Robotic Chloride Analyzer

Applications
8.855.2013

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Applications

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Symbols used in this document:

c (X)	Molar concentration of substance X in mol/L, often written as [X]
M (X)	Molar mass of substance or atomic mass (relative mass) of substance X in g/mol
w (X)	Mass fraction of substance X, e.g. w(NaOH) = 40%
ß (X)	Mass concentration of substance X, e.g. ß(NaCl) = 20 g/L
a (X)	Activity of substance X (only corresponds to the molar concentration in very diluted solutions; as the concentration increases, dissolved particles mutually influence each other so that their activity is lower than would be expected from the concentration).
pK_p	Autoprotolysis constant of a solvent
{ }	In this document braces such as used in the formula {AgCl} indicate solid substances (precipitates) that do not consist of single molecules (in this case AgCl), but whose ionic components form an extended ionic lattice.

tiamo methods

The methods described in this document are part of the *tiamo* installation on your PC system. To use these methods you can import them into your method groups with the built-in method manager in the *tiamo* software. Please consult the *tiamo* user manual or online-help for further instructions.

The methods can be found in the following path:

C:\Program Files\Metrohm\tiamo\examples\methods\english\855 Robotic Analyzer\Chloride

(The *tiamo* installation path of your system may be different.)

The *tiamo* user manual (in pdf file format) can be found in the following path:

C:\Program Files\Metrohm\tiamo\doc\English

Accessories of the Robotic Chloride Analyzer

1.855.0010	855 Robotic Titrosampler
1.772.0110	Pump unit
1.800.0010	Dosino 2x
1.802.0010	Rod stirrer
6.0430.100	Ag Titrode OK
6.1236.020	Sleeve with SGJ 14/12 mm 2x
6.1458.040	Titration head insert 'Macro'
6.1459.300	Sample beakers 100x
6.1462.170	Robotic arm with sensor
6.1543.170	Aspiration tip M8
6.1546.030	Piston rod
6.1608.023	Bottle 1 L 2x
6.1621.000	PE container 10 L 2x
6.1805.060	FEP tubing / M6 / 60 cm 3x
6.1805.120	FEP tubing / M6 / 100 cm 2x
6.1805.510	PTFE tubing M8, 60 cm
6.1812.000	PTFE tubing 4/6 mm, 4m 2x
6.1820.050	Screw connector 2x
6.1826.100	Pump tubing PP 6.4 mm
6.1828.000	PVDF connection nipple 2x
6.1909.020	Stirring propeller 104 mm
6.2001.120	Bottle holder base, right
6.2041.840	Sample rack 59 x 120 mL
6.2053.000	Cable clip 10x
6.2061.010	Bottle holder
6.2104.020	Electrode cable 1 m
6.2151.000	Cable USB A - mini-DIN 8P
6.2621.030	Hexagon key 4 mm
6.2621.070	Hexagon key 5 mm
6.2621.130	Hexagon key 2 mm
6.2621.140	Hexagon key 2.5 mm
6.2711.070	Drip pan
6.2740.020	Spray nozzle 3x
6.2751.100	Safety shield
6.3032.150	Dosing Unit 5 mL
6.3032.220	Dosing Unit 20 mL
6.6056.112	tiamo 1.1 full version CD
T.2400.102	Ferrite cores 4x

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1 Application Information

1.1 Introduction: titration means counting!

Together with gravimetry, titration is one of the oldest analytical methods. Both belong to a group of analytical methods that is based on chemical reaction.

In a titration one determines the volume of a standard solution (titrant) that is necessary for complete chemical reaction with the analyte. The titrant contains a known amount of a particular substance.

Since Loschmidt and Avogadro we know that one gram molecule of a substance contains a defined number of particles. A standard solution is produced by dissolving a particular weight of a substance in a solvent. Each volume fraction of this standard solution contains a defined number of particles of the dissolved substance. This means that measuring the volume of a standard solution is a method of counting particles: Titration means counting!

