oil
in 20 ml glacial acetic acid
add 25 ml *c*(ICl) = 0.1 mol/L (in glacial acetic acid),
10 ml *w*(Mg-Acetat) = 0.03 (3%),
15 ml *w*(KI) = 0.1 (10%)

Electrodes

6.0431.100 Pt-Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   IodineNo.mth                                              Iodine Number

------------------------------------------------------------------------ Commands

     t/s   Command        Parameters                 Parameters
     ----- -------------- -------------------------- --------------------------
 1         SHOW           Page              curve
 2         DET_U*         Iodine Number
                          Reagent    Na2S2O3         Sensor     6.0431.100
                          Concentr.      0.1 mol/l   Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         End
================================================================================
printed: 1999-07-22 11:34:16
```

METROHM 796 Titroprocessor 01101 5.796.0010

Name IodineNo.mth Iodine Number

— Parameters —

2 DET_U* Iodine Number
Reagent Na2S2O3 Sensor 6.0431.100
Concentr. 0.1 mol/l Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	absolute	Meas. val	off mV
Size	10 mL	Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	30 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	4	Signal drift	20 mV/min
Min.increment	10 µL	Equilibr.time	auto s
Titr. rate	max mL/min		

— EP Recognition —

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

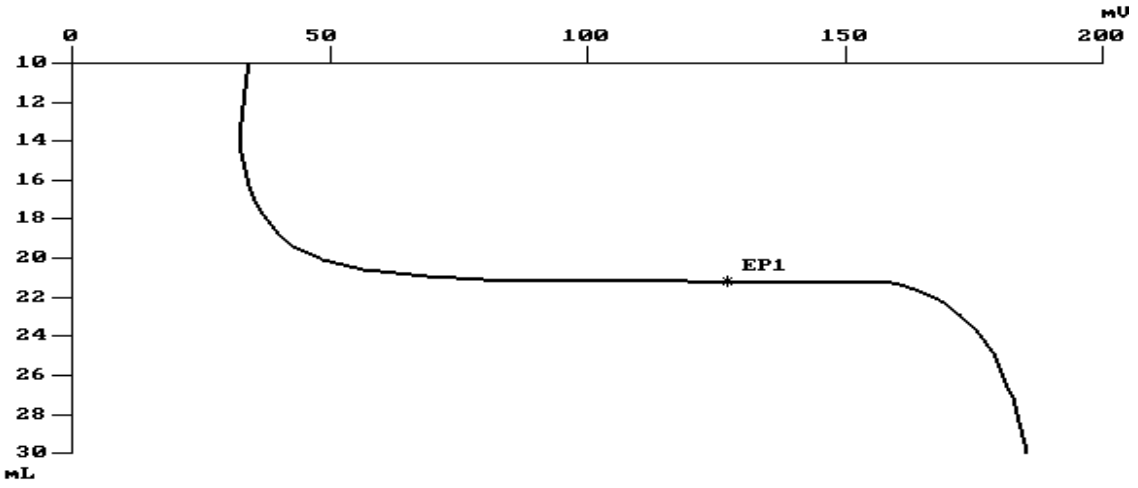
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Interm	X01=C*126.9*0.1		5	normal
2	Iod.No.	RS1=(36.189-EP1)*0.994*X01/SS	g/100g	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method IodineNo.mth [o] Iodine Number

Curve

2 DET_U* Iodine Number



*Standard report

Method	Product	Lot	Size	Unit
IodineNo	sunfloweroil	145962	0.15	g

Remark
Iodine Number

2 DET_U* Iodine Number

EP1 127.2 mV 21.232 mL Iod.No. 125.78 g/100g

Stop condition volume

Original data Determination time: 1999-08-27 09:33:21
Data file 99082709.003 sunfloweroil Metrohm IodineNo Iodine Number

printed: 1999-08-27 09:39:08

Remarks

- **Formula**:
  Interm = intermediate result
  Iod.No = Iodine Number in g Iodine used for 100 g sample
  C = concentration of titrant
  36.189 = consumption of blank sample
  0.994 = titer of titrant
  0.1 = factor for g/100g sample

- **Sample preparation**:
  Weigh out 0.10 ... 1.00 g of the sample in an Erlenmeyer flask, according to the expected Iodine Number and add 20 mL glacial acetic acid. Add 25 mL iodine monochloride solution and add 10 mL magnesia acetate solution, mix and allow to stand for 5 min. in a dark place. Then add 15 mL KI solution, rinse into a beaker with dist. water and back-titrate the excess iodine with sodium thiosulphate. A blank control sample should be prepared and treated in the same way. Enter the blank value in the formula.

- The sample must be stirred well during the titration, in order to obtain a good emulsion.

Literature

- Metrohm Application Bulletin No. 141: Analysis of edible oils and fats.

Determination of Vitamin C (ascorbic acid) in fruit juices

Reagents

c(DPIP) = 0.001 mol/L; Dos. Drive A1

Sample

10 mL dist. water
add 1 mL *w*(sodium acetate) = 0.1 (10%),
15 mL oxalic acid solution 1 g/L
deareate the solution with nitrogen
A sample containing app. 0.05 - 0.5 mg of Vitamin C

Electrodes

6.0431.100 Pt-Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   VitCOran.mth                        Deter. of Vitamin C in orange juice

------------------------------------------------------------------------ Commands

     t/s   Command        Parameters                Parameters
     ----- -------------- ------------------------- -------------------------
 1         SHOW           Page              curve
 2         MET_U*         Determination of Vitamin C and its compounds
                          Reagent    DPIP           Sensor     6.0431.100
                          Concentr.    0.001 mol/L  Meas. input    A2
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END
================================================================================
printed: 1999-07-22 11:34:16
```

METROHM 796 Titroprocessor 01101 5.796.0010

Name VitCOran.mth Deter. of Vitamin C in orange juice

Parameters

2 MET_U* Determination of Vitamin C and its compounds

Reagent	DPIP		Sensor	6.0431.100	
Concentr.	0.001	mol/L	Meas. input	A2	
Dos. drive	A1				

*Parameters

Start conditions

Volume	off		Meas. val	off	mV
			Slope	off	mV/mL
Dos. rate	max	mL/min	Pause	0	s

Titration conditions

Adjustment	custom		Time recording	on	
Temperature	25.0	°C			

Stop conditions

Volume	absolute		Meas. val	off	mV
Size	10	mL	EP#	9	
Fill. rate	max	mL/min	Stop time	off	s
			Mpt. overflow	on	

Custom adjustments

Volume steps	0.1	mL	Signal drift	off	mV/min
Titr. rate	max	mL/min	Equilibr.time	10	s

EP Recognition

Equivalence points	all	min. EPC	20	mV
general lower limit	min mV	upp.	max	mV
pK/HNP Evaluation	off			

Display

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

*Report

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

*Formula

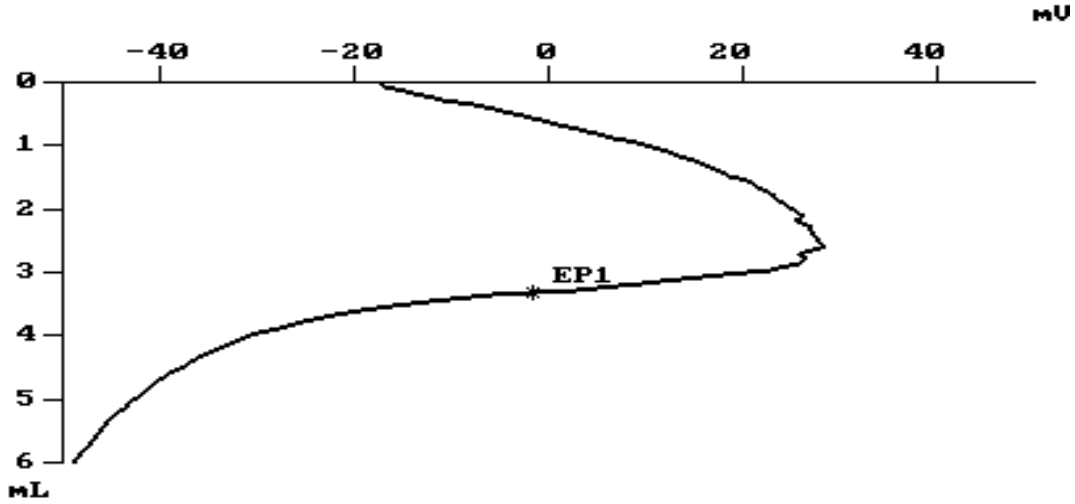
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Vitamine C	R01=EP1*C*0.987*176.12*1000/SS	mg/L	1	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method VitCOran.mth [o] Deter. of Vitamin C in orange juice

Curve

2 MET_U* Determination of Vitamin C and its compounds



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
VitCOran	Orange juice			2	mL

Remark
Determination of Vitamin C in orange juice

2 MET_U* Determination of Vitamin C and its compounds

EP1	-1.7 mV	3.348 mL	Vitamin C	291.0 mg/L

Stop condition volume

Modified data Determination time: 1999-07-23 11:43:56
Data file 99072311.007 Orange juice VitCOran Determination of Vitamine C in

printed: 1999-07-23 11:55:36

Remarks

- **Formula**:
  Vitamin C = content of Vitamin C in mg/L
  C = concentration of titant
  0.987 = titer of titrant
  176.12 = molecular mass of Vitamin C (g/mol)
  1000 = conversion factor mL ⇒ L

- **Titrant**:
  Dissolve 295 mg 2,6-Dichlorophenol indophenol with vigorous agitation in 1 L dist. water, then filter and mix with 100 mg sodium bicarbonate.
  This solution can be stored in the refrigerator for about 1 month, the titer should be checked daily with standard ascorbic acid. (As a titrant, the more readily soluble sodium salt may be used instead.)

- **Standard solution**:
  r (Vitamin C) = 500 mg/L
  Dissolve 50 mg ascorbic acid in oxalic acid solution (1 g/L) and make up to 100 mL. This solution should be freshly prepared daily.

- **Sample preparation**:
  Place dist. water, oxalic acid solution and sodium acetate buffer in the titration vessel and deaerate by passing a stream of nitrogen for 3...5 min. Then add a quantity of sample or standard solution containing about 0.05...0.5 mg vitamin C. Now titrate under nitrogen with titrant.

Literature

- Metrohm Application Bulletin No. 98: Determination of ascorbic acid (Vitamin C) and its compounds.

Salt content (NaCl) of meat products

Reagents

$c(AgNO_3)$ = 0.1 mol/L; Dos. Drive A1

Sample

app 50 g homogenisate of meat (acc. to 2.5 g sample)
in 50 mL dist. water
add 2 mL *c*(HNO3) = 2 mol/L

Electrodes

6.0430.100 Ag Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Name   Clinmeat.mth                      Salt content (NaCl) in meat products

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                Parameters
     ────  ─────────────  ────────────────────────  ──────────────────────────
 1         SHOW           Page              curve
 2         DET_U*         Salt content (NaCl) in meat products
                          Reagent    AgNO3          Sensor     6.0430.100
                          Concentr.      0.1 mol/L  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END
---------------------------------------------------------------------------
printed: 1999-07-26 14:24:55
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Clinmeat.mth

Parameters

2 DET_U* Salt content (NaCl) in meat products

Reagent	AgNO3	Sensor	6.0430.100
Concentr.	0.1 mol/L	Meas. input	A1
Dos. drive	A1		

— *Parameters

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	medium	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	10 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

— EP Recognition

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

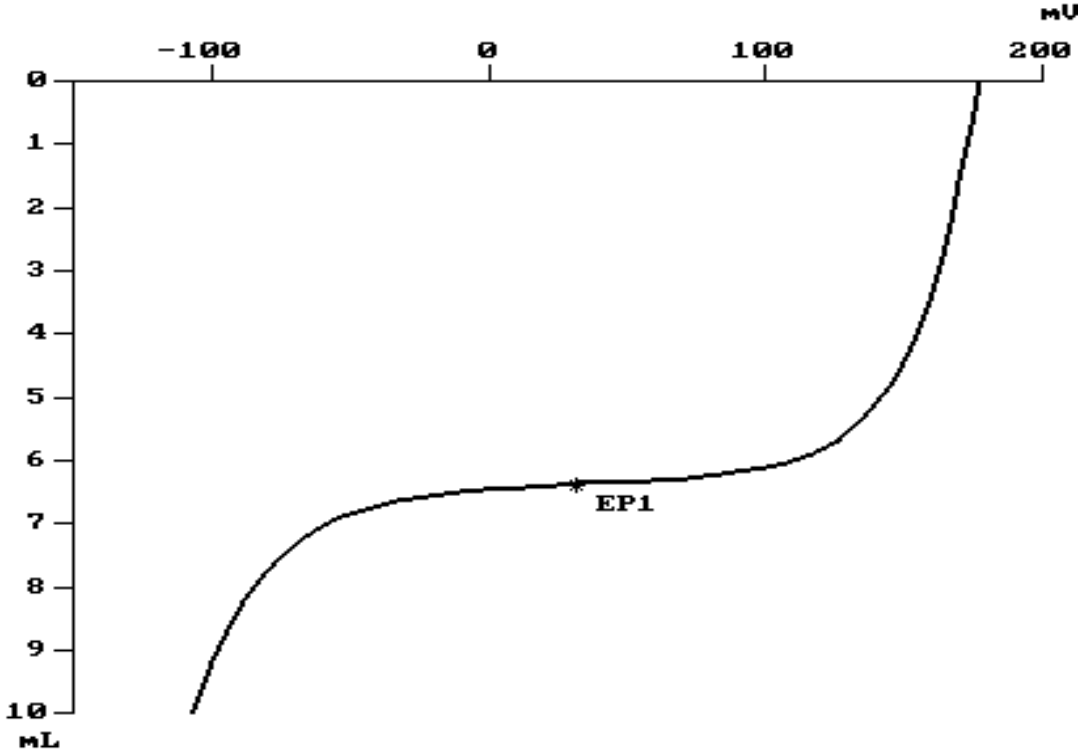
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	NaCl	R01=EP1*C*0.996*58.44*100/SS/1000	%	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method Clinmeat.mth [o] Salt content (NaCl) in meat products

Curve

2 DET_U* Salt content (NaCl) in meat products



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Clinmeat	Sausage			1.83	g

Remark
Salt content (NaCl) in meat products

2 DET_U* Salt content (NaCl) in meat products

EP1	31.2 mV	6.404 mL	NaCl	2.04 %

Stop condition volume

Original data Determination time: 1999-07-27 10:40:36
Data file 99072710.003 Sausage Clinmeat Salt content (NaCl) in meat produ

printed: 1999-07-27 10:43:07

Remarks

- **Formula**:
  NaCl = content of NaCl in %
  C = concentration of the titrant in mol/L
  0.996 = titer of titrant
  58.44 = molecular mass of sodium chloride (g/mol)
  100 = factor for %
  1000 = conversion factor mL ⇒ L

- **Sample preparation:**
  Cut up the sample into small pieces. Weigh about 10 g sample (precision 1 mg) into a mixer. Add 190 g dist. water and mix for 1... 2 min.
  Weigh 50 g homogenisate into a beaker, add 50 mL dist. water and 2 mL c(HNO3) = 2 mol/L and titrate.

Literature

- Metrohm Application Note: Potentiometric Titration [T-4]
  Salt content (NaCl) of meat products

Calcium in milk products

Reagents

c(EGTA) = 0.1 mol/L; Dos. Drive A1

Sample

app. 10 g milk
add 90 mL dist. water,
10 mL buffer solution pH 10,
1 mL *c*(Cu complex) = 0.100 mol/L

Electrodes

6.0502.140 Pt-Titrode; input A1
6.0726.100 Reference electrode (electrolyte KNO_3 sat.)

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   Cainmilk.mth                                    Ca2+ in milk products

------------------------------------------------------------------------ Commands

     t/s   Command        Parameters                 Parameters
     ----- -------------- -------------------------- --------------------------
 1         SHOW           Page              curve
 2         DET_U*         Ca2+ in milk products
                          Reagent    EGTA            Sensor     6.0502.140
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END
================================================================================
printed: 1999-07-22 11:34:16
```

METROHM 796 Titroprocessor 01101 5.796.0010

Name Cainmilk.mth Ca2+ in milk products

Parameters

2 DET_U* Ca2+ in mMilk products
Reagent EGTA Sensor 6.0502.140
Concentr. 0.1 mol/L Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	10 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	1	Signal drift	off mV/min
Min.increment	10 µL	Equilibr.time	5 s
Titr. rate	max mL/min		

— EP Recognition —

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

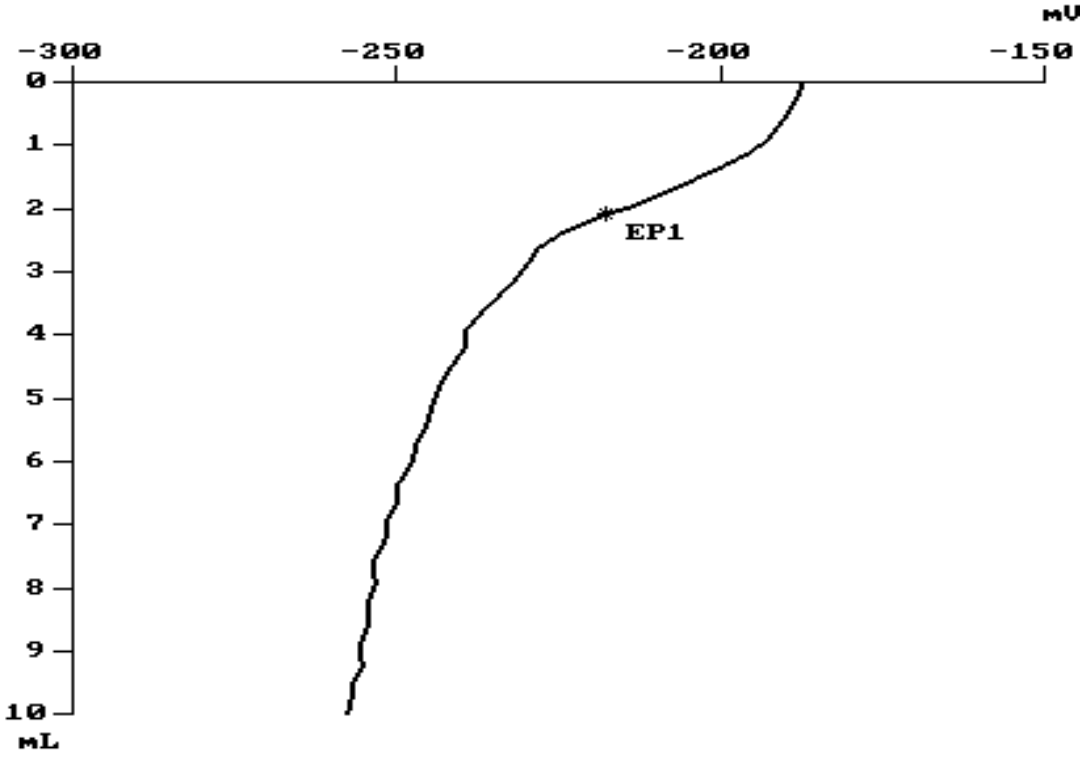
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Ca	RS1=EP1*C*0.998*40.08*0.1/SS	%	3	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method Cainmilk.mth [o] Ca2+ in milk products

Curve

2 DET_U* Ca2+ in milk products



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Cainmilk	Cream	Metrohm	lab. 1b	10.34	g

Remark
Ca2+ in milk products

2 DET_U* Ca2+ in milk products

EP1	-217.6 mV	2.114 mL	Ca	0.082	%

Stop condition volume

Original data Determination time: 1999-09-21 09:32:36
Data file 99092109.002 Cream Metrohm Cainmilk Ca2+ in milk products

printed: 1999-09-21 09:37:04

Remarks

- **Formulas**:
  Ca = content of calcium in %
  C = concentration of titrant
  0.998 = titer of titrant
  0.1 = factor for %
  40.08 = molecular mass of calcium (g/mol)

- **Reagents**:
  c(EGTA) = 0.100 mol/L:
  38.04 g ethylene glycol-0,0'-bis-(2-aminoethyl)-N,N,N',N'-tetraacetic acid are added to a 1 liter volumetric flask, dissolved in 250 mL *c*(NaOH) = 1 mol/L and the solution fill up to the mark with dist. water.

  Cu complex:
  Mix 100 mL of EGTA titrant with 100 mL of a reagent *c*(NH_4Cl)=0.2 mol/L and *c*($Cu(NO_3)_2$) = 0.100 mol/L. Check for any excess of Cu^{2+} or EGTA.

  Buffer solution pH = 10:
  Dissolve 54 g NH_4Cl in app. 400 mL dist. water in a 1 liter volumetric flask, add 300 mL *w*(NH_3) = 0.25 (25%) and fill up to the mark with dist. water.

Literature

- Metrohm Application Bulletin No. 235: Potentiometric titration of Ca (Mg) in milk products.

2-Aminophenol

Reagents

$c(NaNO_2)$ = 0.2 mol/L; Dos. drive A1

Sample

app. 0.3 ... 0.35 g sample (2-aminophenol)
add 10 mL *w*(HBr) = 0.20 (20%)
in 30 mL dist. water

Electrodes

6.0431.100 Pt Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Method  Diazo.mth                    Diazotisation titration of 2-Aminophenol

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1         MET_U*         Determination of 2-Aminophenol
                          Reagent    NaNO2          Sensor     6.0431.100
                          Concentr.      0.2 mol/L  Meas. input    A1
                          Dos. drive             A1
 2         END

═══════════════════════════════════════════════════════════════════════════
printed: 1998-07-11 09:35:13
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method Diazo.mth [o] Diazotisation titration of 2-Aminophenol

Parameters

```
#  1       MET_U*   Determination of 2-Aminophenol
                    Reagent    NaNO2          Sensor     6.0431.100
                    Concentr.      0.2 mol/L  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters

```
Start conditions
  Volume      absolute          Meas. val        off mV
  Size              10 mL       Slope            off mV/mL
  Dos. rate          5 mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size              20 mL       EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Volume steps     0.1 mL       Signal drift     off mV/min
  Titr. rate       max mL/min   Equilibr.time     15 s
```

— EP Recognition

```
Endpoints                 all       min. EPC      30.0 mV
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin              mV             mL
  end                mV             mL
Division                        2 mL/cm
Grid               off
```

— *Report

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

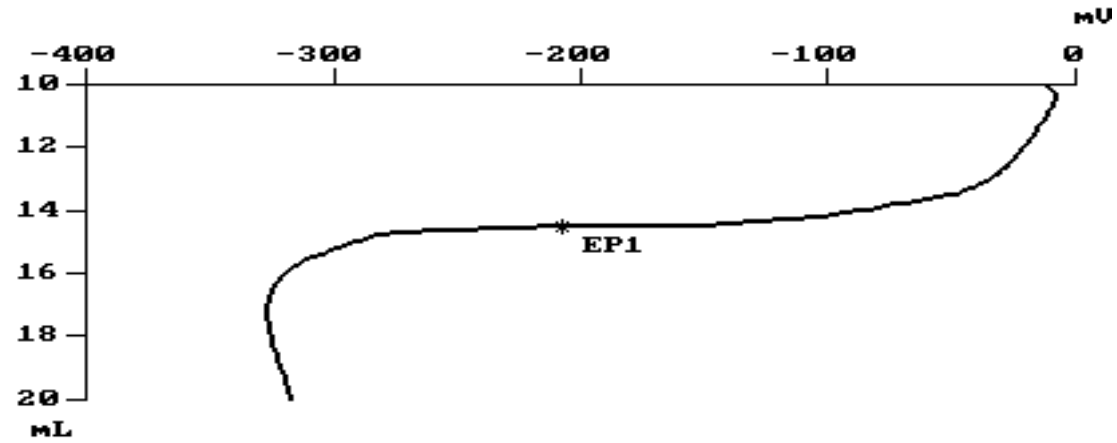
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Content	R1=EP1*109.13*0.1*C/SS	%	2	stat.

METROHM 796 Titroprocessor 01101 5.796.0010

Method Diazo.mth [o] Diazotisation titration of 2-Aminophenol

Curve

1 MET_U* Determination of 2-Aminophenol



*Standard report

Method	Product	Lot	Size	Unit
Diazo	AM 2714	03247	0.3304	g

Remark

1 MET_U* Determination of 2-Aminophenol

EP1	-207.4 mV	14.583 mL	Content	96.34 %

Stop condition volume

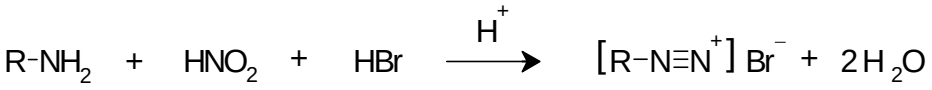
Original data Determination time: 1998-07-11 09:37:36
Data file Diazo.003 AM 2714 03247 Diazo

printed: 1998-07-11 09:39:46

Remarks see next page

Remarks

- **Determination reaction**:



- **Formulas**:
  Content = content of 2-aminophenol in %
  109.13 = molecular mass of 2-aminophenol (g/mol)
  0.1 = factor for conversion mL ⇒ L, and for % (0.001*100=0.1)
  C = concentration of titrating agent (mol/L)

  Enter the appropriate molecular mass for other amines .

- Also the 6.0420.100 combined Pt electrode can be used.

Literature

- Metrohm Application Bulletin No. 228: Diazotisation titrations

NaCl in Isotonic Solution

Reagents

$c(AgNO_3)$ = 0.1 mol/L; Dos. Drive A1

Sample

5 ml sample solution
add 2 ml *c*(HNO3) = 2 mol/L
in 30 ml dist. water

Electrodes

6.0430.100 Ag-Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Name   NaCliso.mth                                  NaCl in isotonic solution

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                Parameters
     ────  ─────────────  ──────────────────────    ──────────────────────────
 1         SHOW           Page              curve
 2         DET_U*         NaCl in isotonic solution
                          Reagent    AgNO3          Sensor     6.0430.100
                          Concentr.      0.1 mol/L  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END
---------------------------------------------------------------------------
printed: 1999-07-26 14:24:55
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method NaCliso.mth NaCl in isotonic solution

Parameters

2 DET_U* NaCl in isotonic solution

Reagent	AgNO3	Sensor	6.0430.100
Concentr.	0.1 mol/L	Meas. input	A1
Dos. drive	A1		

— *Parameters

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	medium	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	10 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

— EP Recognition

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

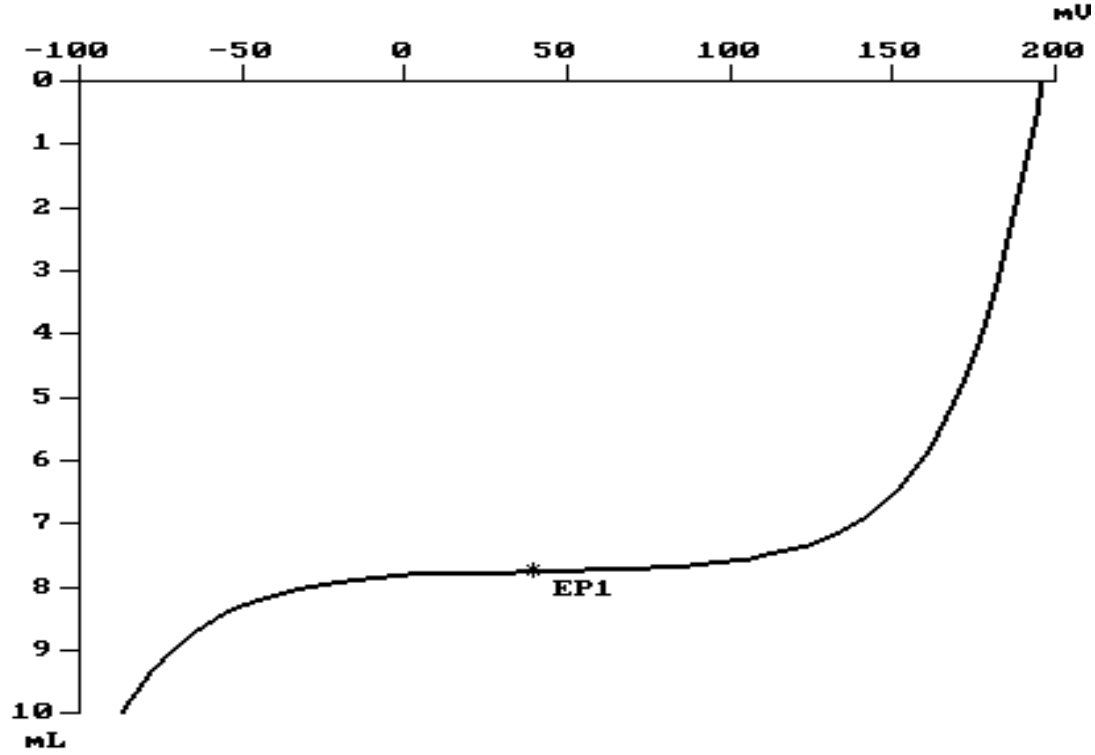
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	NaCl	R01=EP1*C*1000*0.998/SS	mmol/L	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method NaCliso.mth [o] NaCl in isotonic solution

Curve

2 DET_U* NaCl in isotonic solution



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
NaCliso	NaCl			5	mL

Remark
NaCl in isotonic solution

2 DET_U* NaCl in isotonic Solution

EP1	39.6 mV	7.772 mL	NaCl	155.14 mmol/L

Stop condition volume

Original data Determination time: 1999-07-20 11:55:58
Data file 99072011.002 NaCl NaCliso NaCl in isotonic solution

printed: 1999-07-20 11:58:45

Remarks

- **Formulas**:
  NaCl = concentration of NaCl in isotonic solution in mmol/L
  C = concentration of the titrant in mol/L
  0.998 = titer of titrant
  1000 = conversion factor mL ⇒ L

Literature

- Metrohm Application Bulletin No. 130: Chloride titrations with potentiometric end-point titration

Determination of vitamin C (ascorbic acid) by photometric titration

Reagents

c(DPIP) = 0.001 mol/L; Dos. Drive A1

Sample

10 mL dist. water
1 mL *w*(sodium acetate) = 0.10 (10 %)
15 mL oxalic acide (1.4 g/L)
deaerate the solution with nitrogen
Add sample with 0.2 - 0.5 mg of vitamin C content (1-5 ml)
und titrate under nitrogen

Electrodes

6.5501.014 Spectrode 610 nm; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
=============================================================================

Name   VitCphot.mth              Deter. of vitamin C by photometric titration

──────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                Parameters
     ───── ───────────── ──────────────────────── ────────────────────────
 1         SHOW           Page              curve
 2         MET_U*         Determination of vitamin C and its compounds
                          Reagent    DPIP           Sensor     6.5501.01X
                          Concentr.    0.001 mol/L  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END

=============================================================================
printed: 1999-07-22 11:34:16
```

METROHM 796 Titroprocessor 01101 5.796.0010

Name VitCphot.mth [o] Deter. of vitamin C by photometric titration

Parameters

2 MET_U* Determination of vitamin C and its compounds
Reagent DPIP Sensor 6.5501.01X
Concentr. 0.001 mol/L Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	7 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Volume steps	0.1 mL	Signal drift	off mV/min
Titr. rate	max mL/min	Equilibr.time	10 s

— EP Recognition —

Equivalence points	all	min. EPC	60 mV
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

Windows

EP#	from ... to	[mV]	EPC	[mV]

Fixendpoints

F#	M.value [mV]
1	725
2	off
3	off

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

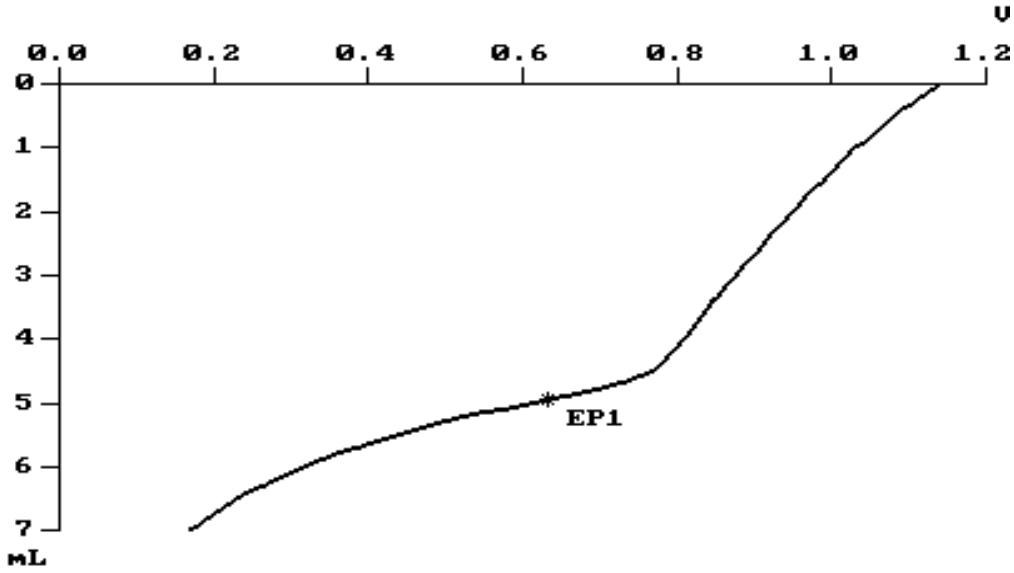
	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no

— *Formula —

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Vitamin C	R01=F1*C*0.992*176.12*1000/SS	mg/L	1	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method VitCphot.mth [o] Deter. of vitamin C by photometric titration



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
VitCphot	vitamin C			2	mL

Remark
Determination of Vitamin C by photometric titration

2 MET_U* Determination of vitamin C and its compounds

EP1	631.5 mV	4.966 mL	vitamin C	412.0 mg/L
F1	725.0 mV	4.716 mL		

Stop condition volume

Original data Determination time: 1999-07-22 11:26:40
Data file 99072211.005 Vitamin C VitCphot Determination of vitamine C

printed: 1999-07-22 11:55:19

Remarks

- **Formula**:
  vitamin C = content of vitamin C in mg/L
  C = concentration of titrant
  0.992 = titer of titrant
  176.12 = molecular mass of vitamin C (g/mol)
  1000 = conversion factor mL ⇒ L

- **Titrant**:
  Dissolve 295 mg 2,6-Dichlorophenol indophenol with vigorous agitation in 1 L dist. water, then filter and mix with 100 mg sodium bicarbonate.
  This solution can be stored in the refrigerator for about 1 month, the titer should be checked daily with standard ascorbic acid. (As a titrant, the more readily soluble sodium salt may be used instead.)

- **Standard solution**:
  r (vitamin C) = 500 mg/L
  Dissolve 50 mg ascorbic acid in oxalic acid solution (1 g/L) and fill up to 100 mL. This solution should be freshly prepared daily.

- **Sample preparation**:
  Place dist. water, oxalic acid solution and sodium acetate buffer in the titration vessel and deaerate by passing a stream of nitrogen for 3...5 min. Then add a quantity of sample or standard solution containing about 0.05...0.5 mg vitamin C. Now titrate under nitrogen with titrant.

Literature

- Metrohm Application Bulletin No. 98: Determination of ascorbic acid (Vitamin C) and its compounds.

EDTA / NTA in detergents

Reagents

$c(Cu^{2+})$ = 0. 01 mol/L; Dos. Drive A1

Sample

10 mL sample solution
10 mL buffer pH = 9.6 [$c(NH_3/NH_4NO_3)$ = 1 mol/L]
2 mL $c(Na_2EDTA)$ = 0.01 mol/L
30 mL dist. water

Electrodes

6.0502.140 Cu^{2+} sensitive indicator electrode; input A1
6.0726.100 Ag/AgCl double junction reference electrode (KNO_3 sat.)

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   EDTANTA2.mth                                    EDTA/NTA in Detergents

-------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                 Parameters
     ____  _____________  _________________________  _________________________

 1         SHOW           Page              curve
 2         MET_U*         EDTA/NTA
                          Reagent    Cu2+           Sensor     6.0502.140
                          Concentr.     0.01 mol/l  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END
================================================================================
printed: 1999-07-22 11:34:16
```

METROHM 796 Titroprocessor 01101 5.796.0010

Name EDTANTA2.mth EDTA/NTA in Detergents

Parameters

```
#  2       MET_U*   EDTA/NTA
                    Reagent    Cu2+           Sensor     6.0502.140
                    Concentr.     0.01 mol/l  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters —

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size               5 mL       EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Volume steps     0.1 mL       Signal drift     off mV/min
  Titr. rate       max mL/min   Equilibr.time      5 s
```

— EP Recognition —

```
Equivalence points        all       min. EPC      30.0 mV
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display —