Despite many new, mainly physical instrumental analytical methods, titrimetry as a «wet-chemistry method» still remains a standard procedure for quantitative analysis today. This is because it has a number of specific advantages:

- Titration is one of the absolute content determination methods, i.e. the result of the analysis provides direct information about the amount of substance to be determined, without instrument or method-specific factors having to be calibrated (such as is normal in relative methods, for example HPLC, atomic spectroscopy or UV/VIS photometry).
- Titrations are easy to carry out: The equipment and the procedures to be performed are simple. They are easy to understand – the fundamentals of titrimetric methods are widely known or can be learned in a short time.
- Titrations are carried out rapidly: If the total time for setting up the workplace to obtaining the analytical result is taken into consideration, then titrimetric determinations require much less time than other methods.
- Titration is a versatile method: Numerous titration methods have been drawn up, these range from the determination of inorganic ions up to the determination of complex organic compounds. The analyte concentrations can range from 100% or virtually 100% (analysis of ultrapure substances, purity determinations) down to the ppm range. Sample amounts of a few micrograms are adequate, amounts in the gram range are also possible.
- Titration supplies highly reproducible and correct results. A typical reproducibility is <1%. In high-precision titrations values of 0.1% are demanded and also achieved. For such demands the accuracy should lie within the limits of the standard deviation.
- Titrations can be automated: Titrimetric determinations can be automated to a high degree. This means that, for example, they are suitable for analyzing the content in routine operation (e.g. active ingredient content in tablets).

1.2 Precipitation reactions

Solubility and solubility product

The solubility of a dissociated sparingly soluble compound is determined by the maximum ionic product or *solubility product* K_L. This means that the product of the molar concentrations of the dissolved ions of a salt cannot be larger than the value K_L. In equilibrium this value becomes established when so much of the sparingly soluble compound is added to water that a precipitate is formed. This value is not exceeded even when the amount of precipitate is increased!

The solubility *L* is understood to be the total concentration of the substance in its saturated solution. For a binary hardly soluble salt the following applies:

$$\{ A+ B- \} \rightleftharpoons A+ + B- \text{ and, approximately,}$$

$c(A^+) \cdot c(B^-) = K_L$ (for the stoichiometric solubility product)

$L = c(AB)_{dissolved} = c(A^+) = c(B^-)$

$L = \sqrt{K_L}$

With AgCl as an example: $K_L = 10^{-10}$ mol^2/L^2, $L = 10^{-5}$ mol/L

Precipitation only begins when the product of the molar concentrations of the dissolved ions A and B, the ionic product $c(A^+) \cdot c(B^-) > K_L$. Tables of solubility products show that the known K_L values of salts differ by many factors of ten and in aqueous solution for 1:1 electrolytes values between approx. 10^2 (e.g. NaOH) and 10^{-52} (e.g. HgS) are achieved. (For HgS this would mean that only 10^{-26} mol/L Hg should dissolve. However, the actual solubility is considerably higher – precipitate aging, complex formation and other effects also play a role. Strictly speaking, the molar concentrations should also be replaced by the activities.)

The equations mentioned above only apply when the dissolved ions A^+ and B^- are in equilibrium with the precipitate. If one of the partners occurs in excess (*isoionic addition*), then the solubility depends on the ion with the lower concentration. With isoionic addition the solubility decreases – the solubility product is never exceeded. (This is why in gravimetry an excess of the precipitation reagent is always used.)

If foreign ions are added (*foreign ion addition*) the opposite takes place – the solubility increases. (In this case the *coefficients of activity* of all the ions present in solution – the *total ionic strength* – play a role.)

The determination limit for precipitation titrations depends very strongly on the solubility product. Concentrations below the solubility (the precipitation) can no longer be titrated. In some cases the solubility product can be reduced by the addition of an organic solvent (e.g. acetone or ethanol); this also results in a lower determination limit. (For chloride titration with $AgNO_3$ the determination limit in H_2O is approx. 3.5 mg/L; in glacial acetic acid, for example AOX determination, it is a few µg/L.)

Many precipitates formed during the titration are voluminous and inclusions could occur (sample ion and/or titrant). A more finely distributed precipitate, almost free from inclusions, is obtained by the addition of protective colloids (e.g. polyvinyl alcohol) or organic solvents (e.g. acetone or ethanol).

For $AgNO_3$ titrations Ag electrodes (Ag Titrode) are usually used for indication of the titrations, with ISEs usually being used for the determination of other ions.

In this Application Information we are only concerned with substances that form sparingly soluble precipitates and can therefore be determined titrimetrically.

Inorganic compounds

Ion (analyte)	Titrant	Precipitation product
Ag^+	KBr	AgBr
Ba_2^+	Na_2SO_4	$BaSO_4$
Bromide	$AgNO_3$	AgBr
Chloride	$AgNO_3$	AgCl
Cyanide	$AgNO_3$	AgCN
Fluoride	$La(NO_3)_3$	LaF_3
Iodide	$AgNO_3$	AgI
Sulfate	$BaCl_2$	$BaSO_4$
Sulfide	$AgNO_3$	Ag_2S
Thiocyanate	$AgNO_3$	AgSCN

In order to be able to titrate quantitatively the various ions present in a mixture, the differences between their solubility products must be at least three factors of ten. This means that the determination of bromide/chloride mixtures is only possible at a ratio of 1:1. If this ratio changes then problems occur or the ions can no longer be determined quantitatively in the mixture. (In contrast, chloride and iodide mixtures can be separated titrimetrically without any problems.)