```
Curve       Y_Axis       X_Axis
-------------------------------
Quantity    M. value         Volume
Scale           auto           auto
  begin              mV             mL
  end                mV             mL
Division                        1 mL/cm
Grid               off
```

— *Report —

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

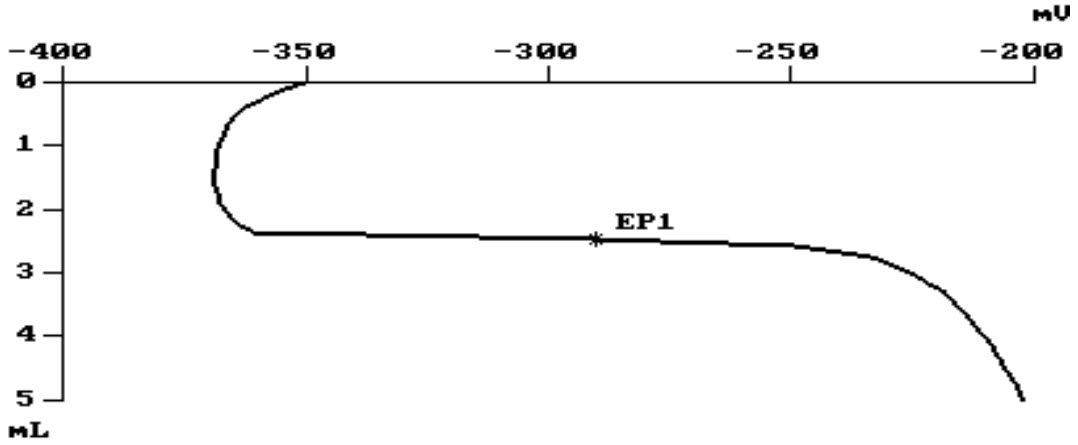
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	EDTA	RS1=(EP1-2)*C*292.25*100/SS	%	2	normal
2	NTA	RS2=(EP1-2)*C*191.14*100/SS	%	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method EDTANTA2.mth [o] EDTA/NTA in Detergents

Curve

2 MET_U* EDTA/NTA



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
EDTANTA2	detergents	Metrohm	lab. 1b	93.4	mg

Remark
EDTA/NTA in Detergents

2 MET_U* EDTA/NTA

EP1	-290.4 mV	2.499 mL	EDTA	1.56 %
			NTA	1.02 %
Stop condition		volume		

Original data Determination time: 1999-08-31 10:55:45
Data file 99083110.010 detergents Metrohm EDTANTA2 EDTA/NTA in Detergents

printed: 1999-08-27 09:39:08

Remarks

- **Formulas:**
  EDTA = content of EDTA in %
  NTA = content of NTA in %
  2 = amount of EDTA / NTA added in mL
  C = concentration of titrant in mol/L
  292.25 = molecular mass of EDTA in g/mol
  191.14 = molecular mass of NTA in g/mol
  100 = conversion factor for %

- **Sample preparation**:
  Dissolve 0.5 ... 1 g detergent in 50 mL dist. water at 40 °C.
  Allow the solution to cool and add up to 100 mL.

- Select the appropriate formula. The other one may be deleted.

- Na_2EDTA is added to obtain a greater potential jump. Treat the amount of Na_2EDTA added like a blank value.

Literature

- Metrohm Application Bulletin No. 143: Potentiometric determination of nitrilotriacetic acid (NTA) and/or ethylenediaminetetracetic acid (EDTA) in detergents.

Cationic Surfactants in fabric softener

Reagents

c(DOS) = 0.01 mol/L; Dos. drive A1
Dioctylsodium sulfosuccinate e.g. Fluka No. 86139
Buffer solution pH = 3.0; Dos. drive A2
citrate/HCl, e.g. Merck Titrisol No. 9883
Methanol puriss p.a.; Dos. drive A3
c(HCl) = 2 mol/L; Dos. drive A4

Sample

app. 1g sample (fabric softener)
60 mL dist. water

Electrodes

6.0507.120 Ionic surfactant electrode; input A1
6.0733.100 Ag/AgCl reference electrode (*c*(KCl) = 3 mol/L); input Aref.

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   Cationic.mth                    Cationic Surfactants in Fabric Softener

-------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                 Parameters
     ----- -------------- -------------------------- --------------------------
 1         STIR_I         Meas.interface          A  State                 off
 2         ADD_A          Reagent    Methanol        Dos. drive     A3
                          Concentr.    99.98 %       Dos. rate     max mL/min
                          Volume              5 mL   Fill. rate    max mL/min
 3         STIR_I         Meas.interface          A  State                  on
 4         ADD_A          Reagent    Buffer pH 3     Dos. drive     A2
                          Concentr.                  Dos. rate     max mL/min
                          Volume              5 mL   Fill. rate    max mL/min
 5         ADD_A          Reagent    HCl             Dos. drive     A4
                          Concentr.         2 mol/L  Dos. rate     max mL/min
                          Volume              1 mL   Fill. rate    max mL/min
 6         DET_U*         Determination of cationic surfactants
                          Reagent    DOS             Sensor     6.0507.120
                          Concentr.     0.01 mol/L   Meas. input    A1
                          Dos. drive             A1
 7         END

================================================================================
printed: 1998-07-10 17:01:07
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Method  Cationic.mth [o]              Cationic Surfactants in Fabric Softener

──────────────────────────────────────────────────────────────────── Parameters
#  6       DET_U*   Determination of cationic surfactants
                    Reagent    DOS            Sensor     6.0507.120
                    Concentr.     0.01 mol/L  Meas. input    A1
                    Dos. drive             A1

      — *Parameters ──────────────────────────────────────────────────────────

      Start conditions
        Volume           off          Meas. val        off mV
                                      Slope            off mV/mL
        Dos. rate        max mL/min   Pause             30 s

      Titration conditions
        Adjustment    custom          Time recording   on
        Temperature     25.0 °C

      Stop conditions
        Volume      absolute          Meas. val        off mV
        Size              20 mL       EP#                9
        Fill. rate       max mL/min   Stop time        off s
                                      Mpt. overflow     on

      Custom adjustments
        Meas.pt.density    3          Signal drift     off mV/min
        Min.increment     10 µL       Equilibr.time     10 s
        Titr. rate       max mL/min

      — EP Recognition ───────────────────────────────────────────────────────

      Endpoints            greatest       min. EPC        5.0
      general lower limit       min mV    upp.            max mV
      pK/HNP Evaluation         off

      — Display ──────────────────────────────────────────────────────────────

      Curve       Y_Axis       X_Axis
      ──────────────────────────────────
      Quantity    M. value          Volume
      Scale           auto            auto
        begin              mV             mL
        end                mV             mL
      Division                        2 mL/cm
      Grid               off

      — *Report ──────────────────────────────────────────────────────────────

                      Type      Specification  print  send  FF
                      ──────    ─────────────  ─────  ────  ──
      Reports for     V_Curve   M. value       yes    no    no
      titration /     *Stand                  yes    no    no
      measuring mode                          no     no    no
                                              no     no    no
                                              no     no    no
                                              no     no    no


      — *Formula ─────────────────────────────────────────────────────────────

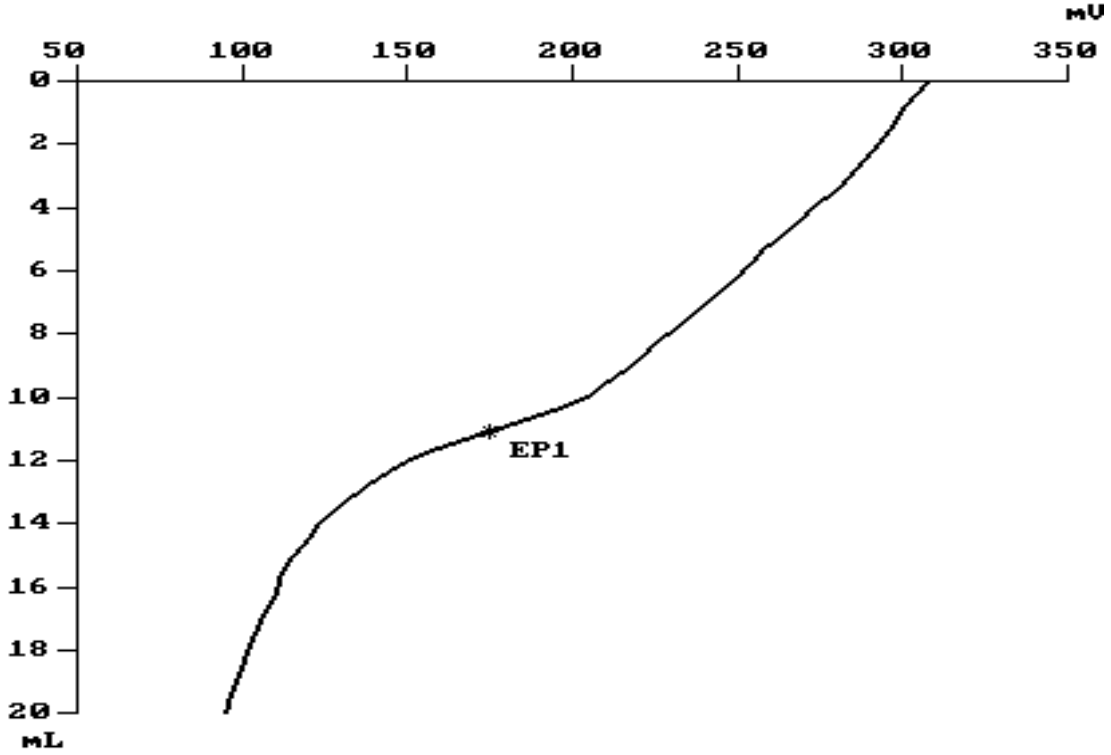
      #  Comment      Formula (R$$, C##, X$$, EP# ..)      Unit    Dec  Type
      ──  ──────────  ──────────────────────────────────   ──────  ───  ──────
       1  Cationic    R1=EP1*C/SS                          meq/g   4    stat.
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Cationic.mth [o] Cationic Surfactants in Fabric Softener

Curve

6 DET_U* Determination of cationic surfactants



*Standard report

Method	Product	Lot	Size	Unit
Cationic	Fabric soft.	15—723	0.9965	g

Remark

6 DET_U* Determination of cationic surfactants

EP1	174.6 mV	11.128 mL	Cationic	0.1117 meq/g

Stop condition volume

Original data Determination time: 1998-07-10 16:56:21

Data file Tens_Cat.003 Fabric soft. 15—723 Cationic

printed: 1998-07-10 17:00:02

Remarks

- **Formula**:
  Cationic = concentration of cationic surfactants in meq/g
  C = concentration of titrant (mol/L)

- **Electrode preparation, maintenance and storage**:
  Store the Ionic Surfactant electrode dry. They are conditioned by two to three titrations. Rinse the electrode after several titrations with methanol or wipe it with a cloth moistend with methanol and rinse with dist. water.
  If you use the electrode frequently, it may also be stored in a solution of 1% polyethyleneglycol 1000. In this case, the electrode is always ready for use.

- **Sample preparation**:
  Adjust the sample size in order to have a titrant consumption of at least 10 mL.

- If you prefer the addition of methanol, buffer solutions, and *c*(HCl) = 2 mol/L manually, you have to delete all of the commands ADD_A for automatic addition first.

- The pH of buffer solution, the amount of added methanol or the titrating agent may change according to the type of surfactant. See also Application Bulletin No. 233.

Literature

- Metrohm Application Bulletin No. 233: Titrimetric/potentiometric determination of anionic and cationic detergents with the high-sense surfactant electrode.

Anionic Surfactants in shampoo

Reagents

c(TEGO®trant A100) = 0.004 mol/L; Dos. drive A1
1,3-Didecyl-2-methyl-imidazolium-chloride
(DDMICl) Metrohm 6.2317.000
Buffer solution pH = 3.0; Dos. drive A2
citrate/HCl, e.g. Merck Titrisol No. 9883
Methanol puriss p.a.; Dos. drive A3

Sample

app. 0.2 g sample (shampoo)
60 mL dist. water

Electrodes

6.0507.120 Ionic surfactant electrode; input A1
6.0733.100 Ag/AgCl reference electrode (*c*(KCl) = 3 mol/L); input Aref.

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
==============================================================================

Method  Anionic.mth [o]                         Anionic Surfactants in Shampoo

------------------------------------------------------------------- Commands

t/s   Command        Parameters               Parameters

 1          STIR_I         Meas.interface        A  State               off
 2          ADD_A          Reagent    Methanol      Dos. drive     A3
                           Concentr.    99.98 %     Dos. rate     max mL/min
                           Volume              5 mL  Fill. rate    max mL/min
 3          STIR_I         Meas.interface        A  State               on
 4          ADD_A          Reagent    Buffer pH 3   Dos. drive     A2
                           Concentr.                Dos. rate     max mL/min
                           Volume             10 mL  Fill. rate    max mL/min
 5          DET_U*         Determination of anionic surfactants
                           Reagent    TEGOtrantA100  Sensor     6.0507.120
                           Concentr.    0.004 mol/L  Meas. input    A1
                           Dos. drive            A1
 6          END

==============================================================================
printed: 1998-07-10 15:30:10
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Method  Anionic.mth [o]                          Anionic Surfactants in Shampoo

──────────────────────────────────────────────────────────────────────── Parameters
#  5       DET_U*   Determination of anionic surfactants
                    Reagent    TEGOtrantA100  Sensor     6.0507.120
                    Concentr.    0.004 mol/L  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ──────────────────────────────────────────────────────────

      Start conditions
        Volume           off          Meas. val        off mV
                                      Slope            off mV/mL
        Dos. rate        max mL/min   Pause             30 s

      Titration conditions
        Adjustment    custom          Time recording   on
        Temperature     25.0 °C

      Stop conditions
        Volume      absolute          Meas. val        off mV
        Size             20 mL        EP#                9
        Fill. rate       max mL/min   Stop time        off s
                                      Mpt. overflow     on

      Custom adjustments
        Meas.pt.density    3          Signal drift     off mV/min
        Min.increment     10 µL       Equilibr.time     10 s
        Titr. rate       max mL/min

      — EP Recognition ───────────────────────────────────────────────────────

      Endpoints            greatest       min. EPC        5.0
      general lower limit       min mV    upp.            max mV
      pK/HNP Evaluation         off

      — Display ──────────────────────────────────────────────────────────────

      Curve       Y_Axis       X_Axis
      ──────────────────────────────────
      Quantity    M. value          Volume
      Scale            auto            auto
        begin               mV              mL
        end                 mV              mL
      Division                           2 mL/cm
      Grid                off

      — *Report ──────────────────────────────────────────────────────────────

                      Type      Specification  print  send  FF
                      ──────    ─────────────  ─────  ────  ──
      Reports for     V_Curve   M. value       yes    no    no
      titration /     *Stand                  yes    no    no
      measuring mode                          no     no    no
                                              no     no    no
                                              no     no    no
                                              no     no    no


      — *Formula ─────────────────────────────────────────────────────────────

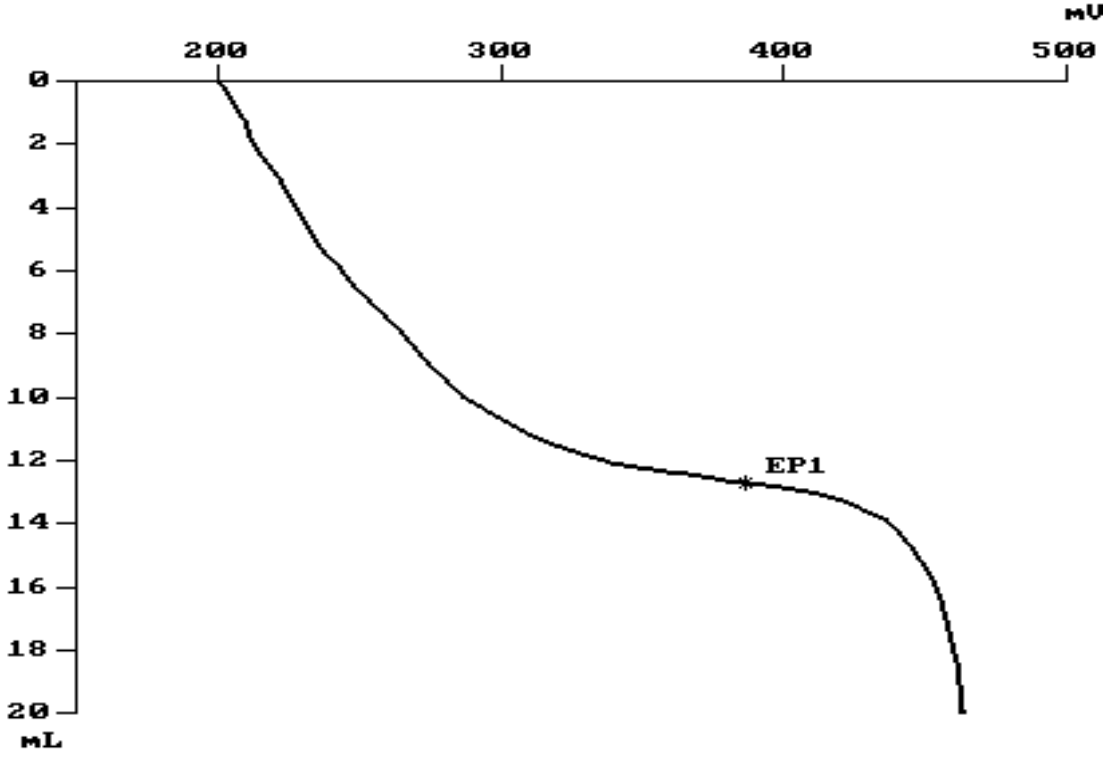
      #  Comment      Formula (R$$, C##, X$$, EP# ..)      Unit    Dec  Type
      ──  ──────────  ──────────────────────────────────   ──────  ───  ──────
       1  Anionic      R1=EP1*C/SS                         meq/g   4    stat.
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Anionic.mth [o] Anionic Surfactants in Shampoo

Curve

5 DET_U* Determination of anionic surfactants



*Standard report

Method	Product	Lot	Ident3	Size	Unit
Anionic	Shampoo	12-3456		0.2090	g

Remark

5 DET_U* Determination of anionic surfactants

EP1	386.5 mV	12.757 mL	Anionic	0.2442 meq/g

Stop condition volume

Original data Determination time: 1998-07-10 15:32:53
Data file Tens_AN.013 Shampoo 12–3456 Anionic

printed: 1998-07-10 15:36:33

Remarks

- **Formulas**:
  Anionic = concentration of anionic surfactants in meq/g
  C = concentration of titrant (mol/L)

- **Electrode preparation, maintenance and storage**:
  Store the Ionic Surfactant electrode dry. They are conditioned by two to three titrations. Rinse the electrode after several titrations with methanol or wipe it with a cloth moistend with methanol and rinse with dist. water.
  If you use the electrode frequently, it may also be stored in a solution of 1% polyethyleneglycol 1000. In this case, the electrode is always ready to use.

- **Sample preparation**:
  Adjust the sample size in order to have a titrant consumption of at least 10 mL.

- If you prefer the addition of methanol and buffer solutions manually, you have to delete the Commands ADD_A for automatic addition first.

- The pH of buffer solution, the amount of added methanol may change according to the type of surfactant. See also Application Bulletin No. 233.

Literature

- Metrohm Application Bulletin No. 233: Titrimetric/potentiometric determination of anionic and cationic detergents with the high-sense surfactant electrode.

Perborate, percarbonate or persulphate in washing powder

Reagents

c ($Na_2S_2O_3$) = 0.1 mol/L; Dos. drive A1

Sample

25 mL sample solution
20 mL *c*(H_2SO_4) = 2 mol/L
1 g of KI p.a.

Electrodes

6.0431.100 Pt-Titrode; Input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   Perborat.mth                          Peroxide compounds in detergents

─────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ─────  ─────────────  ─────────────────────────  ──────────────────────
 1          STIR_I         Meas.interface         A   State                on
 2          MET_U*         bleach in detergents
                           Reagent    Na2S2O3         Sensor     6.0431.100
                           Concentr.      0.1 mol/L   Meas. input    A1
                           Dos. drive            A1
 3          STIR_I         Meas.interface         A   State                off
 4          END

---------------------------------------------------------------------------
printed: 1999-08-05 15:39:32
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Perborat.mth [o] Peroxide compounds in detergents

Parameters

```
#  2       MET_U*   bleach in detergents
                    Reagent    Na2S2O3        Sensor     6.0431.100
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size             2.0 mL       EP#                2
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Volume steps    0.05 mL       Signal drift     off mV/min
  Titr. rate       max mL/min   Equilibr.time     10 s
```

— EP Recognition

```
Equivalence points        all       min. EPC      30.0 mV
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin              mV             mL
  end                mV             mL
Division                        1 mL/cm
Grid               off
```

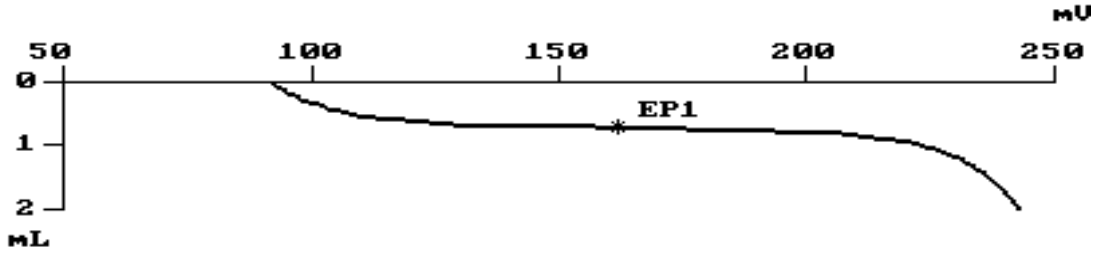
— *Report

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*ShrtRes		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Peroxide	R01=EP1*7.639*100/SS	%	2	normal

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================
                                                                          Curve
#  2       MET_U*   bleach in detergents
```




```
                                                                   Short results
#  2       MET_U*   bleach in detergents

  Peroxide          7.12 %

  Stop condition                volume

Original data                           Determination time: 1998-01-09 15:28:21
Data file 98010915.005     detergents  Perborat
================================================================================
printed: 1999-08-05 15:38:06
```

Remarks

Formulas:

Peroxide	= content of Peroxide in %
7.639	= equivalent of the Peroxide compound in mg/mL*
100	= conversion factor for %

*For perborate, percarbonate or persulfate, the following factors has to be added in the formula:
7.639 mg Na perborate
6.100 mg Na percarbonate
11.905 mg Na persulphate

- **Sample preparation:**
  Weigh exactly about 0.4 g washing powder into a 100 mL volumetric flask. Dissolve sample with $c(H_2SO_4)$ = 2 mol/L and wait for the carbonate to react. Then fill up with dist. water to the mark. Pipette 25.0 mL of the prepared sample solution into a beaker, add 20 mL $c(H_2SO_4)$ = 2 mol/L and about 1 g potassium iodide. Mix to dissolve the iodide, cover the beaker with a watch glass and store it in a dark place for 10 min. Then titrate with $c(Na_2S_2O_3)$ = 0.1 mol/L.

Literature

- Metrohm Titration Application Notes No. T-26: Perborate, percarbonate or persulphate in washing powder

Potentiometric two-phase titration of anionic surfactants in powdered and liquid detergents

Reagents

c(TEGO®trant A100) = 0.004 mol/L; Dos. Drive A1

Sample

app. 200 mg of sample
80 mL dist. water
0.2 mL TEGO®add
adjust with c(HCl) = 0.5 mol/L to pH 3
20 mL solvent mixture MIBK/Ethanol = 1:1 (MIBK=Methylisobutylketone)

Electrodes

6.0507.130 Surfactrode Resistant; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   AnT-r3.mth                                    Anionic Tensides (pH=3)

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                Parameters
     ────  ─────────────  ────────────────────────  ──────────────────────────
 1         SHOW           Page              curve
 2         DET_U*         Anionic Tenside
                          Reagent    TEGOtrantA100  Sensor     6.0507.130
                          Concentr.    0.004 mol/l  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END

---------------------------------------------------------------------------
printed: 1999-07-23 11:26:15
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

2 DET_U* Anionic Tenside

Reagent	TEGOtrantA100	Sensor	6.0507.130
Concentr.	0.004 mol/l	Meas. input	A1
Dos. drive	A1		

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	300 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	20 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	0	Signal drift	5 mV/min
Min.increment	150 µL	Equilibr.time	300 s
Titr. rate	max mL/min		

— EP Recognition —

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

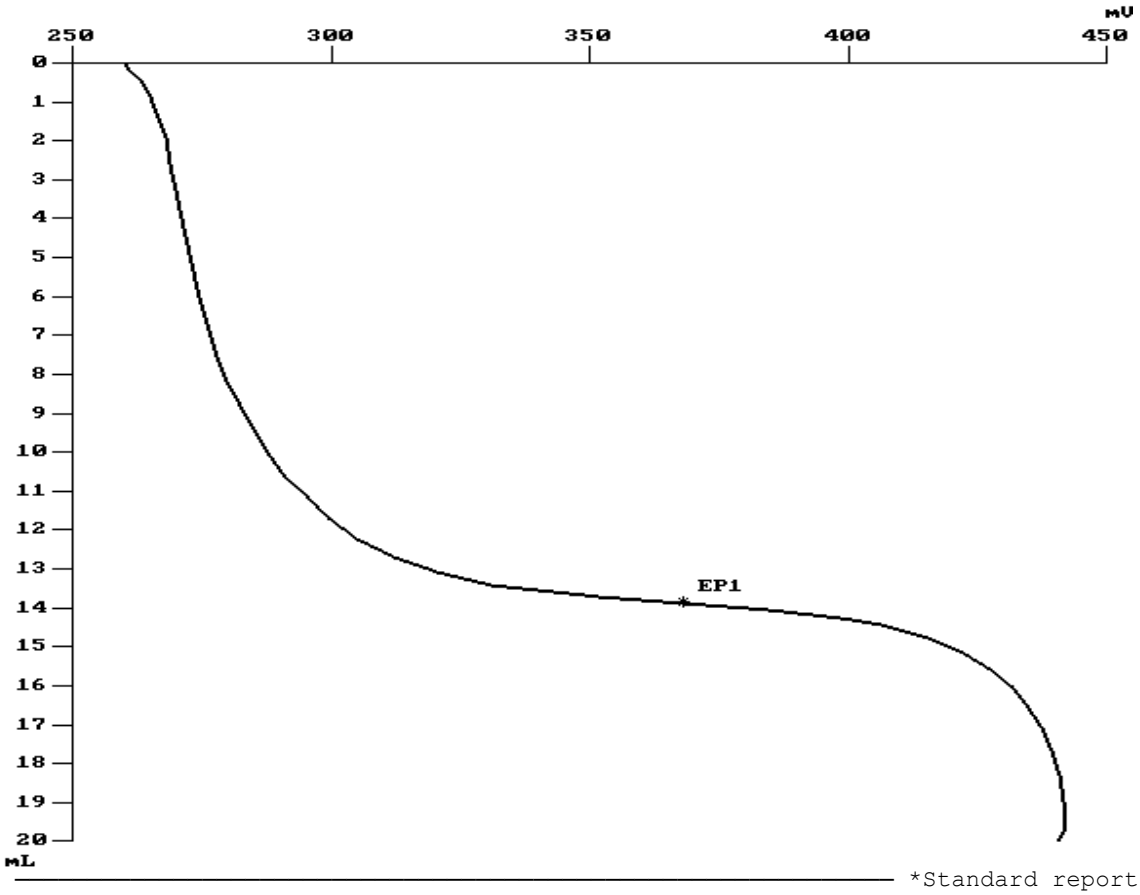
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Anionic	RS1=EP1*C*0.994*100/SS	mmol	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method AnT-r3.mth [o] Anionic Tensides (pH-3)

Curve

2 DET_U* Anionic Tenside



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
AnT-r3	Tenside	Metrohm	lab. 1b	0.180	g

Remark
Anionic Tensides

2 DET_U* Anionic Tenside

EP1	368.1 mV	13.899 mL	Anionic	30.70 mmol

Stop condition volume

Original data Determination time: 1999-09-08 11:52:53
Data file 99090811.003 Tenside Metrohm AnT-r3 Anionic Tensides

printed: 1999-07-23 11:55:36

Remarks

- **Formulas**:
  Anionic = content of anionic tensides in mmol/100g sample
  C = concentration of titrant (mol/L)
  0.994 = factor of titrant
  100 = factor for mmol/100g

- **Sample preparation**:
  The well homogenised sample is weighed into a glass beaker and dissolved in approx. 80 mL dist. water. 0.2 mL TEGO® add is added and the pH value adjusted to 3 with *c*(HCl) = 0.5 mol/L. After the addition of 20 mL solvent mixture, titrate with *c*(TEGO® trant A100) = 0.004 mol/L.

  Adjust the sample size in order to have a titrant consumption of at least 10 ml.

- **Titrant *c*(TEGO® trant A100) = 0.004:**
  Approx. 1.59 g 1,3-didecyl-2-methyl-imidazolium chloride are weighted in a 1000 mL gratuated flask, dissolved in distilled water and filled up to the mark. The titer determination is executed with a solution of sodium dodecylsulphate and is described below.

- **Titer determination of TEGO® trant A100 solution:**
  1.4565 ± 0.0005 g sodium dodecylsulphate (99 %) are weighted in a 1000 mL gratuated flask, dissolved in distilled water and filled up to the mark. The concentration of this solution is 0.005 mol/L.
  Add approx. 70 mL distilled water, 0.2 mL TEGO® add and 10.00 mL Na-dodecylsulphate solution in a glass beaker. Adjust the pH value of the solution with *c*(HCl) = 0.5 mol/L to 3.0, add 20 mL solvent mixture and titrate with TEGO® trant A100.

  Titer = EP1 / 10

Literature

- Metrohm Application Bulletin No. 275: Potentiometric two-phase titration of anionic tensides in washing powder and liquid softener.

Potentiometric two-phase titration of anionic surfactants and soaps in powdered and liquid detergents

Reagents

c(TEGO®trant A100) = 0.004 mol/L; Dos. Drive A1

Sample

app. 200 mg of sample
80 ml dist. water
0.2 ml TEGO®add
adjust with c(HCl) = 0.5 mol/L to pH 11.5
20 ml solvent mixture MIBK / Ethanol = 1:1 (MIBK=Methylisobutylketone)

Electrodes

6.0507.130 Surfactrode Resistant; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   AnT-r11.mth              Summe of Anionic Tensides and Soaps (pH=11.5)

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                Parameters
     ─────  ─────────────  ────────────────────────  ──────────────────────────
 1          SHOW           Page              curve
 2          DET_U*         Anionic Tenside and Soaps
                           Reagent    TEGOtrantA100  Sensor     6.0507.130
                           Concentr.    0.004 mol/l  Meas. input    A1
                           Dos. drive            A1
 3          SHOW           Page            result
 4          END
---------------------------------------------------------------------------
printed: 1999-07-23 11:31:45
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

2 DET_U* Anionic Tenside and Soaps
Reagent TEGOtrantA100 Sensor 6.0507.130
Concentr. 0.004 mol/l Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	300 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	20 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	0	Signal drift	5 mV/min
Min.increment	150 µL	Equilibr.time	300 s
Titr. rate	max mL/min		

— EP Recognition —

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

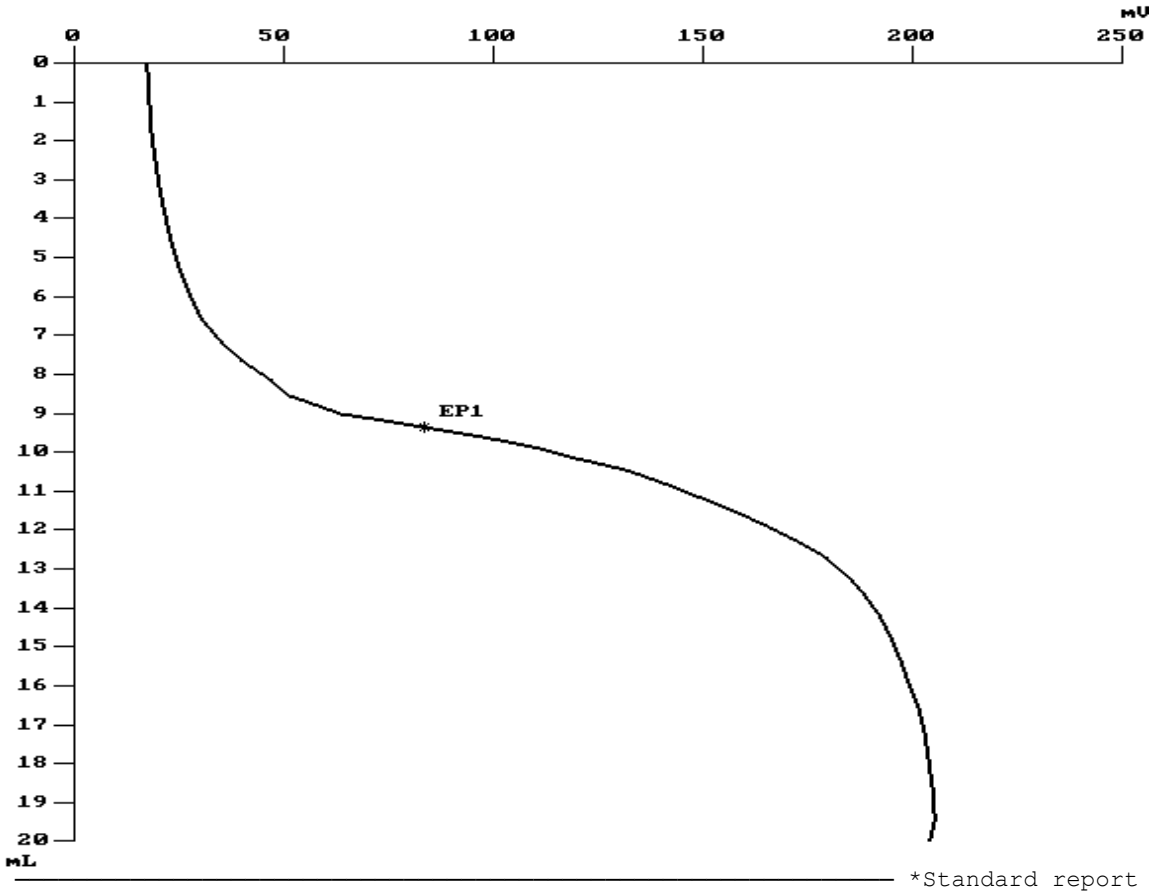
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Anionic	RS1=EP1*C*0.994*100/SS	mmol	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method AnT-r11.mth [o] Summe of Anionic Tensides and Soaps (pH=11.5)

Curve

2 DET_U*



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
AnT-r11	Tenside	Metrohm	lab. 1b	0.100	g

Remark
Anionic Tensides and Soaps

2 DET_U* Anionic Tenside and Soaps

EP1	83.5 mV	9.385 mL	Anionic	37.31 mmol

Stop condition volume

Modified data Determination time: 1999-09-09 09:42:18
Data file 99090909.002 Tenside Metrohm AnT-r11 Anionic Tensides and Soaps

printed: 1999-07-23 11:55:36

Remarks

- **Formulas**:
  Anionic = sum of anionic tensides and soaps in mmol/100g sample
  C = concentration of titrant (mol/L)
  0.994 = factor of titrant
  100 = factor for mmol/100g

- **Sample preparation**:
  The well homogenised sample is weighed into a glass beaker and dissolved in approx. 80 mL dist. water. Add 0.2 mL TEGO®add and adjust the pH value to 11.5 with *c*(NaOH) = 0.5 mol/L. After the addition of 20 mL solvent mixture, titrate with *c*(TEGO®trant A100) = 0.004 mol/L.

  Adapt the sample size in order to have a titrant consumption of at least 10 mL.

- **Titrant *c*(TEGO®trant A100) = 0.004:**
  Approx. 1.59 g 1,3-didecyl-2-methyl-imidazolium chloride are weighed in a 1000 mL gratuated flask, dissolved in distilled water and filled up to the mark. The titer determination is executed with a solution of sodium dodecylsulphate and is described below.

- **Titer determination of TEGO®trant A100 solution:**
  1.4565 ± 0.0005 g sodium dodecylsulphate (99 %) are weighed in a 1000 mL gratuated flask, dissolved in distilled water and filled up to the mark. The concentration of this solution is 0.005 mol/L.
  Add approx. 70 mL distilled water, 0.2 mL TEGO® add and 10.00 mL Na-dodecylsulphate solution in a glass beaker. Adjust the pH value of the solution with *c*(HCl) = 0.5 mol/L to 3.0, add 20 mL solvent mixture and titrate with TEGO®trant A100.

  Titer = EP1 / 10

Literature

- Metrohm Application Bulletin No. 275: Potentiometric two-phase titration of anionic tensides in washing powder and liquid softener.

Potentiometric two-phase titration of anionic surfactants in powdered and liquid detergents

Reagents

c(Hyamine) = 0.004 mol/L; Dos. Drive A1

Sample

app. 200 mg of sample
80 mL dist. water
0.2 mL TEGO® Add
adjust with *c*(HCl) = 0.5 mol/L to pH 2
20 mL solvent mixture MIBK / Ethanol =1:1(MIBK=Methylisobutylketone)

Electrodes

6.0507.140 Surfactrode Refill; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
==============================================================================

Name   AnT-f2.mth                                    Anionic Tensides (pH=2)

— Commands ————————————————————————————————————————————————————————————————————

     t/s   Command         Parameters                 Parameters
     ———   ————————        ————————————————————————   ————————————————————————
 1         SHOW            Page              curve
 2         DET_U*          Anionic Tenside
                           Reagent    HYAMINE         Sensor     6.0507.140
                           Concentr.    0.004 mol/l   Meas. input    A1
                           Dos. drive           A1
 3         SHOW            Page             result
 4         END
==============================================================================
printed: 1999-07-22 11:34:16
```

METROHM 796 Titroprocessor 01101 5.796.0010

Name AnT-f11.mth Anionic Tensides (pH=2)

— Parameters —

2 DET_U* Anionic Tenside
Reagent HYAMINE Sensor 6.0507.140
Concentr. 0.004 mol/l Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	30 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	13 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	2	Signal drift	off mV/min
Min.increment	50 µL	Equilibr.time	15 s
Titr. rate	max mL/min		

— EP Recognition —

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

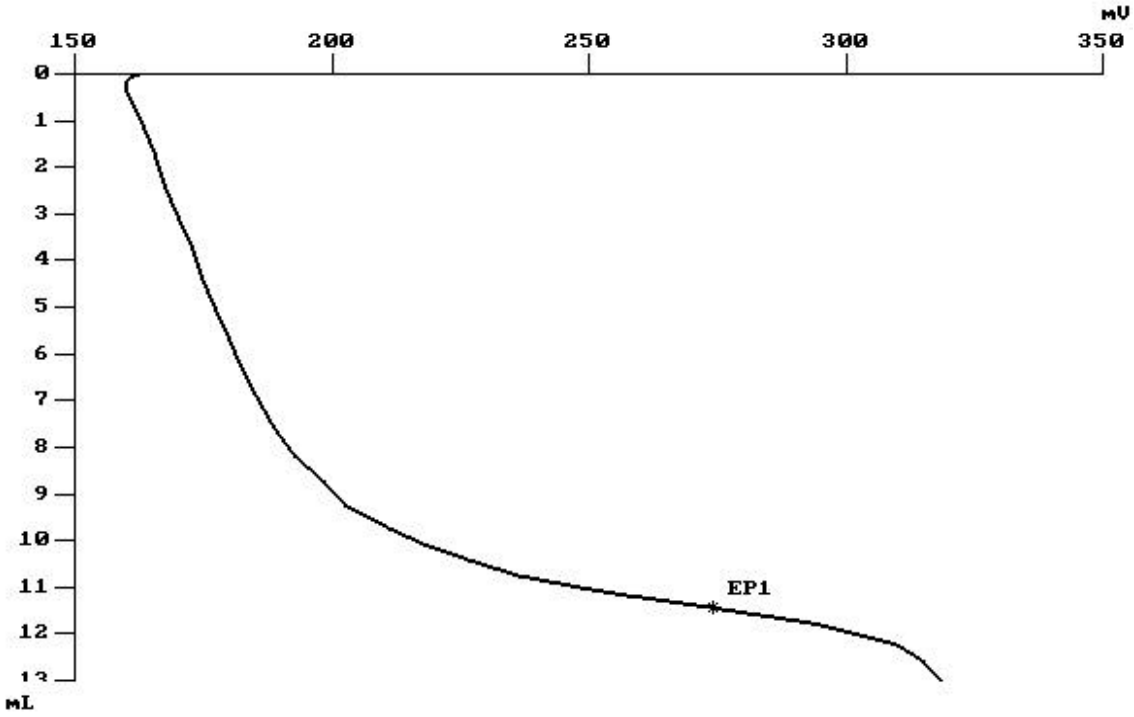
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Anionic	RS1=EP1*C*0.957*100/SS	mmol	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method AnT-f2.mth [o] Anionic Tensides (pH=2)

Curve

2 DET_U* Anionic Tenside



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
AnT-f2	Tenside	Metrohm	lab. 1b	0.130	g

Remark
Anionic Tensides

2 DET_U* Anionic Tenside

EP1	274.1 mV	11.485 mL	Anionic	33.82 mmol

Stop condition volume

Original data Determination time: 1999-09-09 11:32:13
Data file 99090911.005 Tenside Metrohm AnT-f2 Anionic Tensides

printed: 1999-07-23 11:55:36

Remarks

- **Formulas**:
  Anionic = content of anionic tensides in mmol/100g sample
  C = concentration of titrant (0.004 mol/L)
  0.957 = factor of titrant
  100 = factor for mmol/100g

- **Sample preparation**:
  The well homogenised sample is weighed into a glass beaker and dissolved in approx. 80 mL dist. water. Add 0.2 mL TEGO®add and adjust the pH value with *c*(HCl) = 0.5 mol/L to 2.0. After the addition of 20 mL solvent mixture, titrate with *c*(Hyamine 1622) = 0.004 mol/L.

  Adapt the sample size in order to have a titrant consumption of at least 10 ml.

- **Titrant *c*(Hyamine 1622)=0.004mol/L:**
  Approx. 1.80 g Hyamine 1622 are weighed in a 1000 mL gratuated flask, dissolved in distilled water and filled up to the mark. The titer determination is executed with a solution of sodium dodecylsulphate and is described below.

- **Titer determination of Hyamine 1622 solution:**
  1.4565 ± 0.0005 g sodium dodecylsulphate (99 %) are weighed in a 1000 mL gratuated flask, dissolved in distilled water and filled up to the mark. The concentration of this solution is 0.005 mol/L.
  Add approx. 70 mL distilled water, 0.2 mL TEGO® add and 10.00 mL Na-dodecylsulphate solution in a glass beaker. Adjust the pH value of the solution with *c*(HCl) = 0.5 mol/L to 2.0, add 20 mL solvent mixture and titrate with Hyamine 1622

  Titer = EP1 / 10

Literature

- Metrohm Application Bulletin No. 275: Potentiometric two-phase titration of anionic tensides in washing powder and liquid softener.

Potentiometric two-phase titration of anionic surfactants and soaps in powdered and liquid detergents

Reagents

c(Hyamine) = 0.004 mol/L; Dos. Drive A1

Sample

app. 200 mg of sample
80 mL dist. water
0.2 mL TEGO®Add
adjust with *c*(NaOH) = 0.5 mol/L to pH 11.5
20 ml solvent mixture MIBK / Ethanol = 1:1 (MIBK=Methylisobutylketone)

Electrodes

6.0507.140 Surfactrode Refill; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
==============================================================================

Name   AnT-f11.mth                  Total Anionic Tensides and Soaps (pH=11.5)

— Commands ———————————————————————————————————————————————————————————————————

     t/s   Command        Parameters                Parameters
     ————  —————————————  ————————————————————————  ————————————————————————
 1         SHOW           Page              curve
 2         DET_U*         Anionic Tenside and Soaps
                          Reagent    HYAMINE        Sensor     6.0507.140
                          Concentr.    0.004 mol/l  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END
==============================================================================
printed: 1999-07-22 11:34:16
```

METROHM 796 Titroprocessor 01101 5.796.0010

Name AnT-f11.mth Total Anionic Tensides and Soaps (pH=11.5)

Parameters

2 DET_U* Anionic Tenside and Soaps

Reagent	HYAMINE	Sensor	6.0507.140
Concentr.	0.004 mol/l	Meas. input	A1
Dos. drive	A1		

*Parameters

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	30 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	20 mL	EP#	1
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	2	Signal drift	off mV/min
Min.increment	50 µL	Equilibr.time	15 s
Titr. rate	max mL/min		

EP Recognition

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

Display

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

*Report

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

*Formula

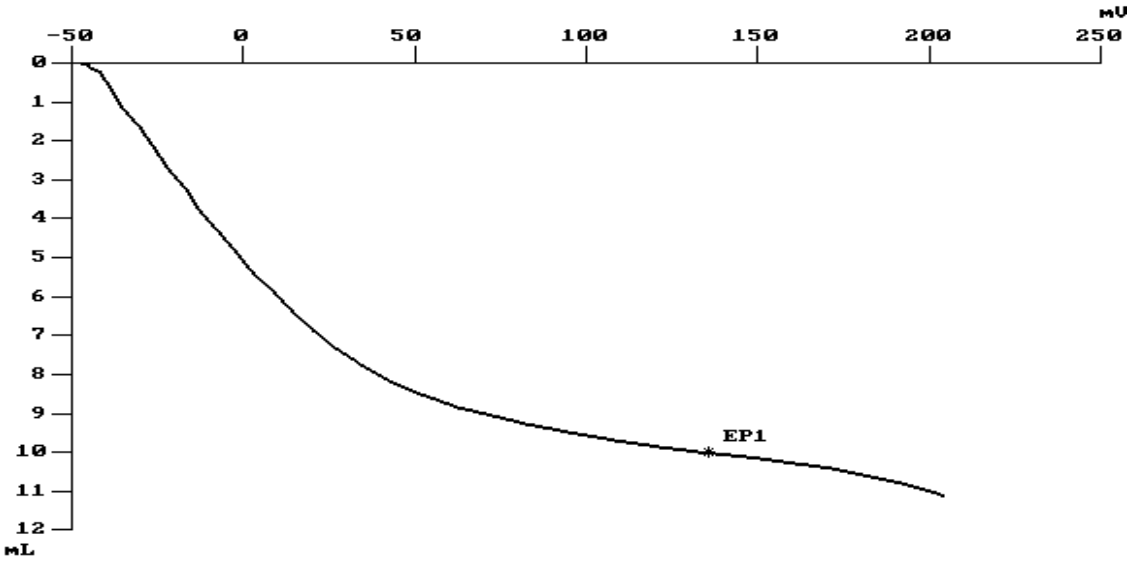
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Anionic	RS1=EP1*C*0.957*100/SS	mmol	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method AnT-f11.mth [o] Total Anionic Tensides and Soaps (pH=11.5)

Curve

2 DET_U* Anionic Tenside and Soaps



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
AnT-f11	Tenside	Metrohm	lab. 1b	0.100	g

Remark
Anionic Tensides and Soaps

2 DET_U* Anionic Tenside and Soaps

EP1	135.8 mV	10.034 mL	Anionic	38.41 mmol

Stop condition #EP reached

Original data Determination time: 1999-09-09 11:53:50
Data file 99090911.006 Tenside Metrohm AnT-f11 Anionic Tensides and Soaps

printed: 1999-07-23 11:55:36

Remarks

- **Formulas**:
  Anionic = sum of anionic tensides and soaps in mmol/100g sample
  C = concentration of titrant (0.004 mol/L)
  0.957 = factor of titrant
  100 = factor for mmol/100g

- **Sample preparation**:
  The well homogenised sample is weighed into a glass beaker and dissolved in approx. 80 mL dist. water. Add 0.2 mL TEGO®add and adjust the pH value with *c*(NaOH) = 0.5 mol/L to 11.5. After the addition of 20 mL solvent mixture, titrate with *c*(Hyamine 1622) = 0.004 mol/L.

  Adapt the sample size in order to have a titrant consumption of at least 10 mL.

- **Titrant *c*(Hyamine 1622)=0.004mol/L:**
  Approx. 1.80 g Hyamine 1622 are weighed in a 1000 mL gratuated flask, dissolved in distilled water and filled up to the mark. The titer determination is executed with a solution of sodium dodecylsulphate and is described below.

- **Titer determination of Hyamine 1622 solution:**
  1.4565 ± 0.0005 g sodium dodecylsulphate (99 %) are weighed in a 1000 mL gratuated flask, dissolved in distilled water and filled up to the mark. The concentration of this solution is 0.005 mol/L.
  Add approx. 70 mL distilled water, 0.2 mL TEGO® add and 10.00 mL Na-dodecylsulphate solution in a glass beaker. Adjust the pH value of the solution with *c*(HCl) = 0.5 mol/L to 2.0, add 20 mL solvent mixture and titrate with Hyamine 1622

  Titer = EP1 / 10

Literature

- Metrohm Application Bulletin No. 275: Potentiometric two-phase titration of anionic tensides in washing powder and liquid softener.

Metals (complexometric titration)

Reagents

c(EDTA) = 0.1 mol/L (titrating agent); Dos. drive A1
Buffer pH = 10; Dos. drive A2
c($Cu(NH_4)_2$-EDTA) = 0.1 mol/L; Dos. drive A3

Sample

2 mL *c*($ZnSO_4$) ≅ 0.1 mol/L
50 mL dist. water

Electrodes

6.0502.140 Ionselective Cu - electrode; input A1
6.0726.100 Ag/AgCl double junction reference electrode (KNO_3 sat.)

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Method  Metals.mth [o]        Complexometric Titration of Metals with Cu++ ISE

─────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1         ADD_A          Reagent    Buffer pH 10    Dos. drive     A2
                          Concentr.                  Dos. rate     max mL/min
                          Volume            5.0 mL   Fill. rate    max mL/min
 2      45 ADD_A          Reagent    Cu(NH4)2-EDTA   Dos. drive     A3
                          Concentr.      0.1 mol/L   Dos. rate     max mL/min
                          Volume              1 mL   Fill. rate    max mL/min
 3         DET_U*         Determination of Metals with Cu++ ISE
                          Reagent    Na2EDTA         Sensor     6.0502.140
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive            A1
 4         END

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printed: 1998-07-10 14:07:30
```

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METROHM 796 Titroprocessor   01101  5.796.0010
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Method  Metals.mth [o]        Complexometric Titration of Metals with Cu++ ISE

──────────────────────────────────────────────────────────────────── Parameters
#  3       DET_U*   Determination of Metals with Cu++ ISE
                    Reagent    Na2EDTA        Sensor     6.0502.140
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ──────────────────────────────────────────────────────────

      Start conditions
        Volume           off          Meas. val        off mV
                                      Slope            off mV/mL
        Dos. rate        max mL/min   Pause              0 s

      Titration conditions
        Adjustment      slow          Time recording   on
        Temperature     25.0 °C

      Stop conditions
        Volume      absolute          Meas. val        off mV
        Size               5 mL       EP#                9
        Fill. rate       max mL/min   Stop time        off s
                                      Mpt. overflow     on

      — EP Recognition ───────────────────────────────────────────────────────

      Endpoints                 all       min. EPC       5.0
      general lower limit       min mV    upp.           max mV
      pK/HNP Evaluation         off

      — Display ──────────────────────────────────────────────────────────────

      Curve       Y_Axis       X_Axis
      ──────────────────────────────────
      Quantity    M. value         Volume
      Scale           auto           auto
        begin              mV             mL
        end                mV             mL
      Division                        1 mL/cm
      Grid               off

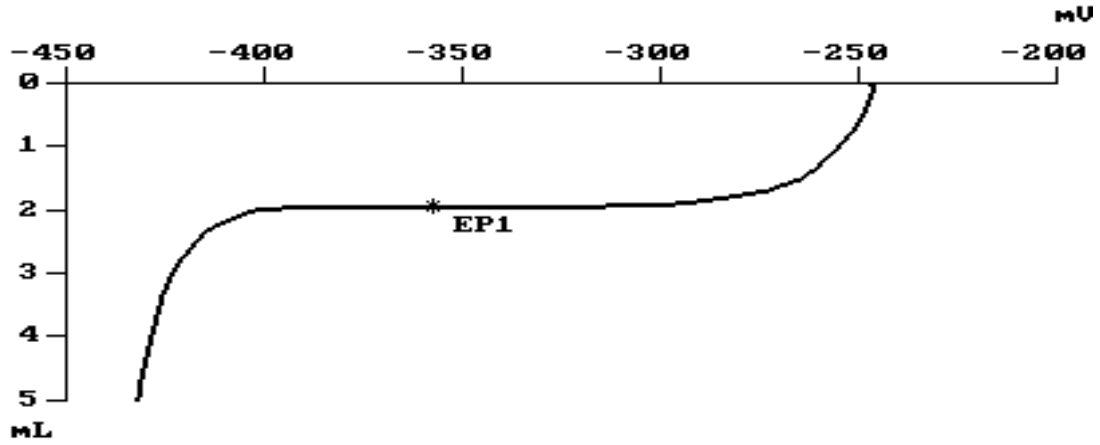
      — *Report ──────────────────────────────────────────────────────────────

                      Type      Specification  print  send  FF
                      ──────    ─────────────  ─────  ────  ──
      Reports for     V_Curve   M. value       yes    no    no
      titration /     *Stand                  yes    no    no
      measuring mode                          no     no    no
                                              no     no    no
                                              no     no    no
                                              no     no    no


      — *Formula ─────────────────────────────────────────────────────────────

      #  Comment      Formula (R$$, C##, X$$, EP# ..)      Unit    Dec  Type
      ── ──────────── ──────────────────────────────────── ─────── ──── ──────
       1 Content(Zn)  R1=EP1*C*65.38/SS                    g/L     2    stat.
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════════
──────────────────────────────────────────────────────────────────────── Curve
#  3       DET_U*   Determination of Metals with Cu++ ISE
```




```
──────────────────────────────────────────────────────────────── *Standard report

  Method    Container     Lot           Date          Size      Unit
  Metals    Zn 15-2               4812 09.07.97             2  ml
  Remark

──────────────────────────────────────────────────────────────────────────────
#  3       DET_U*   Determination of Metals with Cu++ ISE

  EP1          −357.4 mV     1.979 mL        Content(Zn)        6.47 g/L

  Stop condition                volume

Original data                           Determination time: 1998-07-10 14:12:24
Data file Metals.005      Zn 15-2 4812 09.07.97
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printed: 1998-07-10 14:13:27
```

Remarks see next page

Remarks

- **Formula**:
  Content(Zn) = content of metal (zinc) in g/L
  C = concentration of titrating agent (mol/L)
  65.38 = molecular mass of zinc (metal) (g/mol)

- **Buffer pH = 10**:
  Dissolve 54 g NH_4Cl and 350 mL $w(NH_3)$ = 0.25 (25%) in dist. water and fill up to 1 litre.

- **Buffer pH = 4.7**:
  Dissolve 123 g Na-acetate and 86 mL acetic acid in dist. water and fill up to 1 litre.

- The following metals can be determined according to this method:

		buffer solution	molar mass
Water, total hardness	(Ca + Mg)	pH = 10	64.40
Barium	Ba	pH = 10	137.36
Cadmium	Cd	pH = 10	112.41
Cobalt	Co	pH = 10	58.94
Nickel	Ni	pH = 10	58.71
Zinc	Zn	pH = 10	65.38
Lead	Pb	pH = 4.7	207.21

- If you prefer the addition of Buffer and $Cu(NH_4)_2$-EDTA solutions manually, you have to delete the Commands ADD_A for automatic addition first.

- The surface of the Cu ISE must occasionlly be polished with aluminium oxide (6.2802.000 Polishing kit).

- Highly acidic or highly alkaline sample solutions must first be neutralised or more buffer solution added (check pH value).