The formation of precipitates from mixtures depends strictly on the solubility products of the individual components. The most sparingly soluble product is always titrated first, e.g. in the titration of halides with $AgNO_3$ the sequence is always iodide – bromide – chloride.

Solubility products of some selected substances at 25 °C *

Substance	KL	Substance	KL
$BaCO_3$	8.1 x 10–9 mol^2/L^2	AgCl	1.56 x 10^{-10} mol^2/L^2
$BaSO_4$	1.08 x 10–19 mol^2/L^2	Ag_2CrO_4	9 x 10^{-12} mol^3/L^3
CaF_2	3.95 x 10–11 mol^3/L^3	AgI	1.5 x 10^{-16} mol^2/L^2
$CaC_2O_4 \times H_2O$	2.57 x 10–9 mol^2/L^2	AgSCN	1.16 x 10^{-12} mol^2/L^2
$PbCrO_4$	1.77 x 10–14 mol^2/L^2	AgCN	2.2 x 10^{-12} mol^2/L^2
$PbSO_4$	1.06 x 10–8 mol^2/L^2	Ag_2S	1.6 x 10^{-49} mol^3/L^3
PbS	3.4 x 10–28 mol^2/L^2	HgS	1 x 10^{-52} mol^2/L^2
AgBr	7.7 x 10–13 mol^2/L^2	Hg_2S	1 x 10^{-45} mol^3/L^3
Ag_2CO_3	6.15 x 10^{-12} mol^3/L^3		

* With most substances the solubility product increases as the temperature increases (more of the substance dissolves).

If a sensor (electrode) is used for the titration that responds to both the cation and the anion (ISE) then the titration curve is similar to that obtained for the titration of a strong acid with a strong base (pH electrode). This means that when the concentration changes by a factor of ten the electrode potential changes by approx. 59 mV (29 mV for z = 2). z corresponds to the valency, e.g. +2 for Ca. This also means that for the first 59 mV difference 90% of the

ions to be determined have been titrated, for the second 59 mV difference 99% of the ions have already been titrated, etc.

The resulting titration curves are symmetrical, and the point of inflection of the curve corresponds to the equivalence point/titration endpoint.

Self-dissociation/solubility product and dilution must be taken into account in order to obtain the true endpoint. In most cases, however, the resulting systematic error is so small that it hardly affects the result. (The modern evaluation software of the Metrohm titrators at least takes the «dilution error» into account.)

2 Titrant

2.1 Titer determination of c($AgNO_3$) = 0.1 mol/L

Recommended accessories

- 6.3032.220 Dosing Unit, 20 mL
- 6.0430.100 Ag Titrode coated with Ag_2S, 6.2104.020 electrode cable

Reagents

- $c(AgNO_3)$ = 0.1 mol/L (e.g. Merck no. 109081)
  or: Weigh 16.988 g $AgNO_3$ into a 1000 mL volumetric flask and dissolve in approx. 500 mL dist. H_2O. Add 0.1 mL $c(HNO_3)$ = 2 mol/L, make up to the mark with dist. H_2O and mix. The solution must be stored in a dark bottle.
- $c(HNO_3)$ = 2 mol/L (dilute conc. HNO_3 with dist. H_2O 1:5)
- Sodium chloride (NaCl, e.g. Merck no. 102406)

Titer determination

Dry the sodium chloride overnight in a drying oven at 140 °C and leave to cool in a desiccator for at least 2 hours. The temperature must be constant during the titrations.

The titer is usually determined in triplicate and the mean value is stored as titer.