Literature

- Metrohm Application Bulletin No. 101: Complexometric titrations with the Cu ISE

Aluminium

Reagents

c(HCl) = 1 mol/L; Dos. Drive A1
c(NaOH) = 1 mol/L: Dos.Drive A2
w(KF) = 0.10 (10 %); Dos.Drive A3

Sample

a sample with 40...50 mg Al content
in 50 mL dist. water
add 5 mL *w*(sodium gluconat) = 0.25 (25%)

Electrodes

6.0232.100 combined pH glass electrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   Alum.mth                                                  Aluminium

─────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1         SET_PH*        pH ajustment
                          Reagent    NaOH            Sensor     6.0232.100
                          Concentr.        1 mol/L   Meas. input    A1
                          Dos. drive            A2
 2         DET_PH*        surplus of OH
                          Reagent    HCl             Sensor     6.0232.100
                          Concentr.        1 mol/L   Meas. input    A1
                          Dos. drive            A1
 3         ADD_A          Reagent    KF              Dos. drive     A3
                          Concentr.       10 %       Dos. rate     max mL/min
                          Volume             5 mL    Fill. rate    max mL/min
 4     180 WAIT
 5         DET_PH*        Determination of Aluminium
                          Reagent    HCl             Sensor     6.0232.100
                          Concentr.        1 mol/L   Meas. input    A1
                          Dos. drive            A1
 6         END

---------------------------------------------------------------------------
printed: 1999-07-27 11:18:54
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
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— Parameters ——————————————————————————————————————————————————————————

#  1      SET_pH*   pH ajustment
                    Reagent    NaOH          Sensor     6.0232.100
                    Concentr.        1 mol/L  Meas. input    A1
                    Dos. drive            A2

      — *Parameters ———————————————————————————————————————————————————

      Start conditions
        Volume           off          Pause 1            0 s
                                      Pause 2            0 s
                                      Extract. time      0 s

      Titration conditions
        Direction       auto          Temperature     25.0 ˚C
        End-point  pH   11.5          Time recording    on
        Adjustment    medium          Derivation       off
        Mpt. interval      5 s

      Stop conditions
        Volume      absolute          Stop time        off s
        Size           99.99 mL       Mpt. overflow    off
        Fill. rate       max mL/min

      — Display ———————————————————————————————————————————————————————

      Curve       Y_Axis       X_Axis
      ──────────────────────────────────
      Quantity    M. value          time
      Scale           auto          auto
        begin   pH                      s
        end     pH                      s
      Division                       30 s/cm
      Grid               off

— Parameters ——————————————————————————————————————————————————————————

#  2      DET_pH*   surplus of OH
                    Reagent    HCl           Sensor     6.0232.100
                    Concentr.        1 mol/L  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ———————————————————————————————————————————————————

      Start conditions
        Volume           off          Meas.val. pH     off
                                      Slope            off pH/mL
        Dos. rate        max mL/min   Pause              0 s

      Titration conditions
        Adjustment    medium          Time recording   on
        Temperature     25.0 ˚C

      Stop conditions
        Volume      absolute          Meas.val. pH     off
        Size           99.99 mL       EP#                1
        Fill. rate       max mL/min   Stop time        off s
                                      Mpt. overflow     on

      — EP Recognition ————————————————————————————————————————————————

      Equivalence points        all       min. EPC       5.0
      Gen. lower limit   pH     min       upp. pH        max
      pK/HNP Evaluation         off
```

```
— Display ————————————————————————————————————————————————

Curve       Y_Axis       X_Axis
————————————————————————————————————
Quantity    M. value         Volume
Scale           auto           auto
  begin   pH                       mL
  end     pH                       mL
Division                       1 mL/cm
Grid               off

— *Report ————————————————————————————————————————————————

                 Type      Specification  print  send  FF
                 ————————  ———————————————  —————  ————  ————
Reports for      V_Curve   M. value        yes    no    no
titration /                               no     no    no
measuring mode                            no     no    no
                                          no     no    no
                                          no     no    no
                                          no     no    no

— *Formula ———————————————————————————————————————————————

#  Comment      Formula (R$$, C##, X$$, EP# ..)      Unit    Dec  Type
—— ———————————  ———————————————————————————————————  ——————  ———  ——————
 1 excess       X01=CV-EP1                           mL      3    normal

— Parameters ———————————————————————————————————————————————

#  5      DET_pH*   Determination of Aluminium
                    Reagent    HCl            Sensor     6.0232.100
                    Concentr.        1 mol/L  Meas. input    A1
                    Dos. drive            A1

— *Parameters ————————————————————————————————————————————

Start conditions
  Volume           off          Meas.val. pH     off
                                Slope            off pH/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    medium          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas.val. pH     off
  Size               6 mL       EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on

— EP Recognition ——————————————————————————————————————————

Equivalence points        all       min. EPC       5.0
Gen. lower limit   pH     min       upp. pH        max
pK/HNP Evaluation         off

— Display ————————————————————————————————————————————————

Curve       Y_Axis       X_Axis
————————————————————————————————————
Quantity    M. value         Volume
Scale           auto           auto
  begin   pH                       mL
  end     pH                       mL
Division                       1 mL/cm
Grid               off
```

— *Report

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Aluminium	R1=(EP1+X01)*C*8.994*100/1000/SS	%	3	normal

— Determination report

	initial	print	send	FF	final	print	send	FF
Determination reports		no	no	no	Standard	yes	no	no
		no	no	no		no	no	no
		no	no	no		no	no	no
		no	no	no		no	no	no

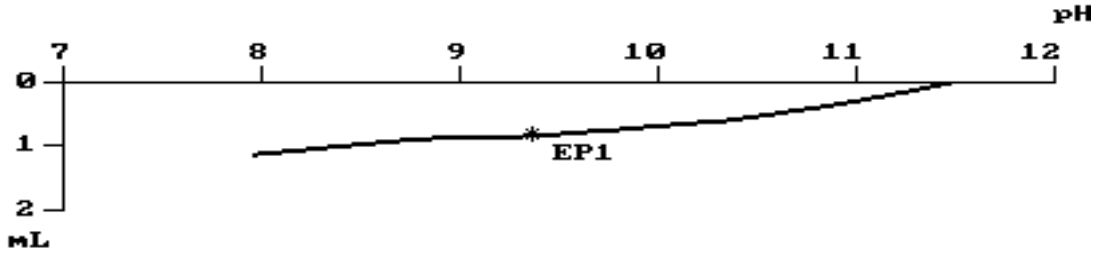
printed: 1999-07-27 11:19:15

METROHM 796 Titroprocessor 01101 5.796.0010

Method Alum.mth [o]

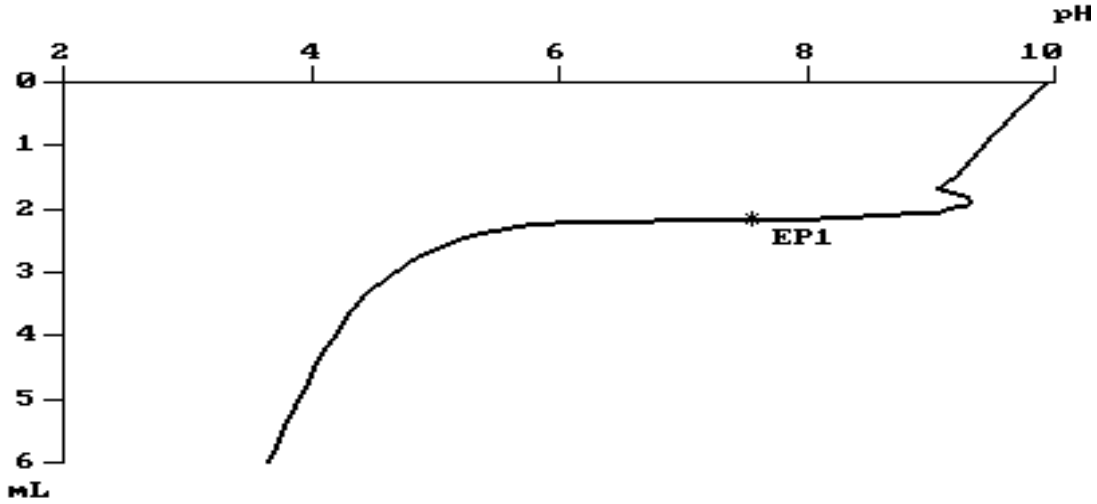
Curve

2 DET_pH* surplus of OH



Curve

5 DET_pH* Determination of Aluminium



Final reports

Standard report

Run number : 003

Method	Ident1	Ident2	Ident3	Size	Unit
Alum				0.328	g
Remark					

1 SET_PH* pH ajustment

EP	pH 11.502	3.354 mL	
Dosing time		296.9 s	

2 DET_PH* surpuls

EP1	pH 9.367	0.855 mL	

5 DET_PH* Determination of Aluminium

EP1	pH 7.563	2.183 mL	Aluminium	6.856 %

Original data Determination time: 1999-07-27 10:57:13
Data file 99072710.003 Alum

printed: 1999-07-27 11:10:48

Remarks

- **Determination reaction**:

$$Al(OH)_3 + 6\ KF \longrightarrow K_3AlF_6 + 3\ OH^-$$

- **Formulas**:

excess	= excess of the first DET titration
Aluminium	= content of Al in %
C	= concentration of titrant (1 mol/L)
8.994	= $^1/_3$ molecular mass (26.982 / 3)
100	= factor for %
1000	= conversion factor mL ⇒ L

Literature

- Metrohm Application Bulletin No. 24: Potentiometric determination of aluminium

Chromium in galvanic bath

Reagents

$c(Na_2S_2O_3)$ = 0.1 mol/L; Dos. Drive A1

Sample

0.20 mL chromium bath
in 50 mL dist. water
add 0.2 g $(NH_4)HF_2$,
10 mL c(HCl) = 0.36 (36 %),
1 g KI

Electrodes

6.0431.100 Pt Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Name   Chromium.mth                                  Chromium in galvanic bath

─────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                Parameters
     ────  ─────────────  ──────────────────────    ──────────────────────────
 1         SHOW           Page              curve
 2         DET_U*         Chromium determination
                          Reagent    Na2S2O3        Sensor     6.0431.100
                          Concentr.      0.1 mol/L  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END

---------------------------------------------------------------------------
printed: 1999-07-26 14:24:55
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method Chromium.mth [o]

Parameters

```
#  2       DET_U*   Chromium determination
                    Reagent    Na2S2O3        Sensor     6.0431.100
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    medium          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size          99.99 mL        EP#                1
  Fill. rate      max mL/min    Stop time        off s
                                Mpt. overflow     on
```

— EP Recognition

```
Equivalence points        all       min. EPC       5.0
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin              mV             mL
  end                mV             mL
Division                        1 mL/cm
Grid               off
```

— *Report

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

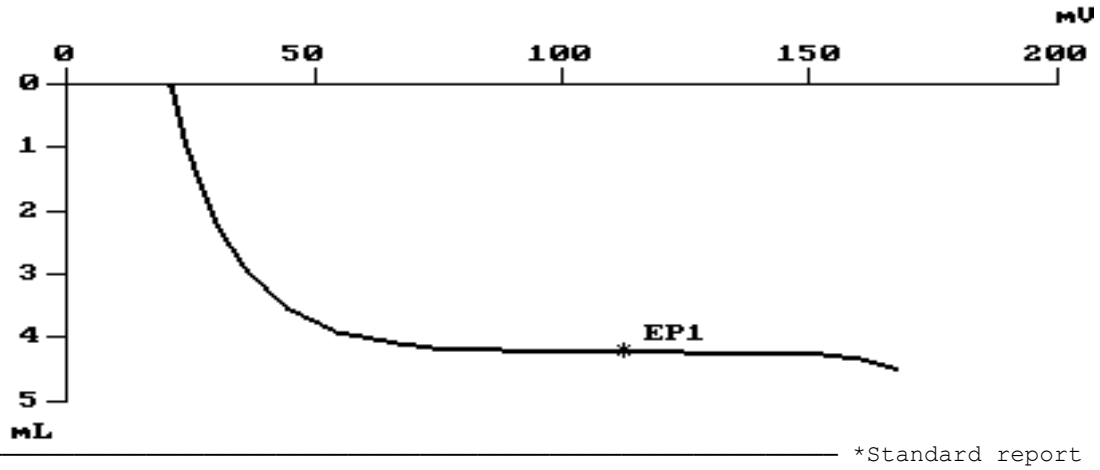
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Cr(VI)	R1=EP1*1.7332/SS	g/L	3	normal

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method Chromium.mth [o]

Curve

```
#  2       DET_U*   Chromium determination
```



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Chromium				0.2	mL
Remark					

```
#  2       DET_U*   Chromium determination

  EP1          112.6 mV     4.247 mL        Cr(VI)           36.804 g/L

  Stop condition            #EP reached

Original data                           Determination time: 1999-07-26 14:19:10
Data file 99072614.006       Chromium
================================================================================
printed: 1999-07-26 14:22:49
```

Remarks

- **Formula**:
  Cr(VI) = concentration of Cr(VI) in g/L
  1.7332 = factor for g/L (51.996 * 0.1 / 3)

Literature

- Metrohm Application Note T20 : Cr(VI) and Cr(III) in chromium bath.

Photometric determination of nickel

Reagents

c(EDTA)= 0.1 mol/L; Dos. drive A1
dist. water; Dos. drive A2
buffer pH 10; Dos. drive A3

Sample

1 mL sample (cointaining max. 15 mg Ni)
1-2 mL Murexide indicator

Electrodes

6.5501.004 Spectrode, wavelength 525 nm; Input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Name   Nickel.mth                                      Nickel determination

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ─────  ─────────────  ─────────────────────────  ──────────────────────────
 1          ADD_A          Reagent    buffer pH10     Dos. drive     A3
                           Concentr.                  Dos. rate     max mL/min
                           Volume           10.0 mL   Fill. rate    max mL/min
 2          STIR_I         Meas.interface          A  State                 on
 3          ADD_A          Reagent    dist. water     Dos. drive     A2
                           Concentr.                  Dos. rate     max mL/min
                           Volume           50.0 mL   Fill. rate    max mL/min
 4          MET_U*         Ni-determination
                           Reagent    EDTA            Sensor     6.5501.004
                           Concentr.      0.1 mol/L   Meas. input    A1
                           Dos. drive             A1
 5          STIR_I         Meas.interface          A  State                off
 6          END

---------------------------------------------------------------------------
printed: 1999-08-05 09:21:58
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Method  Nickel.mth [o]

──────────────────────────────────────────────────────────────────── Parameters
#  4       MET_U*   Ni-determination
                    Reagent    EDTA           Sensor         6.5501.004
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ──────────────────────────────────────────────────────

      Start conditions
        Volume      absolute          Meas. val        off mV
        Size             0.9 mL       Slope            off mV/mL
        Dos. rate        max mL/min   Pause             10 s

      Titration conditions
        Adjustment    custom          Time recording   on
        Temperature     25.0 °C

      Stop conditions
        Volume      absolute          Meas. val        off mV
        Size             2.0 mL       EP#              off
        Fill. rate       max mL/min   Stop time        off s
                                      Mpt. overflow     on

      Custom adjustments
        Volume steps   0.010 mL       Signal drift       3 mV/min
        Titr. rate       max mL/min   Equilibr.time   auto s

      — EP Recognition ───────────────────────────────────────────────────

      Equivalence points        all       min. EPC        10 mV
      general lower limit       min mV    upp.           max mV
      pK/HNP Evaluation         off

      — Display ──────────────────────────────────────────────────────────

      Curve       Y_Axis       X_Axis
      ──────────────────────────────
      Quantity    M. value         Volume
      Scale            auto           auto
        begin               mV             mL
        end                 mV             mL
      Division                          1 mL/cm
      Grid                off

    — *Report ────────────────────────────────────────────────────────────

                      Type      Specification  print  send  FF
                      ──────────  ─────────────  ─────  ────  ──
      Reports for     V_Curve   M. value       yes    no    no
      titration /     *ShrtRes                yes    no    no
      measuring mode                          no     no    no
                                              no     no    no
                                              no     no    no
                                              no     no    no

      — *Formula ─────────────────────────────────────────────────────────

      #  Comment      Formula (R$$, C##, X$$, EP# ..)      Unit    Dec  Type
      ──  ──────────  ──────────────────────────────────  ──────  ───  ──────
       1  Nickel       R01=EP1*5.869/SS                    g/L     3    normal
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
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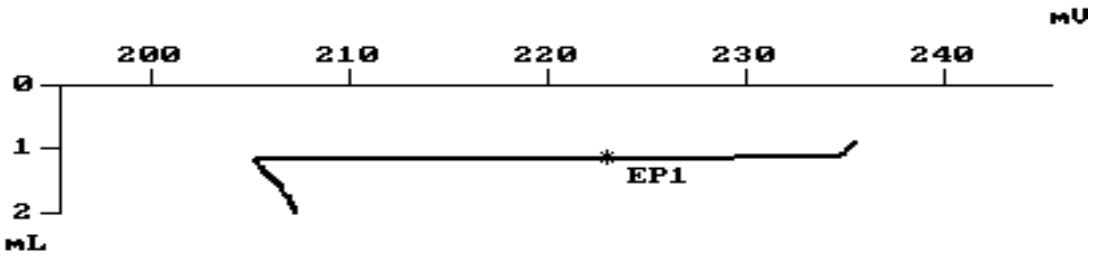
──────────────────────────────────────────────────────────────────────── Curve
#  4       MET_U*   Ni-determination
```




```
──────────────────────────────────────────────────────────────── Short results
#  4       MET_U*   Ni-determination

  Nickel            6.767 g/L

  Stop condition               volume

Original data                          Determination time: 1998-06-04 12:17:50
Data file 98060412.004     sample 1  Nickel Murexide
═══════════════════════════════════════════════════════════════════════════
printed: 1998-06-04 13:27:35
```

Remarks

Formulas
Nickel = amount of nickel in g/L
5.869 = equivalent of nickel in g/L (58.69 * 0.1)

- **Buffer pH 10**
  Dissolv 54 g NH_4Cl and 300 mL $w(NH_3)$ = 0.25 in 1 L dist. water

- **Indicator**
  Pulverize 1 g Murexide and 100 g NaCl in a mortar. Weigh about 1g mixture in a 100 mL volumetric flask and fill up with dist. water to the mark.

General remarks
If the concentration of the sample is approximately known, apply a fixed start volume and small volume steps for titration.

If you prefer the addition of buffer pH 10 and dist. water manually, you have to delete the command Add A (Line 1) and command Add A (Line 3) for automatic addition first.

Literature

- Metrohm Ti Application Note. T-51

Chloride in acidic copper plating bath

Reagents

$c(AgNO_3)$ = 0.01 mol/L; Dos. Drive A1

Sample

20 mL of sample
add 2 mL $c(HNO_3)$ = 2 mol/L,
50 mL dist. water

Electrodes

6.0430.100 Ag Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Name   CubathCl.mth                    Chloride in acidic copper plating bath

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                Parameters
     ────  ─────────────  ──────────────────────    ──────────────────────
 1         SHOW           Page              curve
 2         MET_U*         Chloride in acidic copper plating bath
                          Reagent    AgNO3          Sensor     6.0430.100
                          Concentr.     0.01 mol/L  Meas. input    A2
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END
---------------------------------------------------------------------------
printed: 1999-08-11 07:53:25
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method CubathCl.mth Chloride in acidic copper plating bath

— Parameters —

```
#  2       MET_U*   Chloride in acidic copper plating bath
                    Reagent    AgNO3          Sensor     6.0430.100
                    Concentr.     0.01 mol/L  Meas. input    A2
                    Dos. drive            A1
```

— *Parameters —

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size               2 mL       EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Volume steps    0.10 mL       Signal drift     off mV/min
  Titr. rate       max mL/min   Equilibr.time     10 s
```

— EP Recognition —

```
Equivalence points        all       min. EPC      30.0 mV
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Chloride	RS1=EP1*C*0.992*35.53*1000/SS	mg/L	2	normal

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method CubathCl.mth [o] Chloride in acidic copper plating bath

Curve

```
#  2       MET_U*   Chloride in acidic copper plating bath
```

*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
CubathCl	Galvanic			20	ml

Remark
Chloride in acidic copper plating bath

```
#  2       MET_U*   Chloride in acidic copper plating bath

  EP1           61.4 mV     0.982 mL        Chloride          17.30 mg/L

  Stop condition                volume

Original data                          Determination time: 1999-07-29 09:20:46
Data file 99072909.002     Galvanic  CubathCl Chloride in acidic copper platin
```

printed: 1999-07-29 09:24:41

Remarks

- **Formulas**:
  Chloride = concentration of chloride in mg/L
  C = concentration of titrant in mol/L
  0.992 = titer of titrant
  35.53 = molecular mass of chloride
  1000 = conversion factor of g ⇒ mg

Literature

- Metrohm Application Note [T-5]: Potentiometric Titration Chloride in acidic copper plating bath.

Phosphorous in fertilizer

Reagents

c (NaOH) = 1.0 mol/L; Dos. Drive A1
Sodium oxalate, saturated; Dos. Drive A 2

Sample

5 mL liquid fertilizer
add 5 mL *c*(HCl) = 1 mol/L,
40 mL dist. water

Electrodes

6.0232.100 combined pH glass elektrode ; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
==============================================================================

Name   P2O5.mth                                  Phosphorous in Fertilizer
────────────────────────────────────────────────────────────────── Commands

     t/s    Command        Parameters                 Parameters
     ─────  ─────────────  ────────────────────────   ────────────────────────
 1          DET_PH*        1st step H3PO4 and HCl
                           Reagent    NaOH            Sensor     6.0232.100
                           Concentr.      1.0 mol/L   Meas. input    A1
                           Dos. drive            A1
 2          ADD_A          Reagent    Na-Oxalate      Dos. drive     A2
                           Concentr.          sat.    Dos. rate     max mL/min
                           Volume            15 mL    Fill. rate    max mL/min
 3          DET_PH*        2nd step H3PO4
                           Reagent    NaOH            Sensor     6.0232.100
                           Concentr.      1.0 mol/L   Meas. input    A1
                           Dos. drive            A1
 4          END

==============================================================================
printed: 1999-07-22 15:41:57
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================
Method  P2O5.mth
___________________________________________________________ Parameters
#  1      DET_pH*   1st step H3PO4 and HCl
                    Reagent    NaOH           Sensor     6.0232.100
                    Concentr.      1.0 mol/L  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ————————————————————————————————————————————

      Start conditions
        Volume           off          Meas.val. pH     off
                                      Slope            off pH/mL
        Dos. rate        max mL/min   Pause              0 s

      Titration conditions
        Adjustment    medium          Time recording   on
        Temperature     25.0 °C

      Stop conditions
        Volume      absolute          Meas.val. pH     off
        Size           99.99 mL       EP#                1
        Fill. rate       max mL/min   Stop time        off s
                                      Mpt. overflow     on

      — EP Recognition —————————————————————————————————————————

      Equivalence points        all       min. EPC       5.0
      Gen. lower limit   pH     min       upp. pH        max
      pK/HNP Evaluation         off

      — *Formula ———————————————————————————————————————————————

      #  Comment      Formula (R$$, C##, X$$, EP# ..)     Unit    Dec  Type
      —  ———————————  ——————————————————————————————————  ——————  ———  ——————
       1 Excess       X01=CV-EP1                          mL      4    normal
___________________________________________________________ Parameters
#  3      DET_pH*   2nd step H3PO4
                    Reagent    NaOH           Sensor     6.0232.100
                    Concentr.      1.0 mol/L  Meas. input    A1
                    Dos. drive            A1

      — *Parameters ————————————————————————————————————————————

      Start conditions
        Volume           off          Meas.val. pH     off
                                      Slope            off pH/mL
        Dos. rate        max mL/min   Pause             30 s

      Titration conditions
        Adjustment    medium          Time recording   on
        Temperature     25.0 °C

      Stop conditions
        Volume      absolute          Meas.val. pH     off
        Size           99.99 mL       EP#                1
        Fill. rate       max mL/min   Stop time        off s
                                      Mpt. overflow     on

      — EP Recognition —————————————————————————————————————————

      Equivalence points     window       min. EPC       5.0
      Gen. lower limit   pH     min       upp. pH        max
      pK/HNP Evaluation         off

      Windows                                 Fixendpoints
      EP# from ... to   [pH]   EPC   []       F#  M.value [pH]
      ————————————————————————————————————    —————————————————
      1         7        9       5.0          1       off
      2       off      off       5.0          2       off
```

— Display ——

Curve	Y_Axis	X_Axis	
Quantity	M. value	Volume	
Scale	auto	auto	
begin	pH		mL
end	pH		mL
Division		1	mL/cm
Grid	off		

— *Report ———————————————————————————————————————

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula ———————————————————————————————————————

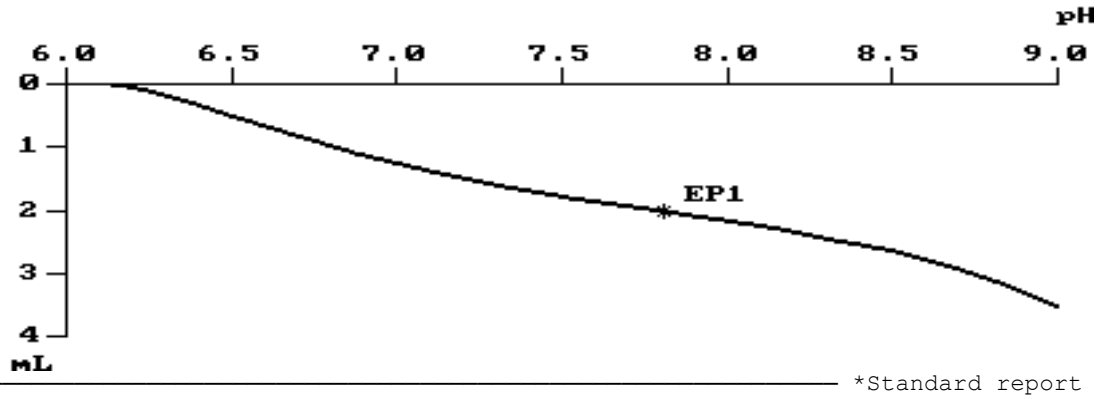
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	P2O5	R1=(X01+EP1)*C*70.97/SS	g/L	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method P2O5.mth [o]

Curve

3 DET_pH* 2nd step H3PO4



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
P2O5					5 mL
Remark					

3 DET_PH* 2nd step H3PO3

EP1	pH	7.810	2.051 mL	P2O5	34.14 g/L

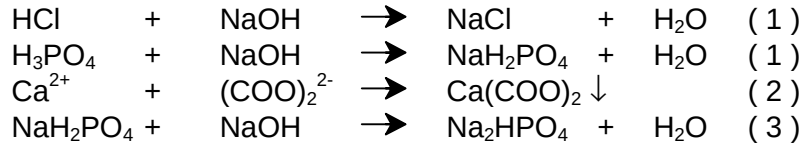
Stop condition #EP reached

Modified data Determination time: 1999-07-22 15:18:25
Data file 99072215.004 P2O5

printed: 1999-07-22 15:39:40

Remarks

- **Determination reaction**:



- **Formulas**:
  P2O5 = content of P_2O_5 in g/L
  Excess = excess of titrant for the first titration
  C = concentration of titrant
  70.97 = equivalent weight of P_2O_5 in g/mol

Literature

- Metrohm Application Bulletin No. 240: Fully automatic determination of the phosphorous content (P2O5) in fertilizers.

Phosphate

Reagents

c (NaOH) = 0.1 mol/L; Dos. Drive A1
c ($La(NO_3)_3$= 0.1 mol/L, pH = 4.2; Dos. Drive A2

Sample

5 mL *c* (NaH_2PO_4) ≅ 0.1 mol/L
add 40 mL dist. water,
adjust the pH value to 4.2 with dilute NaOH or H_2SO_4

Electrodes

6.0232.100 combined pH glass electrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Name   Phosphat.mth                                                Phosphate

──────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1         ADD_A          Reagent    La(NO3)3        Dos. drive     A2
                          Concentr.      0.1 mol/L   Dos. rate     max mL/min
                          Volume            10 mL    Fill. rate    max mL/min
 2         SET_PH*        Determination of Phosphate
                          Reagent    NaOH            Sensor     6.0232.100
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive           A1
 3         END

---------------------------------------------------------------------------
printed: 1999-07-26 09:31:55
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Phosphat.mth [o]

Parameters

```
#  2      SET_pH*   Determination of Phosphate
                    Reagent    NaOH          Sensor     6.0232.100
                    Concentr.      0.1 mol/L  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters —

```
Start conditions
  Volume           off          Pause 1            0 s
                                Pause 2            0 s
                                Extract. time      0 s

Titration conditions
  Direction       auto          Temperature     25.0 °C
  End-point  pH    4.2          Time recording    on
  Adjustment    custom          Derivation        on
  Mpt. interval      5 s

Stop conditions
  Volume      absolute          Stop time        off s
  Size           99.99 mL       Mpt. overflow    off
  Fill. rate      max mL/min

Custom adjustments
  Dynamics  pH    1.00
  Min. rate      25.00 µL/min   Stop crit.     drift
  Max. rate      10.00 mL/min   Stop drift        20 µL/min
```

— Display —

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin   pH                       mL
  end     pH                       mL
Division                       1 mL/cm
Grid               off
```

— *Report —

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

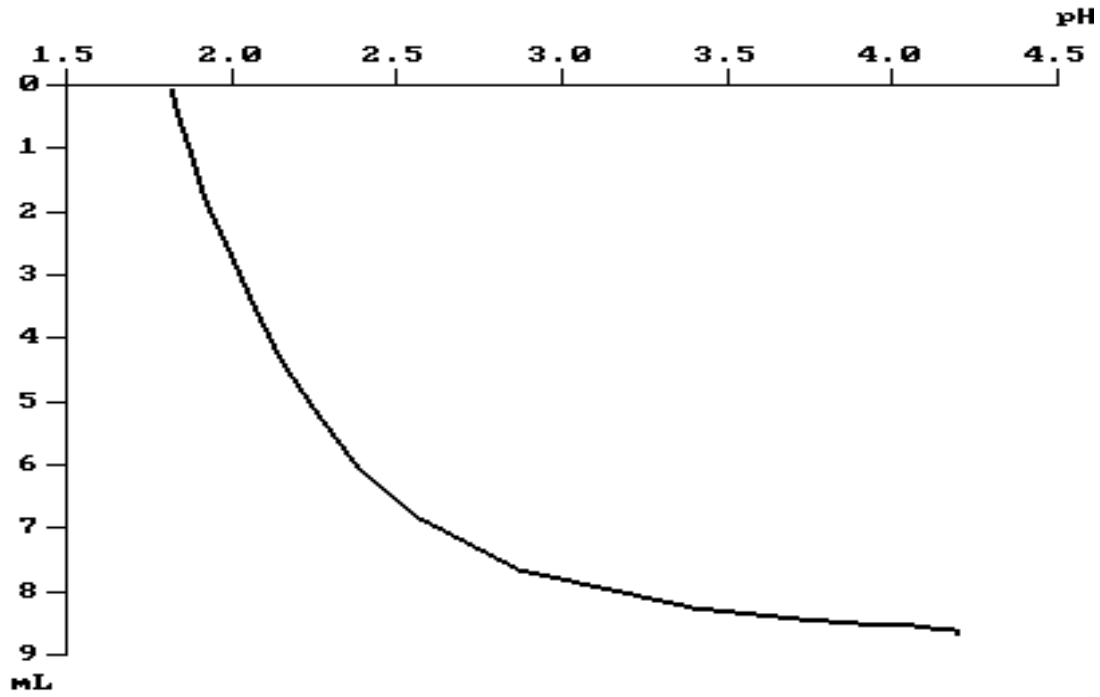
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	P	R1=EP1*0.1*1.5487/SS	%	2	normal
2	P2O5	R2=EP1*0.1*3.5486/SS	%	2	normal
3	PO4	R3=EP1*0.1*4.7486/SS	%	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method Phosphat.mth [o]

Curve

2 SET_pH* Determination of Phosphate



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Phosphat				5	mL
Remark					

2 SET_PH* Determination of Phosphate

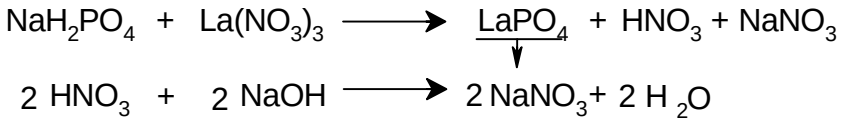
EP	pH	4.200	8.668 mL	P	0.27 %
Dosing time			170.6 s	P2O5	0.62 %
				PO4	0.82 %
Stop condition			stop drift		

Original data Determination time: 1999-07-26 09:22:21
Data file 99072609.004 Phosphat

printed: 1999-07-26 09:25:35

Remarks

Determination reaction:



- **Formulas**:
  P = content of P in %
  P_2O_5 = content of P_2O_5 in %
  PO_4 = content of PO_4 in %
  0.1 = factor for %
  1.5487 = conversion factor for P
  3.5486 = conversion factor for P_2O_5
  4.7486 = conversion factor for PO_4

- **Sample preparation:**
  Adjust the pH of your sample aliquot to 4.2 with either NaOH or H_2SO_4.

- Select the appropriate formula. The other ones may be deleted.

Literature

- Metrohm Application Bulletin No. 129: Potentiometric determination of ortho-, meta- and polyphosphates.

2-Aminophenol

Reagents

$c(NaNO_2)$ = 0.2 mol/L; Dos. drive A1

Sample

app. 0.3 ... 0.35 g sample (2-aminophenol)
add 10 mL w(HBr) = 0.20 (20%),
30 mL dist. water

Electrodes

6.0431.100 Pt Titrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Method  Diazo.mth                     Diazotisation titration of 2-Aminophenol

-------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                Parameters
     ____  _____________  ________________________  ________________________

 1         MET_U*         Determination of 2-Aminophenol
                          Reagent    NaNO2          Sensor     6.0431.100
                          Concentr.      0.2 mol/L  Meas. input    A1
                          Dos. drive             A1
 2         END
================================================================================
printed: 1998-07-11 09:35:13
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method Diazo.mth [o] Diazotisation titration of 2-Aminophenol

Parameters

```
#  1       MET_U*   Determination of 2-Aminophenol
                    Reagent    NaNO2          Sensor     6.0431.100
                    Concentr.      0.2 mol/L  Meas. input    A1
                    Dos. drive            A1
```

— *Parameters

```
Start conditions
  Volume      absolute          Meas. val        off mV
  Size              10 mL       Slope            off mV/mL
  Dos. rate          5 mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume      absolute          Meas. val        off mV
  Size              20 mL       EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Volume steps     0.1 mL       Signal drift     off mV/min
  Titr. rate       max mL/min   Equilibr.time     15 s
```

— EP Recognition

```
Endpoints                 all       min. EPC      30.0 mV
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		2 mL/cm
Grid	off	

— *Report

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

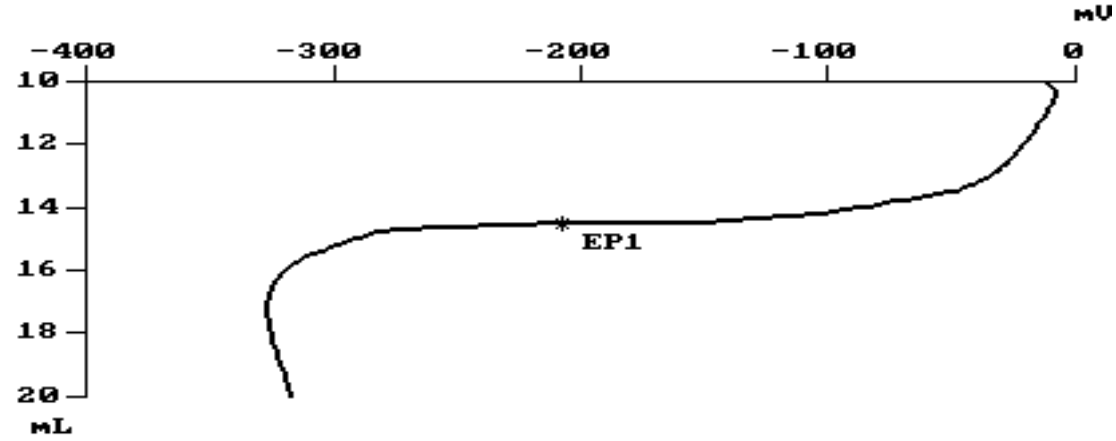
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Content	R1=EP1*109.13*0.1*C/SS	%	2	stat.

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method Diazo.mth [o] Diazotisation titration of 2-Aminophenol

Curve

1 MET_U* Determination of 2-Aminophenol



*Standard report

Method	Product	Lot	Size	Unit
Diazo	AM 2714	03247	0.3304	g

Remark

1 MET_U* Determination of 2-Aminophenol

EP1	-207.4 mV	14.583 mL	Content	96.34 %

Stop condition volume

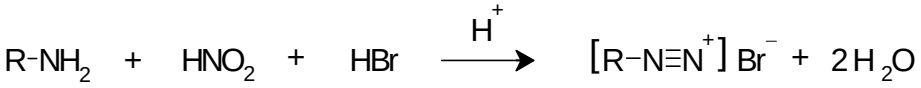
Original data Determination time: 1998-07-11 09:37:36
Data file Diazo.003 AM 2714 03247 Diazo

printed: 1998-07-11 09:39:46

Remarks see next page

Remarks

- **Determination reaction**:



- **Formula**:
  Content = content of 2-aminophenol in %
  109.13 = molecular mass of 2-aminophenol (g/mol)
  0.1 = conversion factor mL ⇒ L, and for % (0.001*100)
  C = concentration of titrant (mol/L)

  Enter the appropriate molecular mass for other amines.

- The combined Pt electrode 6.0420.100 may also be used.

Literature

- Metrohm Application Bulletin No. 228: Diazotisation titrations

Trace chloride in cement

Reagents

$c(AgNO_3)$ = 0.01 mol/L; Dos. Drive A1

Sample

50 mL sample solution
add 20 mL glacial acetic acid,
0.5 g Na-acetate

Electrodes

6.0430.100 Ag-Titrode with Ag_2S coating; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   CementCl.mth                        Trace chloride in cement and clinker

_______________________________________________________________________ Commands

     t/s   Command        Parameters                 Parameters
     ___   _____________  ________________________   ________________________

 1         SHOW           Page                curve
 2         MET_U*         Trace chloride in cement and clinker
                          Reagent    AgNO3           Sensor     6.0430.100
                          Concentr.     0.01 mol/L  Meas. input    A2
                          Dos. drive            A1
 3         SHOW           Page                result
 4         END
------------------------------------------------------------------------------
printed: 1999-07-29 10:34:15
```

METROHM 796 Titroprocessor 01101 5.796.0010

Parameters

2 MET_U* Trace chloride in cement and clinker
Reagent AgNO3 Sensor 6.0430.100
Concentr. 0.01 mol/L Meas. input A2
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	1.5 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Volume steps	0.05 mL	Signal drift	off mV/min
Titr. rate	max mL/min	Equilibr.time	10 s

— EP Recognition —

Equivalence points	all	min. EPC	30.0 mV
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

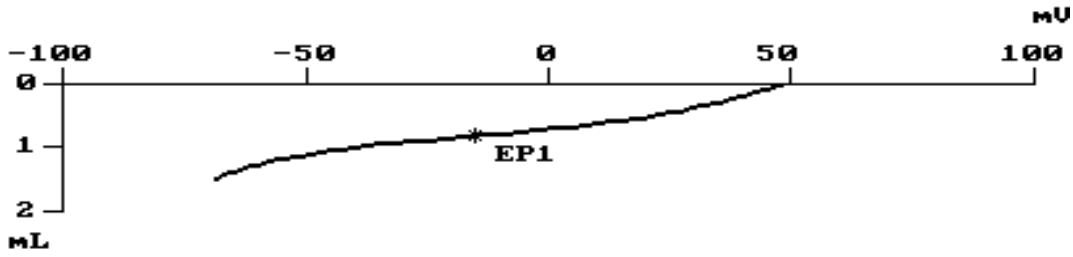
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Chloride	RS1=EP1*C*0.987*3553/(1000*SS)	%	3	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method CementCl.mth [o] Trace chloride in cement and clinker

Curve

2 MET_U* Trace chloride in cement and clinker



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
CementCl	cement			1.265	g

Remark
Trace chloride in cement and clinker

2 MET_U* Trace chloride in cement and clinker

EP1	-15.0 mV	0.843 mL	Chloride	0.023	%

Stop condition volume

Original data Determination time: 1999-07-28 11:23:20
Data file 99072811.002 cement CementCl Trace chloride in cement and clink

printed: 1999-07-28 11:28:53

Remarks

- **Sample preparation:**
  Weigh app. 2.5 g clinker or cement exactly in a beaker, then add 30 mL H_2O. While stirring add 6 mL conc. HNO_3 and sonicate for 2 min. Filter the solution through a chloride free paper filter into a 100 mL volume flask, rinse and fill up with H_2O to the mark.
  Use a aliquote for the titration.

- For the titer determination of the titrant use 100 µL *c*(KCl) = 0.1 mol/L standard solution (Metrohm No: 6.2301.060)

- **Formulas**:
  Chloride = chloride content of the sample in %
  C = concentration of the titrant
  0.987 = titer of the titrant
  3553 = molecular mass of chloride * 100 %
  1000 = conversion factor g $\Rightarrow$ mg

Literature

- Metrohm Application Note: Potentiometric Titration [T-6]
  „Trace chloride in cement and clinker“

White Liquor

Reagents

c(HCl) = 1 mol/L; Dos. Drive A1

Sample

2.00 mL white liquor
withe liquor is a mixture of NaOH, Na_2S (pK_1=7.04,pK_2=11.96), Na_2CO_3 (pK_1=6.37 , pK_2=10.25)
50 mL dist. water

Electrodes

6.0239.100 combined pH glass elektode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   WhiteLiq.mth                                              White Liquor

─────────────────────────────────────────────────────────────────── Commands

     t/s    Command          Parameters                 Parameters
     ────   ─────────────    ────────────────────────   ────────────────────────
 1          SHOW             Page              curve
 2          DET_PH*          White Liquor
                             Reagent    HCl              Sensor     6.0232.100
                             Concentr.         1 mol/L   Meas. input    A1
                             Dos. drive             A1
 3          SHOW             Page              result
 4          END

------------------------------------------------------------------------------
printed: 1999-07-28 08:41:18
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method WhiteLiq.mth [o]

Parameters

2 DET_pH* White Liquor
Reagent HCl Sensor 6.0232.100
Concentr. 1 mol/L Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions
Volume off Meas.val. pH off
Slope off pH/mL
Dos. rate max mL/min Pause 0 s

Titration conditions
Adjustment medium Time recording on
Temperature 25.0 °C

Stop conditions
Volume absolute Meas.val. pH off
Size 9 mL EP# 9
Fill. rate max mL/min Stop time off s
Mpt. overflow on

— EP Recognition —

Equivalence points all min. EPC 5.0
Gen. lower limit pH min upp. pH max
pK/HNP Evaluation off

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	pH	mL
end	pH	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

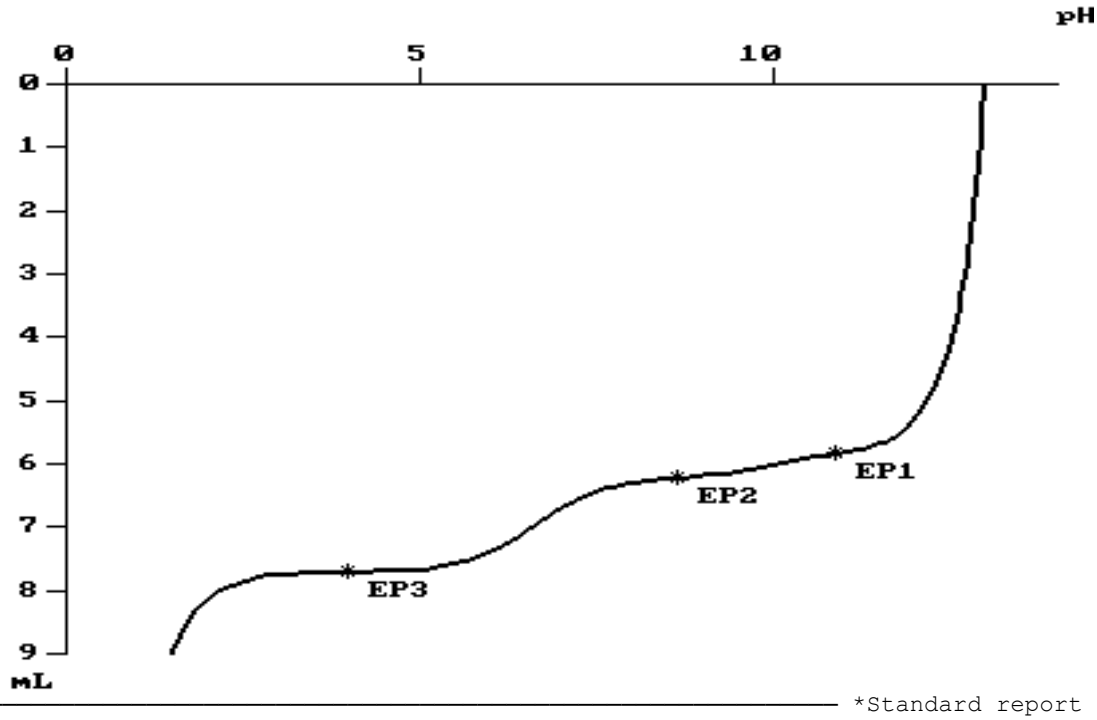
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Intermediad	X01=40*C/SS		5	normal
2	Total	R1=EP3*X01	g/L	2	normal
3	Active	R2=(EP3-2*(EP2-EP1))*X01	g/L	2	normal
4	Effective	R3=EP1*X01	g/L	2	normal
5	NaOH	R4=(EP1-((EP3-EP2)-(EP2-EP1)))*X01	g/L	2	normal
6	Na2S	R5=((EP3-EP2)-(EP2-EP1))*2*C*39/SS	g/L	2	normal
7	Na2CO3	R6=(EP2-EP1)*2*C*53/SS	g/L	2	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method WhiteLiq.mth [o]

Curve

2 DET_pH* White Liquor



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
WhiteLiq				2.00	mL
Remark					

2 DET_PH* White Liquor

EP1	pH 10.859	5.856 mL	Total	154.49	g/L
EP2	pH 8.616	6.247 mL	Active	138.85	g/L
EP3	pH 3.983	7.725 mL	Effective	117.11	g/L
			NaOH	95.38	g/L
Stop condition		volume	Na2S	42.38	g/L
			Na2CO3	20.73	g/L

Modified data Determination time: 1999-07-28 08:31:29
Data file 99072808.001 WhiteLiq

printed: 1999-07-28 08:38:09

Remarks

- Pass a stream of nitrogen through the solution during titration.

- **Determination reaction**:

  1^{st} EP: OH^- + S^{2-} + 2 H^+ $\longrightarrow$ H_2O + HS^-

  2^{nd} EP: CO_3^{2-} + H^+ $\longrightarrow$ HCO_3^-

  3^{rd} EP: HCO_3^- + HS^- + 2 H^+ $\longrightarrow$ H_2CO_3 + H_2S

- **Formulas:**

Total	= total alkali (NaOH + Na_2S + Na_2CO_3) as g NaOH per liter
Active	= active alkali (NaOH + Na_2S) as g NaOH per liter
Effective	= effective alkali (NaOH +½ Na_2S) as g NaOH per liter
NaOH	= concentration of NaOH in g/L
Na2S	= concentration of Na_2S in g/L
Na2CO3	= concentration of Na_2CO_3 in g/L
40	= molecular mass of NaOH in g/mol
C	= concentration of titrant(1 mol/L)
2	= factor
39	= molecular mass of ½ Na_2S
53	= molecular mass of ½ Na_2CO_3

Literature

- SCAN - N2:63 (1963)

Silver in Fixing baths

Reagents

c(Thioacetamide) = 0.025 mol/L in buffer pH 5; Dos. Drive A1

Sample

5 mL of sample
add 20 mL *c*(NaOH) = 2 mol/L,
20 mL *c*(EDTA) = 0.1 mol/L,
10 mL *w*(gelatine) = 0.012 (1.2 %)

Electrodes

6.0430.100 Ag Titrode with Ag_2S coating; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Name   Fixing.mth                          Silver determination in Fixing bath

---------------------------------------------------------------------- Commands

     t/s   Command        Parameters                Parameters
     ___   ____________   ________________________  ________________________

 1         SHOW           Page              curve
 2         MET_U*
                          Reagent    Thioacetamide  Sensor     6.0430.100
                          Concentr.    0.025 mol/L  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page             result
 4         END

------------------------------------------------------------------------------
printed: 1999-08-11 07:53:25
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method Fixing.mth [o] Silver determination in Fixing bath

Parameters