Procedure

Weigh approx. 60 mg NaCl with an accuracy of 0.1 mg into the titration beaker and dissolve in approx. 50 mL dist. H_2O. Add 1 mL $c(HNO_3)$ = 2 mol/L and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Calculation of the titer

Titer = 'MV.Sample size' * 1000 / ('DET U.EP{1}.VOL' * 'DET.U CONC' * 58.442)

where:

'MV.Sample size'	weight of the NaCl [g]
1000	conversion factor for millilitres
'DET U.EP{1}.VOL'	mL $AgNO_3$ consumed up to the endpoint
'DET.U CONC'	concentration of the $AgNO_3$
58.442	molecular weight of NaCl [g/mol]

2.2 *tiamo* method: Titer determination of c($AgNO_3$) = 0.1 mol/L

Application note

With this method the titer of a solution of $AgNO_3$ can be determined. Once the titrant bottle is open the titer value changes slightly. With the titration of a primary standard the actual titer is determined. The method consists of five different tracks. In the start series track the rack is initialized and the system prepared for the determination series. The main track handles the dissolving of the primary standard and the titration followed by the rinsing of the electrode with water, which is done after every determination. In the exit track the results are calculated, a report is printed and the data is saved in the predefined database 'Robotic Chloride Analyzer' (can be modified). In the series end track the electrode is moved to a storage beaker where it is stored in dist. water for a proper treatment of the electrode between the determination series. In case of an error, the error track is carried out, which guarantees that the electrode is moved to the storing beaker.

Sample preparation

The sodium chloride (NaCl) is dried over night in a drying oven at 140° C and allowed to cool down in a desiccator for at least 2 hours. For a determination approx. 60 mg NaCl are weighed out in a beaker with an accuracy of 0.1 mg.

Procedure

The beakers are placed on the rack and the determination series started. Approximately 60 mL dist. water and 1 mL of c(HNO_3) = 2 mol/L are added automatically for dissolving. Then the solution is titrated with c($AgNO_3$) = 0.1 mol/L and the titration stopped after the first endpoint.

Remarks:

To run this method the settings of the 855 Robotic Titrosampler have to be adjusted. The lift positions have to be defined according to the rack and beakers used. As the robotic swing arm is equipped with a beaker sensor the head has to touch the beaker brim when moving to work position. If this requirement can not be fulfilled no beaker will be recognized. One special beaker has to be defined including its work position. Special beaker 1 is used for a proper electrode treatment between determination series and in case of an error.

Result report (example)

tiamo™ titration and more

Robotic Chloride Analyzer
Titer determination

Programm version tiamo 1.1

2005-11-02 09:04:22 UTC+1

Results report

Determination

Method	Titer determination of c(AgNO3) = 0.1 M
Method saving date	2005-09-21 11:00:53 UTC+2
Method version	1
Method state	original
Determination ID	75565b4a:10677812b2d:-7da9
Determination start	2005-09-21 11:58:15 UTC+2
Determination state	original
Determination version	1
Run number	17
User (full name)	Metrohm

Sample data

Sample Identification 1	Titer AgNO3 (0.1 M)
Sample size	0.0497 g

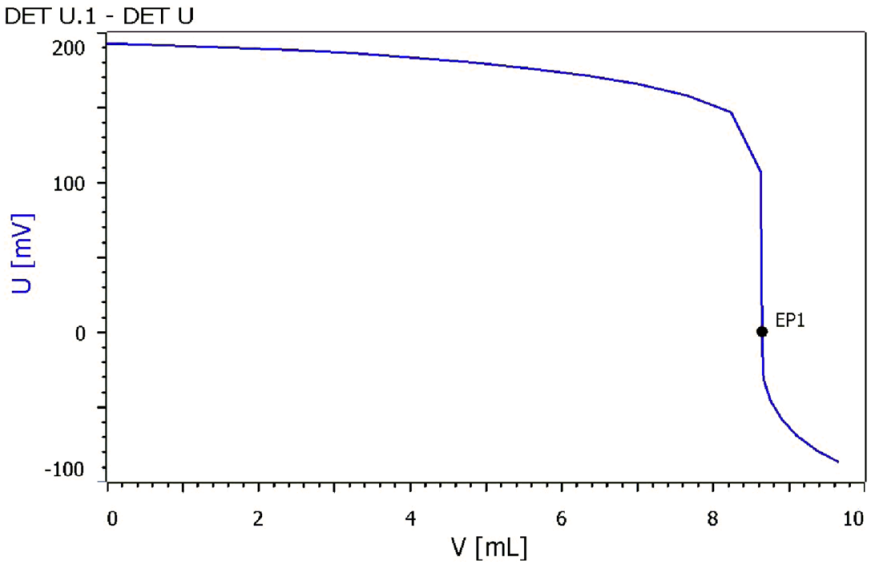
End points

DET U **DET U.1**

EP1	0.3	mV	8.6497	mL

Results

Titer AgNO3	**0.9832**
Mean value titer	**1.0004**



Statistical data (short)

Robotic Chloride Analyzer
Titer determination

Programm version tiamo 1.1

2005-11-02 09:04:22 UTC+1

Method . . . . . Titer determination of c(AgNO3) = 0.1 mol_L
Number of single determinations 10

Result name	n	Mean value	s +/-	s rel
Titer AgNO3	10	1.0004	0.00750	0.75 %

Page 2 of 2

Statistical results (example)

Titer determination $AgNO_3$ (0.1M)

Sample size [g]	Titer
0.0571	1.0001
0.0501	1.0040
0.0512	1.0029
0.0566	0.9944
0.0600	0.9960
0.0564	1.0075
0.0499	1.0077
0.0566	1.0059
0.0547	1.0019
0.0497	0.9832
Mean value	1.0004
abs. std. dev.	0.0075
rel. std. dev. %	0.75

3 Typical applications for the Robotic Chloride Analyzer

3.1 Determination of chloride in tap water

Recommended accessories

- 6.0430.100 Ag Titrode with Ag_2S coating, 6.2104.020 electrode cable
- 6.3032.220 Dosing Unit, 20 mL

Reagents

- Titrant: $c(AgNO_3)$ = 0.01 mol/L. Purchased ready-to-use or self-prepared: dilute $c(AgNO_3)$ = 0.1 mol/L 1:10 with dist. H_2O.
- Nitric acid: $c(HNO_3)$ = approx. 2 mol/L; dilute $w(HNO_3)$ = 65% 1:5 with dist. H_2O.

Analysis

60 mL water sample is pipetted into the titration beaker. After adding 5 mL nitric acid titrate with $c(AgNO_3)$ = 0.01 mol/L to after the first endpoint.

Calculation

mg/L chloride = 'DET U.EP{1}.VOL' * 'DET.U TITER' * 'DET.U CONC' * 35.453 * 1000 / 'MV.Sample size'

where:

'DET U.EP{1}.VOL	mL $AgNO_3$ consumed up to the endpoint
'DET.U TITER'	titer of the $AgNO_3$
'DET.U CONC'	concentration of the $AgNO_3$ [mol/L]
35.453	molecular weight of NaCl [g/mol]
1000	conversion factor for gram
'MV.Sample size'	volume of the sample [mL]

Remarks

- The Ag_2S coating on the Ag Titrode provides short response times and increases the long-term stability of this electrode.
- If a sample contains sulfides or hydrogen sulfide then these are comprised in the first, very distinct endpoint. Chloride is then calculated from the difference EP2 – EP1.
- As the chloride content in tap water is very low, it is advisable to add a standard of known chloride concentration to the sample and calculate the chloride content of the sample after the determination.

3.2 *tiamo* method: Chloride in tap water

Application note

With this method the content of chloride in tap water can be determined. The method consists of five different tracks. In the start series track the rack is initialized and the system prepared for the determination series. The main track handles the titration followed by the rinsing of the electrode which is done after every determination. In the exit track the results are calculated, a report is printed and the data is saved in the predefined database Robotic Chloride Analyzer (can be modified). In the series end track, the electrode is moved to a storage beaker where it is stored in dist. water for a proper electrode treatment between the determination series. In case of an error, the error track is carried out, which guarantees that the electrode is rinsed and moved to the storage beaker.

Sample preparation

60 mL water sample are pipetted into a titration beaker.

Procedure

The beakers are placed on the rack and the determination series started. 5 mL c(HNO_3) = 2 mol/L are added automatically to the sample. The solution is then titrated with c($AgNO_3$) = 0.1 mol/L and the titration stopped after the first endpoint (with sulfides after the second endpoint).

The value 35.453 in the calculation formula is the molecular weight of chloride in [g/mol].

If a sample contains sulfides or hydrogen sulfide then these are comprised in the first, very distinct endpoint. Chloride is then calculated from the difference EP2 – EP1.

Remarks

To run this method the settings of the 855 Robotic Titrosampler have to be adjusted. The lift positions have to be defined according to the rack and beakers used. As the robotic swing arm is equipped with a beaker sensor the head has to touch the beaker brim when moving to the work position. If this requirement can not be fulfilled no beaker will be recognized. One special beaker has to be defined including its own work position. Special beaker 1 is used for a proper electrode treatment between determination series and in case of an error.