```
#  2       MET_U*
                   Reagent    Thioacetamide  Sensor     6.0430.100
                   Concentr.    0.025 mol/L  Meas. input    A1
                   Dos. drive             A1
```

— *Parameters

```
Start conditions
  Volume           off          Meas. val        off mV
                                Slope            off mV/mL
  Dos. rate        max mL/min   Pause              0 s

Titration conditions
  Adjustment    custom          Time recording   on
  Temperature     25.0 °C

Stop conditions
  Volume       absolute         Meas. val        off mV
  Size              5 mL       EP#                9
  Fill. rate       max mL/min   Stop time        off s
                                Mpt. overflow     on

Custom adjustments
  Volume steps     0.1 mL       Signal drift    50.0 mV/min
  Titr. rate       max mL/min   Equilibr.time     10 s
```

— EP Recognition

```
Equivalence points   greatest       min. EPC      30.0 mV
general lower limit       min mV    upp.           max mV
pK/HNP Evaluation         off
```

— Display

```
Curve       Y_Axis       X_Axis
Quantity    M. value         Volume
Scale           auto           auto
  begin              mV             mL
  end                mV             mL
Division                        1 mL/cm
Grid               off
```

— *Report

	Type	Specification	print	send	FF
Reports for	V_Curve	M. value	yes	no	no
titration /	*Stand		yes	no	no
measuring mode			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula

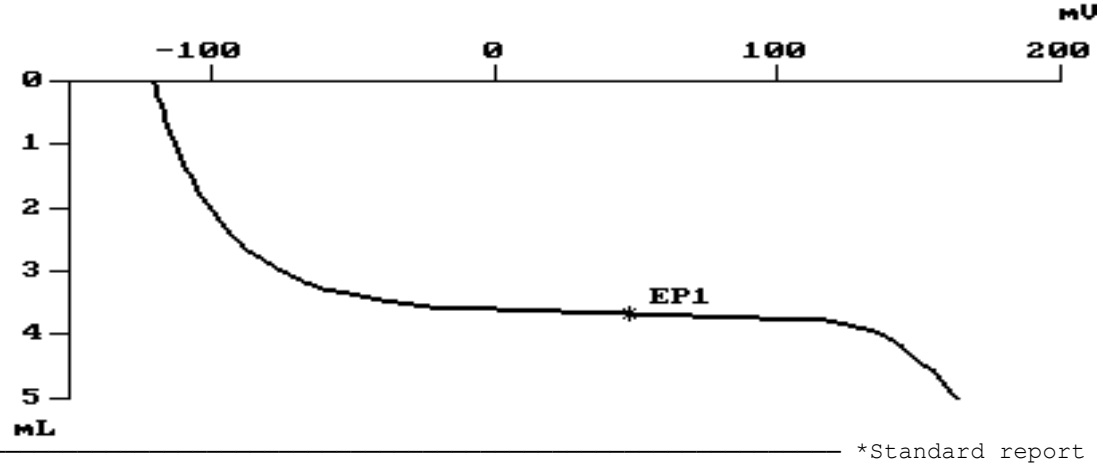
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Silver	R1=EP1*C*107.868*2/SS	g/L	3	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method Fixing.mth [o] Silver determination in Fixing bath

Curve

2 MET_U*



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Fixing				10	mL
Remark					

1 MET_U*

EP1	48.0 mV	3.700 mL	Silver	1.996 g/L

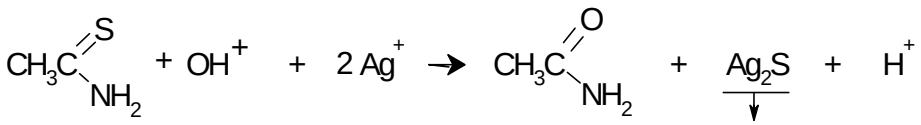
Stop condition volume

Original data Determination time: 1999-08-11 07:48:33
Data file 99081107.001 Fixing

printed: 1999-08-11 07:51:17

Remarks

- **Determination reaction**:



- **Formulas**:
  Silver = content of Ag in g/L
  C = concentration of titrant
  107.868 = molecular mass of Ag
  2 = equivalent of $Ag^+ \Rightarrow$ thioacetamide

- The gelatine solution prevents the agglomeration of the precipitates produced. In alkaline solution, thioacetamide forms sulphide ions. Owing to their solubility product with mercuric and silver ions (app. 10^{-50}), the halide ions are displaced out of the compound. This reaction is assisted by the formation of complexes with EDTA.

- **Ag_2S coating of electrode**:
  Immerse Ag Titrode in alkaline solution of thioacetamide for 15 min.

- **Buffer pH = 5:**
  Mix *c*(potassium biphthalate) = 0.1 mol/L with *c*(trisodium phosphate) = 0.05 mol/L in a proportion of 50:24. Dissolve 0.5 g thymol in 1 litre of this solution.

- **Titrant:**
  Dissolve 1.9 g Thioacetamide in 1 L buffer pH = 5 solution.

- **Gelatine solution:**
  Dissolve 12 g gelatine in hot water, add 0.5 g thymol, allow to cool and add up to 1 L.

Literature

- Metrohm Application Bulletin No. 72: Potentiometric determination of mercury or silver in the presence of halide ions.

Silver in film emulsions

Reagents

$c(Na_2S_2O_3)$ = 0.025 mol/L in buffer pH 5; Dos. Drive A1

Sample

10.0 mL solution (100 cm^2 black and white film in 100 mL fixing agent $Na_2S_2O_3$ 300 g/L)
add 20 mL c(NaOH) = 2 mol/L,
20 mL c(EDTA) = 0.1 mol/L,
10 mL w(gelatine) = 0.012 (1.2%)

Electrodes

6.430.100 Ag Titrode with Ag_2S coating; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
═══════════════════════════════════════════════════════════════════════════

Name   Silver.mth                                    Silver in film emulsions

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────────
 1         SHOW           Page              curve
 2         DET_U*         Silver titration
                          Reagent    Thioacetamide  Sensor     6.0430.100
                          Concentr.    0.025 mol/L  Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END

---------------------------------------------------------------------------
printed: 1999-08-02 14:45:35
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method Silver.mth [o]

Parameters

2 DET_U* Silver titration
Reagent Thioacetamide Sensor 6.0430.100
Concentr. 0.025 mol/L Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	custom	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	3 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

Custom adjustments

Meas.pt.density	4	Signal drift	20 mV/min
Min.increment	10 µL	Equilibr.time	auto s
Titr. rate	max mL/min		

— EP Recognition —

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		1 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

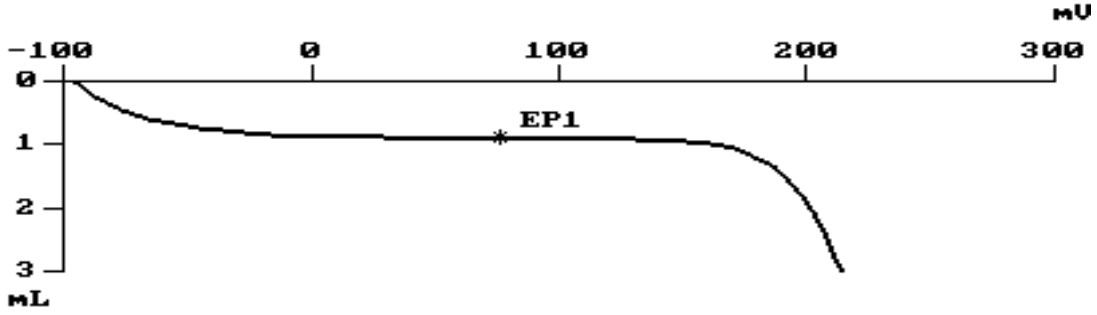
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	AgNO3	R1=EP1*C*169.87*2/SS*100/0.01/1000	g/m2	3	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method Silver.mth [o]

Curve

2 DET_U* Silver titration



*Standard report

Method	Ident1	Ident2	Ident3	Size	Unit
Silver				10	mL
Remark					

2 DET_U* Silver titration

EP1	76.1 mV	0.920 mL	AgNO3	7.815 g/m2

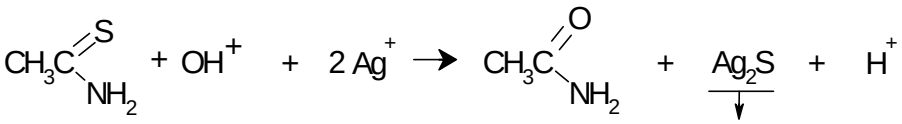
Stop condition volume

Original data Determination time: 1999-08-02 14:07:43
Data file 99080214.001 Silver

printed: 1999-08-02 14:43:12

Remarks

- **Determination reaction**:



- **Formulas**:
  AgNO3 = content of $AgNO_3$ in g/m^2
  C = concentration of titrant
  169.87 = molecular mass of $AgNO_3$
  2 = equivalent of $Ag^+ \Rightarrow$ thioacetamide
  100 = factor for 100 mL sample
  0.01 = conversion factor in m^2
  1000 = conversion factor mL $\Rightarrow$ L

- **Sample preparation:**
  Cut 100 cm^2 of black and withe film in to pieces, add 100 ml of *c*($Na_2S_2O_3$ 300 g/L) and stir for not less then 30 min.

- The gelatine solution prevents the agglomeration of the precipitates produced. In alkaline solution, thioacetamide forms sulphide ions. Owing to their solubility product with mercuric and silver ions (app. 10^{-50}), the halide ions are displaced out of the compound. This reaction is assisted by the formation of complexes with EDTA.

- **Ag_2S coating of electrode:**
  Immerse Ag Titrode in alkaline solution of thioacetamide for 15 min.

- **Buffer pH = 5:**
  Mix *c*(potassium biphthalate) = 0.1 mol/L with *c*(trisodium phosphate) = 0.05 mol/L in a proportion of 50:24. Dissolve 0.5 g thymol in 1 litre of this solution.

- **Titrant:**
  Dissolve 1.9 g Thioacetamide in 1 L buffer pH = 5 solution.

- **Gelatine solution:**
  Dissolve 12 g gelatine in hot water, add 0.5 g thymol, allow to cool and add up to 1 L.

Literature

- Metrohm Application Bulletin No. 72: Potentiometric determination of mercury or silver in the presence of halide ions.

Kappa Number of paper pulp

Reagents

$c(Na_2S_2O_3)$ = 0.1 mol/L; Dos. Drive A1

Sample

13 g cellulose pulp
780 mL dist. water
100 mL $c(^1/_5KMnO_4)$ = 0.1 mol/L
100 mL $c(H_2SO_4)$ = 2 mol/L
20 mL dist. water
35 mL w(KI) = 0.10 (10%)

Electrodes

6.0451.100 combined Pt ring electrode; input A1

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Name   KappaNo.mth                                              Kappa number

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command        Parameters                 Parameters
     ────  ─────────────  ─────────────────────────  ──────────────────────
 1         SHOW           Page              curve
 2         DET_U*         Kappa number
                          Reagent    Na2S203         Sensor     6.0451.100
                          Concentr.      0.1 mol/L   Meas. input    A1
                          Dos. drive            A1
 3         SHOW           Page              result
 4         END

---------------------------------------------------------------------------
printed: 1999-07-29 10:34:15
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method KappaNo.mth [o]

Parameters

2 DET_U* Kappa number
Reagent Na2S203 Sensor 6.0451.100
Concentr. 0.1 mol/L Meas. input A1
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Meas. val	off mV
		Slope	off mV/mL
Dos. rate	max mL/min	Pause	0 s

Titration conditions

Adjustment	medium	Time recording	on
Temperature	25.0 °C		

Stop conditions

Volume	absolute	Meas. val	off mV
Size	40 mL	EP#	9
Fill. rate	max mL/min	Stop time	off s
		Mpt. overflow	on

— EP Recognition —

Equivalence points	all	min. EPC	5.0
general lower limit	min mV	upp.	max mV
pK/HNP Evaluation	off		

— Display —

Curve	Y_Axis	X_Axis
Quantity	M. value	Volume
Scale	auto	auto
begin	mV	mL
end	mV	mL
Division		5 mL/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	V_Curve	M. value	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

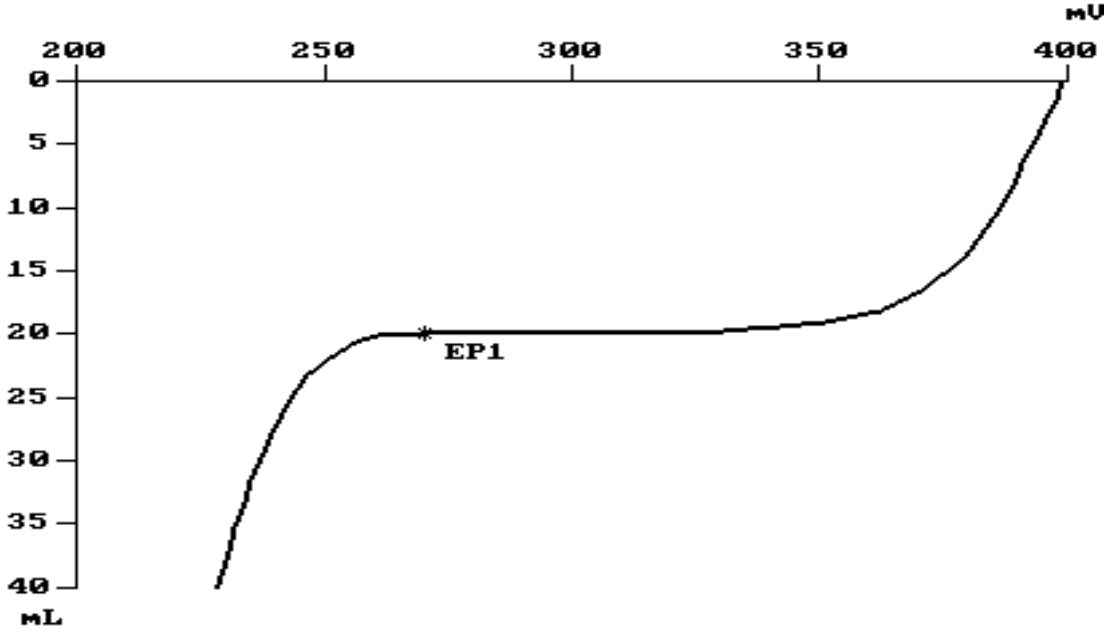
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	p	R1=(C1-EP1)*C*2/0.1		1	normal
2	factor	X01=R1*0.00211+0.895		3	normal
3	KappaNo.	R2=R1*X01*100/SS/ID1		1	normal

METROHM 796 Titroprocessor 01101 5.796.0010

Method KappaNo.mth [o]

Curve

2 DET_U* Kappa number



*Standard report

Method	dry content	Ident2	Ident3	Size	Unit
KappaNo	21.52			13.41	g
Remark					

2 DET_U* Kappa number

EP1	270.1 mV	20.131 mL	p	58.7
			KappaNo.	20.7
Stop condition		volume		

Original data Determination time: 1999-07-29 09:44:05
Data file 99072909.003 21.52 KappaNo

printed: 1999-07-29 09:53:25

Remarks

- The Kappa number is the consumption of $c(^1/_5KMnO_4)$ = 0.1 mol/L in mL. The results are corrected to the consumption of 50% of the permanganate solution added.

- Determine the dry content of the sample: Dry sample at 105 °C for app. 90 minutes. Calculate the dry content in % and enter it as dry content in the sample data as Ident 1.

- Weigh in an appropriate amount of sample. Add 780 mL of dist.water and defibrate it with the stirrer. Add the mixture of 100 mL $c(^1/_5KMnO_4)$ = 0.1 mol/L und100 mL $c(H_2SO_4)$ = 2 mol/L as quickly as possible and rinse with 20 mL dist. water. After a waiting time of exactly 10 minutes, add 35 mL w(KI) = 0.10 (10%) to stop the reaction. Titrate immediately.
  Treat the blank sample in the same way as above and store the consumption of titrant as C1 .

- **Formulas**:

p	= consumption of $c(^1/_5KMnO_4)$ = 0.1 mol/L in mL
KappaNo.	= Kappa number
C1	= mL of titrant of blank sample in mL
C	= concentration of $c(Na_2S_2O_3)$ = 0.1 mol/L
2	= factor for molarity $\rightarrow$ " normality "
0.1	= factor for percent of permanaganate consumption
X01	= factor for correction to a 50 % $KMnO_4$ consumption
100	= factor to compensate for entry of dry content in %
ID1	= dry content in %

Literature

- TAPPI T236 os-76

KF Titer determination with standard

Reagents

HYDRANAL® Composite 5; Dos. drive A1

Sample

20 -30 mL methanol, conditioned to complete dryness
app. 1 g water standard 10.0 (1 g contains 10.0 mg H_2O)

Electrodes

6.0338.100 double Pt electrode; input Apol

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Method  KF_Titer.mth [o]                    Titer of KF Reagent with standard

──────────────────────────────────────────────────────────────────────── Commands

     t/s   Command         Parameters                 Parameters
     ────  ─────────────   ────────────────────────   ────────────────────────

 1         (OMOVE
 2           KFC_IPOL*    Conditioning of solvent
                          Reagent    KF Reagent     Sensor     6.0338.100
                          Concentr.        5 mg/L   Meas. input  Apol
                          Dos. drive            A1
 3   99999   WAIT_C       Preconditioning, wait for * cond. ready *
 4         )OMOVE
 5         WAIT_C         Termination of conditioning
 6         ASK            Ident. item         none  Size        yes
 7         KFT_IPOL*      Titer determination of KF Reagent with standard
                          Reagent    KF Reagent     Sensor     6.0338.100
                          Concentr.        5 mg/L   Meas. input  Apol
                          Dos. drive            A1
 8         KFC_IPOL*      Conditioning of solvent
                          Reagent    KF Reagent     Sensor     6.0338.100
                          Concentr.        5 mg/L   Meas. input  Apol
                          Dos. drive            A1
 9         END

==============================================================================
printed: 1998-07-11 10:17:53
```

```
METROHM 796 Titroprocessor   01101  5.796.0010
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Method  KF_Titer.mth [o]                    Titer of KF Reagent with standard

──────────────────────────────────────────────────────────────────── Parameters
#  7    KFT_IPOL*   Titer determination of KF Reagent with standard
                    Reagent    KF Reagent     Sensor     6.0338.100
                    Concentr.        5 mg/L   Meas. input  Apol
                    Dos. drive            A1

      — *Parameters ──────────────────────────────────────────────────────────

      Start conditions
        Volume           off          Pause 1            0 s
                                      Pause 2            0 s
                                      Extract. time      0 s

      Titration conditions
        Direction       neg.          Temperature     25.0 °C
        Endpoint at      250 mV       Time recording    on
        Adjustment    medium          Derivation       off
        Mpt. interval      1 s
                                      I(pol)            50 µA
      Stop conditions
        Volume      absolute          Stop time        off s
        Size           99.99 mL       Mpt. overflow    off
        Fill. rate       max mL/min

      — Display ──────────────────────────────────────────────────────────────

      Curve       Y_Axis       X_Axis
      ──────────────────────────────────
      Quantity      Volume           Time
      Scale           auto           auto
        begin              mL             s
        end                mL             s
      Division                        30 s/cm
      Grid               off

      — *Report ──────────────────────────────────────────────────────────────

                      Type      Specification  print  send  FF
                      ──────    ─────────────  ─────  ────  ──
      Reports for     T_Curve   Volume         yes    no    no
      titration /     *Stand                   yes    no    no
      measuring mode                           no     no    no
                                               no     no    no
                                               no     no    no
                                               no     no    no


      — *Formula ─────────────────────────────────────────────────────────────

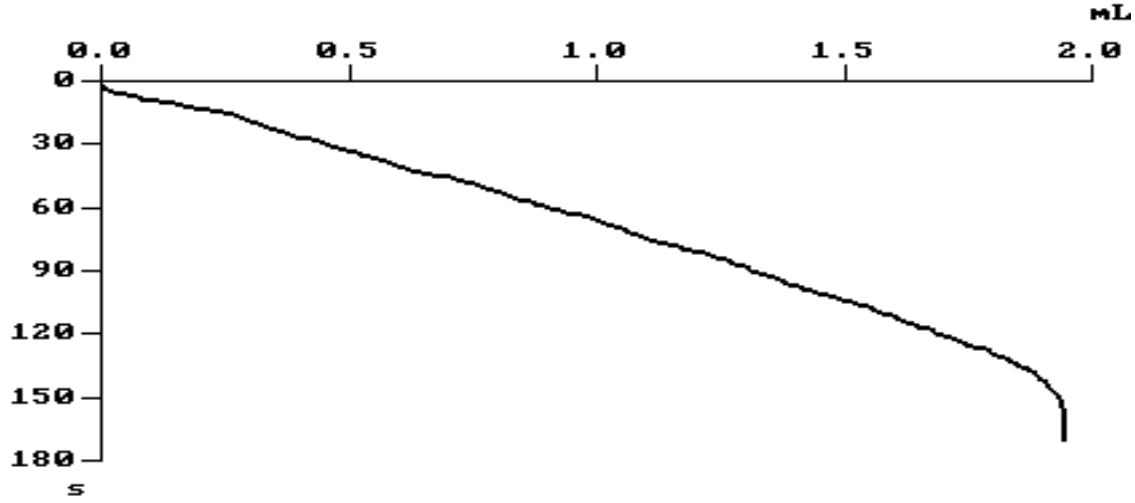
      #  Comment      Formula (R$$, C##, X$$, EP# ..)      Unit    Dec  Type
      ── ──────────── ──────────────────────────────────── ─────── ──── ──────
       1 Titer        R1=SS/EP1*10.04                      mg/mL   4    stat.
       2 KFR Titer    C17=MNR1                             mg/mL   4    normal
```

METROHM 796 Titroprocessor 01101 5.796.0010

Method KF_Titer.mth [o] Titer of KF Reagent with standard

Curve

7 KFT_IPOL* Titer determination of KF Reagent with standard



*Standard report

Method	Firm	Product	Lot	Size	Unit
KF_Titer	Riedel	Water Stand.	50320	-1.0011	g

Remark

7 KFT_IPOL* Titer determination of KF Reagent with standard

EP	202.8 mV	1.946 mL	Titer	5.1636	mg/mL
Cond. drift		1.5 µl/min	KFR Titer	5.1579	mg/mL
Inter.titr.time		19.8 s			
Dosing time		169.3 s			
Stop condition		stop drift			

Original data Determination time: 1998-07-11 10:19:34

Data file 97071110.006 Riedel Water Stand. KF_Titer

printed: 1998-07-11 10:21:13

Remarks see next page

Remarks

- Use this method only with Autostart “off“

- **Formula**:
  Titer = titer of HYDRANAL® Composite 5
  KFR Titer = assignment of mean value to common variable C17
  10.04 = factor in mg water per gram water standard (if water is used, enter 1000 as factor)

- Mean from 5 determinations.