Result report (example)

tiamo™ titration and more

Robotic Chloride Analyzer
Chloride in tap water

Programm version tiamo 1.1

2005-11-02 10:24:26 UTC+1

Results report

Determination

Method	Chloride in tapwater
Method saving date	2005-09-21 15:35:36 UTC+2
Method version	1
Method state	original
Determination ID	75565b4a:10677812b2d:-7cb6
Determination start	2005-09-21 15:39:07 UTC+2
Determination state	original
Determination version	1
Run number	22
User (full name)	Metrohm

Sample data

Sample Identification 1	Tap water
Sample size	60 mL

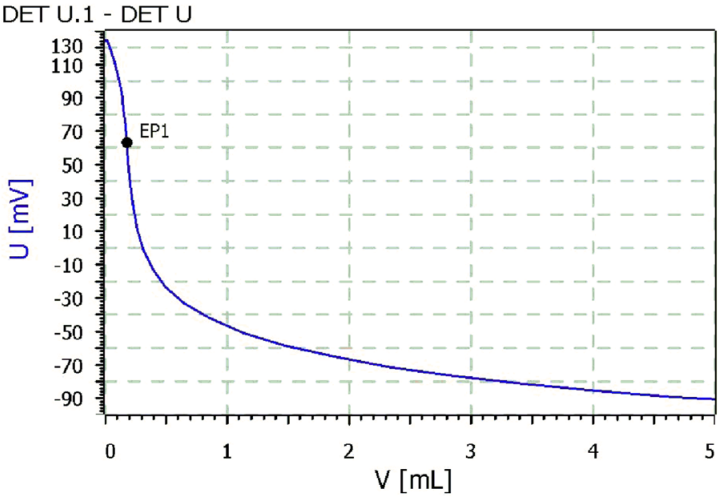
End points

DET U **DET U.1**

EP1	63.0	mV	0.1806	mL

Results

content of chloride **10.6773 mg/L**



Statistical results (example)

Chloride in tap water

Sample size [mL]	Content [mg/L]
60.0000	10.6773
60.0000	10.5519
60.0000	10.7684
60.0000	10.7010
60.0000	10.7223
60.0000	10.8660
60.0000	10.6539
60.0000	10.5465
60.0000	10.6228
60.0000	10.4422
Mean value	10.6552
abs. std. dev.	0.1217
rel. std. dev. %	1.14

3.3 Determination of chloride in wine

Recommended accessories

- 6.3032.220 Dosing Unit, 20 mL
- 6.0430.100 Ag Titrode with Ag_2S coating and 6.2104.020 electrode cable

Reagents

- Titrant: $c(AgNO_3) = 0.05$ mol/L, e.g. Merck no. 111718
  OR: Weigh out 8.50 g $AgNO_3$ (e.g. Merck no. 101510) into a 1000 mL volumetric flask, add 1 mL $w(HNO_3) = 65\%$, dissolve in dist. H_2O, make up to the mark and mix.
- Nitric acid: $w(HNO_3) = 65\%$, e.g. Merck no. 100462

General

The chloride content of wine is normally 50...200 mg/L (0.05...0.2 g/L). Contents of up to 600 mg/L have been found in wines from vineyards near the sea. In CH and the EU wines with a content of >500 mg/L chloride must be objected to. The USA and Au do not have any corresponding regulations.

The potentiometric titration method described below is a classic example of how a determination method can be simplified. The USA und SA describe methods that are preceded by complicated sample preparation steps for decoloring the wine. An additional complication is brought about by the determination itself, which is a back-titration.

Analysis

Pipet 50 mL sample into a beaker, treat with 1 mL $c(HNO_3) = 2$ mol/L and approx. 25 mL dist. H_2O and then titrate with $c(AgNO_3) = 0.1$ mol/L until after the first endpoint.

Calculations

The chloride content is given in g/L chloride and g/L NaCl.

g/L Cl^- = 'DET U.EP{1}.VOL' * 'DET.U TITER' * 'DET.U CONC' * 35.453 / 'MV.Sample size'

g/L NaCl = 'DET U.EP{1}.VOL' * 'DET.U TITER' * 'DET.U CONC' * 58.442 / 'MV.Sample size'

where:

'DET U.EP{1}.VOL'	mL $AgNO_3$ consumed up to the endpoint
'DET.U TITER'	titer of the $AgNO_3$
'DET.U CONC'	concentration of the $AgNO_3$ [mol/L]
'MV.Sample size'	volume of the sample
35.453	molecular weight of chloride
58.442	molecular weight of sodium chloride

Remarks

The normal chloride content of wine is between 50...220 mg/L. Extreme values of 5 mg/L and 600 mg/L have also been found. There is normally no difference between red and white wines.

The concentration of the $AgNO_3$ should be adjusted to the sample in order to make sure that the specifications of the burette are complied.

3.4 *tiamo* method: Determination of chloride in wine

Application note

With this method the content of chloride in wine can be determined. The method consists of five different tracks. In the start series track the rack is initialized and the system prepared for the determination series. The main track handles the titration followed by the rinsing of the electrode which is done after every determination. In the exit track the results are calculated, a report is printed and the data is saved in the predefined database 'Robotic Chloride Analyzer' (can be modified). In the series end track the electrode is moved to a storage beaker where it is stored in dist. water for a proper electrode treatment between the determination series. In case of an error, the error track is carried out, which guarantees that the electrode is moved to the storing beaker.

Sample preparation

50 mL of the sample are pipetted into a titration beaker.

Procedure

The beakers are placed on the rack and the determination series started. Approximately 25 mL dist. water and 1 mL $c(HNO_3) = 2$ mol/L are added automatically. The solution is then titrated with $c(AgNO_3) = 0.01$ mol/L and the titration stopped after the first endpoint.

Two results are calculated. One is the content of chloride and the other the content of sodium chloride in the sample. The values 35.453 and 58.442 respectively in the calculation formula are the molecular weights of chloride and sodium chloride in [g/mol].

Remarks

To run this method the settings of the 855 Robotic Titrosampler have to be adjusted. The lift positions have to be defined according to the rack and beakers used. As the robotic swing arm is equipped with a beaker sensor the head has to touch the beaker brim when moving to the work position. If this requirement can not be fulfilled no beaker will be recognized. One special beaker has to be defined including its work position. Special beaker 1 is used for a proper electrode treatment between determination series as well as in case of an error for both rinsing and storing.

Result report (example)

tiamo™ titration and more

Robotic Chloride Analyzer
Chloride in wine

Programm version tiamo 1.1

2005-09-28 14:42:18 UTC+2

Results report

Determination

Method	Determination of choride in wine
Method saving date	2005-09-28 14:04:01 UTC+2
Method version	1
Method state	original
Determination ID	282da969:1069b4b5824:-7cf1
Determination start	2005-09-28 14:34:50 UTC+2
Determination state	original
Determination version	1
Run number	10
User (full name)	Metrohm

Sample data

Sample Identification 1	Red wine
Sample size	50 mL

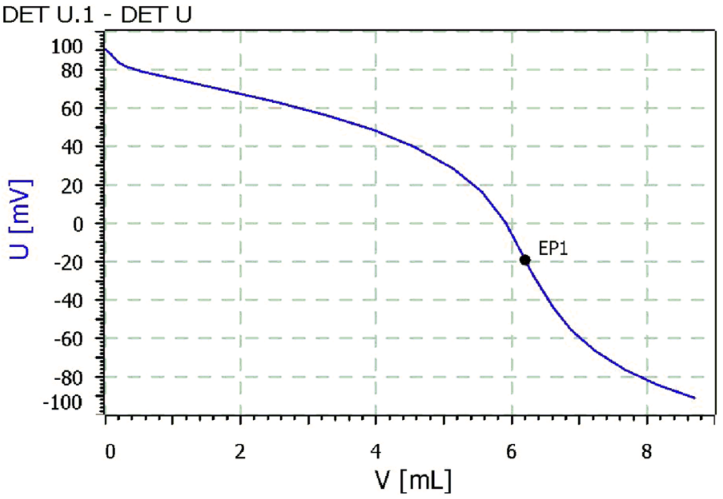
End points

DET U **DET U.1**

EP1	-19.3	mV	6.2043	mL

Results

content of chloride	**0.0441**	**g/L**
content of sodiumchlorid	**0.0727**	**g/L**



Statistical results (example)

Chloride in red wine

Sample size [mL]	Content [g/L]
50.0000	0.0442
50.0000	0.0442
50.0000	0.0441
50.0000	0.0441
50.0000	0.0441
50.0000	0.0439
50.0000	0.0440
50.0000	0.0441
50.0000	0.0442
50.0000	0.0442
Mean value	0.0441
abs. std. dev.	0.0001
rel. std. dev. %	0.23

3.5 Determination of Ammonium chloride

Recommended accessories

- 6.3032.220 Dosing Unit, 20 mL
- 6.0430.100 Ag Titrode with Ag_2S coating
- 6.2104.020 electrode cable

Reagents

- Titrant I: $c(AgNO_3)$ = 0.1 mol/L

Any additional reagents required are mentioned under the individual substances.

General remarks

Direct titration with $AgNO_3$ is used for this method, which serves to determine halide contents (e.g. in hydrochlorides, salts, injection solutions) or organic halides after saponification (and reduction with Zn). The total substance content is then calculated from the halide content.

For the potentiometric indication of this titration we recommend the Ag Titrode with Ag_2S coating as it has decisive advantages over the uncoated electrodes.