- Water standard or water can be injected either with a microliter syringe or with any syringe and reweighed.

- Adjust the calculation value according to your sample size:

  Water standard
  SS in g factor = content of methanol [mg/g]
  SS in mL factor = content of methanol [mg/mL]
  SS in uL factor = 0.001 * content of methanol [mg/mL]

  Water
  SS in g factor = 1000
  SS in uL factor = density of H_2O [mg/mL] ≈ 1

- The titration parameters of KFT and KFC are the same.

Literature

- Water determination by Karl Fisher titration, G. Wieland, GIT Verlag, Darmstadt (Germany)
- HYDRANAL®, practical course, Water reagents according to Eugen Scholz, Riedel de Haën, Seelze (Germany)
- Metrohm Application Bulletin No. 77: KF water determination

Water determination in Oil

Reagents

HYDRANAL® Composite 5; Dos. drive A1

Sample

20 - 30 mL methanol, conditioned to complete dryness
1 g oil

Electrodes

6.0338.100 double Pt electrode; input Apol

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
================================================================================

Method  KFsample.mth [o]                          Water determination in oil

--------------------------------------------------------------------------- Commands

     t/s   Command        Parameters                 Parameters
     ----- -------------- -------------------------- --------------------------
 1         (OMOVE
 2           KFC_IPOL*    Conditioning of solvent
                          Reagent    KF Reagent      Sensor     6.0338.100
                          Concentr.        5 mg/L    Meas. input  Apol
                          Dos. drive            A1
 3    99999   WAIT_C       Preconditioning, wait for * cond. ready *
 4         )OMOVE
 5         WAIT_C         Termination of conditioning
 6         ASK            Ident. item          all  Size        yes
 7         KFT_IPOL*      Water determination in oil
                          Reagent    KF Reagent      Sensor     6.0338.100
                          Concentr.        5 mg/L    Meas. input  Apol
                          Dos. drive            A1
 8         KFC_IPOL*      Conditioning of solvent
                          Reagent    KF Reagent      Sensor     6.0338.100
                          Concentr.        5 mg/L    Meas. input  Apol
                          Dos. drive            A1
 9         END

================================================================================
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```

METROHM 796 Titroprocessor 01101 5.796.0010

Method KFsample.mth [o] Water determination in oil

Parameters

7 KFT_IPOL* Water determination in oil
Reagent KF Reagent Sensor 6.0338.100
Concentr. 5 mg/L Meas. input Apol
Dos. drive A1

— *Parameters —

Start conditions

Volume	off	Pause 1	0 s
		Pause 2	0 s
		Extract. time	0 s

Titration conditions

Direction	neg.	Temperature	25.0 °C
Endpoint at	250 mV	Time recording	on
Adjustment	medium	Derivation	off
Mpt. interval	1 s		
		I(pol)	50 µA

Stop conditions

Volume	absolute	Stop time	off s
Size	99.99 mL	Mpt. overflow	off
Fill. rate	max mL/min		

— Display —

Curve	Y_Axis	X_Axis
Quantity	Volume	time
Scale	auto	auto
begin	mL	s
end	mL	s
Division		30 s/cm
Grid	off	

— *Report —

	Type	Specification	print	send	FF
Reports for titration / measuring mode	T_Curve	Volume	yes	no	no
	*Stand		yes	no	no
			no	no	no
			no	no	no
			no	no	no
			no	no	no

— *Formula —

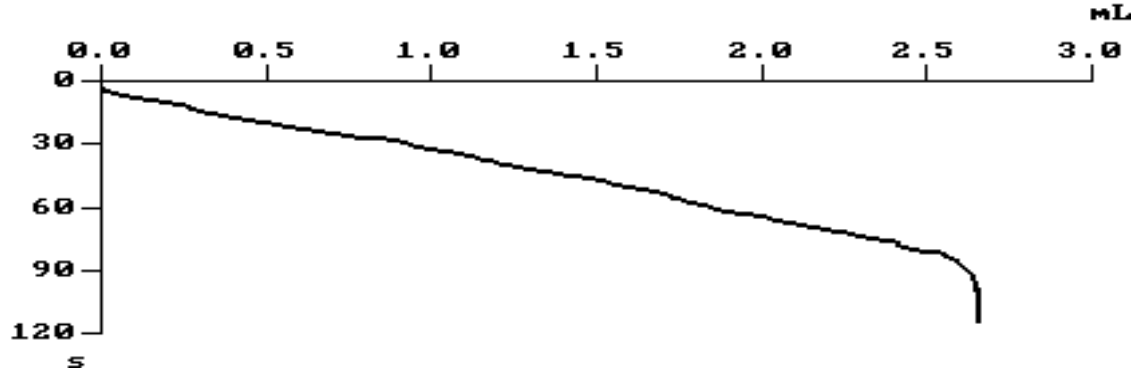
#	Comment	Formula (R$$, C##, X$$, EP# ..)	Unit	Dec	Type
1	Water	R1=EP1*C17*0.1/1/SS	%	2	stat.

METROHM 796 Titroprocessor 01101 5.796.0010

Method KFsample.mth [o] Water determination in oil

Curve

7 KFT_IPOL* Water determination in oil



*Standard report

Method	Lab	Product	Lot	Size	Unit
KFsample	QC01	Brake fluid	6201.505	-1.1920	g

Remark

7 KFT_IPOL* Water determination in oil

EP	239.3 mV	2.663 mL	Water	5.92 %
Cond. drift		0.5 µl/min		
Inter.titr.time		25.2 s		
Dosing time		113.7 s		
Stop condition		stop drift		

Original data Determination time: 1998-07-13 07:28:44

Data file Breakflu.003 QC01 Brake fluid KFsample

printed: 1998-07-13 07:32:16

Remarks see next page

Remarks

- Use this method only with Autostart “off“

- **Formula**:
  Water = content of water in oil in %
  C17 = titer of HYDRANAL® Composite 5
  0.1 = factor for %, see below
  1 = divisor, see below

- This method can be generally used for KF titrations without blank values. For work with a KF Oven, you need an extraction time.

· Adjust the calculation values factor and divisor according the desired result unit and your sample size:

Formula Unit	Smpl size in..	Factor	Divisor
%	g	0.1	1
%	mg	100	1
%	mL	0.1	Dens. of sample
ppm	g	1000	1
ppm	mL	1000	Dens. of sample
ppm	uL	1000 000	Dens. of sample
mg/mL	g	Dens. of sample	1
mg/mL	mL	1	1
g/L	g	Dens. of sample	1
g/L	mL	1	1
mg	1	1	1
mL	1	1	1000*Dens. H_2O
mg/pc	pc	1	1

Literature

- Water determination by Karl Fisher titration, G. Wieland, GIT Verlag, Darmstadt (Germany)
- HYDRANAL®, practical course, Water reagents according to Eugen Scholz, Riedel de Haën, Seelze (Germany)
- Metrohm Application Bulletin No. 208: Volumetric determination of water in honey with Karl Fisher reagent.
- Metrohm Application Bulletin No. 77: KF water determination

Sample Changer, rinsing in sample beaker

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method SCsimple.mth [o] Rinse and aspirate in the titration beaker

Commands

	t/s	Command	Parameters		Parameters	
1		(OMOVE				
2		CHANGER	Selection	1	Rack name	
			Lift rate 1	25	Lift rate 2	25
			Shift rate	20	Beaker test mode	single
			Shift direction	auto	On beaker error	MOVE_S
3		MOVE_B	Special beaker	Waste	to tower	1
4		LIFT	on tower	1	to position	rinse mm
5		PUMP	Address	1.rinse	State	on
6	10	PUMP	Address	1.aspir	State	on
7		PUMP	Address	1.rinse	State	off
8		PUMP	Address	1.aspir	State	off
9		LIFT	on tower	1	to position	shift mm
10		)OMOVE				
11		MOVE_S	Sample to tower	1		
12		LIFT	on tower	1	to position	work mm
13		STIR_C	Address	1	Stirring rate	6
14						
15		REM	Select a titration mode			
16						
17		STIR_C	Address	1	Stirring rate	off
18	10	PUMP	Address	1.aspir	State	on
19	10	PUMP	Address	1.rinse	State	on
20		PUMP	Address	1.aspir	State	off
21		PUMP	Address	1.rinse	State	off
22		LIFT	on tower	1	to position	shift mm
23		SAMPLE	Function	+	Value	1
24		END				

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Remarks

- **Special beaker**:
  Define the special beaker “Waste“ at the last rack position.
  (<Config.> <Sample changer>: select the corresponding rack <Special beakers>)

- **Lift positions**:
  Define work, rinse and shift positions for your sample changer rack, depending on the beaker size.

- **Course of method**:
  At the beginning of a sample series, electrodes and buret tips are rinsed in the special beaker “Waste“ (OMOVE sequence). Then the first sample beaker is moved to the tower 1 where the titration is carried out. At the end of the titration, the sample is aspirated, the electrodes and buret tips are rinsed, and the next beaker is moved to the tower 1.
  The rinsing nozzle is used.
  For Sample Changer with 1 tower and 2 pumps.

- Insert the titration mode instead of Command REM (line 15).

- Use this rinsing method for relatively clean, aqueous solutions.

Literature

Sample Changer, rinsing in Special beaker

Method documentation

METROHM 796 Titroprocessor 01101 5.796.0010

Method SCrinse.mth [o] Rinse and aspirate in the special beaker

Commands

	t/s	Command	Parameters		Parameters	
1		(OMOVE				
2		CHANGER	Selection	1	Rack name	
			Lift rate 1	25	Lift rate 2	25
			Shift rate	20	Beaker test mode	single
			Shift direction	auto	On beaker error	MOVE_S
3		MOVE_B	Special beaker	Waste	to tower	1
4		LIFT	on tower	1	to position	rinse mm
5		PUMP	Address	1.rinse	State	on
6	10	PUMP	Address	1.aspir	State	on
7		PUMP	Address	1.rinse	State	off
8		PUMP	Address	1.aspir	State	off
9		LIFT	on tower	1	to position	shift mm
10		)OMOVE				
11		CHANGER	Selection	1	Rack name	
			Lift rate 1	25	Lift rate 2	25
			Shift rate	20	Beaker test mode	single
			Shift direction	+	On beaker error	MOVE_S
12		MOVE_S	Sample to tower	1		
13		LIFT	on tower	1	to position	work mm
14		STIR_C	Address	1	Stirring rate	6
15						
16		REM	Select a titration mode			
17						
18		STIR_C	Address	1	Stirring rate	off
19		LIFT	on tower	1	to position	shift mm
20		CHANGER	Selection	1	Rack name	
			Lift rate 1	25	Lift rate 2	25
			Shift rate	20	Beaker test mode	single
			Shift direction	-	On beaker error	MOVE_S
21		MOVE_B	Special beaker	Waste	to tower	1
22		LIFT	on tower	1	to position	rinse mm
23		PUMP	Address	1.aspir	State	on
24	10	PUMP	Address	1.rinse	State	on
25		PUMP	Address	1.aspir	State	off
26		PUMP	Address	1.rinse	State	off
27		LIFT	on tower	1	to position	shift mm
28		SAMPLE	Function	+	Value	1
29		END				

printed: 97-07-30 15:26:08

Remarks

- **Special beaker**:
  Define the special beaker “Waste“ at the last rack position.
  (<Config.> <Sample changer>: select the corresponding rack <Special beakers>)

- **Lift positions**:
  Define work, rinse and shift positions for your sample changer rack, depending on the beaker size.

- **Course of method**:
  At the beginning of a sample series, electrodes and buret tips are rinsed in the special beaker “Waste“ (OMOVE sequence). Then the first sample beaker is moved to the tower 1 where the titration is carried out. At the end of the titration, the special beaker is moved to the tower 1, the electrodes and buret tips are rinsed there. Then the next sample beaker is moved to the tower 1.
  The shift direction is selected such that new samples are never below the electrodes and buret tips.
  The rinsing nozzle is used.
  For Sample Changer with 1 tower and 2 pumps.

- Insert the titration mode instead of Command REM (line 16).

- Use this rinsing method for samples contains solids, aggressive or pasting substances, or non-aqueous solutions.

Literature

pH calibration with Sample Changer

Method documentation

```
METROHM 796 Titroprocessor   01101  5.796.0010
```

Method SC_CAL.mth [o] pH electrode calibr. at the beginning of a serie

Commands

	t/s	Command	Parameters		Parameters	
1		(OMOVE				
2		CHANGER	Selection	1	Rack name	
			Lift rate 1	25	Lift rate 2	25
			Shift rate	20	Beaker test mode	single
			Shift direction	auto	On beaker error	MOVE_S
3		MOVE_B	Special beaker	Waste	to tower	1
4		LIFT	on tower	1	to position	rinse mm
5		PUMP	Address	1.rinse	State	on
6	10	PUMP	Address	1.aspir	State	on
7		PUMP	Address	1.rinse	State	off
8		PUMP	Address	1.aspir	State	off
9		LIFT	on tower	1	to position	shift mm
10		(CAL				
11		(CASE	$BC = 1			
12		MOVE_B	Special beaker	Buffer 7	to tower	1
13		CASE	$BC = 2			
14		MOVE_B	Special beaker	Buffer 4	to tower	1
15		)CASE				
16		LIFT	on tower	1	to position	work mm
17		STIR_C	Address	1	Stirring rate	6
18		CAL*	pH electrode calibration			
			Sensor		Signal drift	2 mV/min
			Meas. input	A1	Equilibr.time	auto s
			Temperature	25.0 °C		
19		STIR_C	Address	1	Stirring rate	off
20		LIFT	on tower	1	to position	shift mm
21		MOVE_B	Special beaker	Waste	to tower	1
22		LIFT	on tower	1	to position	rinse mm
23		PUMP	Address	1.rinse	State	on
24	10	PUMP	Address	1.aspir	State	on
25		PUMP	Address	1.rinse	State	off
26		PUMP	Address	1.aspir	State	off
27		LIFT	on tower	1	to position	shift mm
28		)CAL				
29		)OMOVE				
30		MOVE_S	Sample to tower	1		
31		LIFT	on tower	1	to position	work mm
32		STIR_C	Address	1	Stirring rate	6
33						
34		REM	Insert here your titration mode			
35						
36		STIR_C	Address	1	Stirring rate	off
37	10	PUMP	Address	1.aspir	State	on
38	10	PUMP	Address	1.rinse	State	on
39		PUMP	Address	1.aspir	State	off
40		PUMP	Address	1.rinse	State	off
41		LIFT	on tower	1	to position	shift mm
42		SAMPLE	Function	+	Value	1
43		(CMOVE				
44		MOVE_B	Special beaker	Buffer 7	to tower	1
45		LIFT	on tower	1	to position	work mm
46		)CMOVE				
47		END				

```
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```

Remarks

- **Special beaker**:
  Define the special beaker “Waste“ at the last rack position, “Buffer 7“ at the second last and “Buffer 4“ at the third last position. (<Config.> <Sample changer>: select the corresponding rack <Special beakers>)

- **Lift positions**:
  Define work, rinse and shift positions for your sample changer rack, depending on the beaker size.

- **Course of method**:
  At the beginning of a sample series, electrodes and buret tips are rinsed in the special beaker “Waste“; then buffer 7 is measured; then the inserts are rinsed again in the “Waste“ beaker; then the buffer 4 is measured and the inserts rinsed again (all this is in the OMOVE sequence).
  Then the first sample beaker is moved to the tower 1 where the titration is carried out. At the end of the titration, the sample is aspirated, the electrodes and buret tips are rinsed, and the next beaker is moved to the tower 1.
  At the end of the sample series, electrodes and buret tips are dived in the special beaker “Buffer 7“ for conditioning (CMOVE sequence). The rinsing nozzle is used.
  For Sample Changers with 1 tower and 2 pumps.

- Insert the titration (or measuring) mode instead of Command REM (line 34).

- Use this method if you need a pH calibration, e.g. for pH SET titrations, fixendpoints in pH titrations, and pH measurements.

- Use this rinsing method for relatively clean, aqueous solutions without solids.

Literature

Sample Changer with "Auto start: Rack"

Method documentation

METROHM 796 Titroprocessor 01101 5.796.0010

Name SC_Rack.mth Use with "Auto start: Rack"

Commands

	t/s	Command	Parameters		Parameters	
1		(OMOVE				
2		CHANGER	Selection	1	Rack name	
			Lift rate 1	25	Lift rate 2	25
			Shift rate	20	Beaker test mode	single
			Shift direction	auto	On beaker error	MOVE_S
3		MOVE_B	Special beaker	Waste	to tower	1
4		LIFT	on tower	1	to position	rinse mm
5		PUMP	Address	1.rinse	State	on
6	10	PUMP	Address	1.aspir	State	on
7		PUMP	Address	1.rinse	State	off
8		PUMP	Address	1.aspir	State	off
9		LIFT	on tower	1	to position	shift mm
10		MOVE_S	Sample to tower	1		
11		)OMOVE				
12		LIFT	on tower	1	to position	work mm
13		STIR_C	Address	1	Stirring rate	6
14						
15		REM	Select a titration mode			
16						
17		STIR_C	Address	1	Stirring rate	off
18	10	PUMP	Address	1.aspir	State	on
19	10	PUMP	Address	1.rinse	State	on
20		PUMP	Address	1.aspir	State	off
21		PUMP	Address	1.rinse	State	off
22		LIFT	on tower	1	to position	shift mm
23		SAMPLE	Function	+	Value	1
24		MOVE_S	Sample to tower	1		
25		END				

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Remarks

- **Special beaker**:
  Define the special beaker “Waste“ at the last rack position.
  (<Config.> <Sample changer>: select the corresponding rack <Special beakers>)

- **Lift positions**:
  Define work, rinse and shift positions for your sample changer rack, depending on the beaker size.

- **Course of method**:
  At the beginning of a sample series, electrodes and buret tips are rinsed in the special beaker “Waste“ (OMOVE sequence). Then the first sample beaker is moved to the tower 1 where the titration is carried out. At the end of the titration, the sample is aspirated, the electrodes and buret tips are rinsed, and the next beaker is moved to the tower 1.
  The rinsing nozzle is used.
  For Sample Changer with 1 tower and 2 pumps.

- Insert the titration mode instead of Command REM (line 15).

- Use this rinsing method for relatively clean, aqueous solutions.

Literature

Access control Levels

Access Control

The 796 Titroprocessor application card contains eight access control files (*.acf). They may be used to create key cards for different users of the 796 Titroprocessor.

These eight access control files represent sample user levels (four of them can be used for work with the 717 Sample Changer) which may be modified to suit your needs. Access control files contain predefinitions of the basic status settings and restrictions for the softkey sets to reduce the navigation pathways and functions.

The table below shows the functions enabled for each Access Control Level.

	LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 1 SC**	**LEVEL 2 SC**	**LEVEL 3 SC**	**LEVEL 4 SC**
load method	X	X	X	X	via Silo	via Silo	X	X
run method	X	X	X	X	X	X	X	X
edit para-meter			X	X			X	X
advanced editing of method				X				X
view meas. curve		X	X	X		X	X	X
view results		X	X	X		X	X	X
recalc. results			X	X			X	X
prepare dos. instr. manually	X	X	X	X			X	X
manual dosing			X	X			X	X
manual calibration			X	X			X	X
use sample silo			X	X	X	X	X	X
advanced editing of sample silo			X	X			X	X
access to file manager			X	X			X	X
edit configuration				X				X
edit common variables				X				X
Remarks	calibration in method possible	calibration in method possible		all possibilities	preparation of dosing instr. and calibration in method possible	preparation of dosing instr. and calibration in method possible		all possibilities

Status Settings:

The following table shows the predefined status settings for each Access Control Level.

	LEVEL 1	**LEVEL 2**	**LEVEL 3**	**LEVEL 4**	**LEVEL 1 SC**	**LEVEL 2 SC**	**LEVEL 3 SC**	**LEVEL 4 SC**
save datas	yes	yes	yes	yes	yes	yes	yes	yes
save on	Datacard	Datacard	Datacard	Datacard	internal memory	internal memory	internal memory	internal memory
load method from	Datacard	Datacard	Datacard	Datacard	Datacard	Datacard	Datacard	Datacard
Statistics	no	yes; modifyable	yes; modifyable	yes; modifyable	no	yes; modifyable	yes; modifyable	yes; modifyable
Statistics of		2; modifyable	2; modifyable	2; modifyable		2; modifyable	2; modifyable	2; modifyable
clear working area	yes	yes	no	no	yes	yes	no	no
show method window	yes	yes	yes	yes	no	no	no	no
edit user	no, on card	yes, request	yes, request	yes	no, on card	yes, request	yes, request	yes
sample changer	no	no	no	no, modifyable	yes	yes	yes	yes; modifyable
sample silo	no	no	no, modifyable	no, modifyable	yes; modifyable	yes; modifyable	yes; modifyable	yes; modifyable

Remarks

Access Control files can be used to create key cards with which a user can automatically sign-on to the titrator. To load and edit an Access Control file do the following:

- Insert the application card into the memory card slot of the 796 Titroprocessor
- Press <ALT> and <A> simultaneously or alternatively the softkeys [Config] and [Access control]
- Enter the administrator's password (if any defined) and press <ENTER>. By default there is no password, you can press <ENTER> only.
- Press the softkey [File] to open a file dialog window.
- MOVE the cursor to the 'storage' field, press the space bar and select 'Data card' from the selector list. Press <ENTER>.
- Move the cursor to the 'Name' field, press the space bar and select a file name from the now appearing selector list. Press <ENTER>.
- Press the softkey [Load].

Modify the settings as you wish. Press [Status defin.] to edit the basic status settings. See user manual for further instructions.

To create a key card, do the following:

- Press the softkey [File].
- Select 'Data card' for storage location.
- Enter a file name.
- Press [Save].
- Press <QUIT> to close the Access Control page
- On the 'Configuration' page set 'Key card : yes'.
- Press <QUIT>.

Store only one Access Control file on a key card.

To use a key card, insert the card in the memory card slot of the 796 Titroprocessor and press the Softkey [Card sign on]. Alternatively turn off and on the instrument.