The Ag_2S coating increases the electrode's stability compared to the uncoated Ag electrode. The potentials are established quickly and the electrode surface does not have to be re-polished – just wipe with a soft, moist paper tissue.

The Ag Titrode with Ag_2S coating is a robust electrode that requires little maintenance.

General procedure

Direct titration

Weigh in and dissolve the sample, saponify if required, acidify and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Calculations

Mass fraction *w* in % = 'DET U.EP{1}.VOL' * 'DET.U TITER' * 'DET.U CONC' * 53.49 *100 / ('MV.Sample size' * 1000)

where:

'DET U.EP{1}.VOL'	mL AgNO3 consumed up to the endpoint
'DET.U TITER'	titer of the AgNO3
'DET.U CONC'	concentration of the AgNO3 [mol/L]
'MV.Sample size'	weight of the sample [g]
53.49	molecular weight of ammonium chloride [g/mol]
100	conversion factor for %
1000	conversion factor for liter

The following substances can also be titrated according to this method, though the calculation formula has to be adjusted:

Aluminum chlorohydrate, chloride content (USP)

Weigh approx. 0.700 g sample into a 100 mL volumetric flask, dissolve in dist. H_2O, add 10 mL $c(HNO_3)$ = 2 mol/L, fill up to the mark with dist. H_2O and mix. Pipet 10.0 mL of this solution (1/10 of the sample weight) into the titration beaker, add 50 mL dist. H_2O and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Aluminum zirconium octachlorohydrate, chloride content (USP)

Weigh approx. 0.250 g sample into the titration beaker and dissolve in 100 mL dist. H_2O plus 10 mL $c(HNO_3)$ = 2 mol/L. Titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Ammonium bromide (Pharm.Europe)

Weigh approx. 1.5 g sample into a 100 mL volumetric flask, dissolve in dist. H_2O, fill up to the mark with dist. H_2O and mix. Pipet 10.0 mL of this solution (1/10 of the sample weight) into the titration beaker, add 50 mL dist. H_2O and 5 mL $c(HNO_3)$ = 2 mol/L and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight (NH_4Br) = 97.94 g/mol

Ammonium chloride (USP)

Weigh approx. 0.100 g sample into the titration beaker and dissolve in 50 mL dist. H_2O. Add 2 mL glacial acetic acid and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight (NH_4Cl) = 53.49 g/mol

Diatrizoate meglumine (USP)

Weigh approx. 0.400 g sample into a round-bottomed flask and add 30 mL c(NaOH) = 1.5 mol/L, 0.5 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 1 hour. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 5 mL glacial acetic acid to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{11}H_9I_3N_2O_4$ x $C_7H_{17}NO_5$) = 809.12 g/mol

Diatrizoate sodium (USP)

Weigh approx. 0.300 g sample into a round-bottomed flask and add 30 mL c(NaOH) = 1.5 mol/L, 0.5 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 1 hour. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 5 mL glacial acetic acid to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{11}H_8I_3N_2NaO_4$) = 635.88 g/mol

Diatrizoic acid (USP)

Weigh approx. 0.300 g sample into a round-bottomed flask and add 30 mL c(NaOH) = 1.5 mol/L, 0.5 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 1 hour. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 5 mL glacial acetic acid to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{11}H_9I_3N_2O_4$) = 613.90 g/mol

Haemodialysis solution, chloride content (Pharm.Europe)

Exactly measure into the titration beaker a sample volume corresponding to approx. 60 mg chloride. Add 50 mL dist. H_2O and 5 mL $c(HNO_3)$ = 2 mol/L and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Haemofiltration solution, chloride content (Pharm.Europe)

Weigh into the titration beaker a sample volume corresponding to approx. 60 mg chloride. Add 50 mL dist. H_2O and 5 mL $c(HNO_3)$ = 2 mol/L and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Hydrocortisone sodium phosphate, chloride content (USP)

Weigh approx. 3.0 g sample into the titration beaker and dissolve in 75 mL dist. H_2O. Add 1 mL $w(HNO_3)$ = 65% and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Iodipamide (USP)

Weigh approx. 0.300 g sample into a round-bottomed flask and add 30 mL c(NaOH) = 1.5 mol/L, 0.5 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 30 min. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 5 mL glacial acetic acid to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{20}H_{14}I_6N_2O_6$) = 1139.74 g/mol

Iodipamide meglumine injection (USP)

Pipet a sample volume corresponding to approx. 5 g iodipamide meglumine into a 100 mL round-bottomed flask and determine the sample weight. Fill up to the mark with $c(NaOH)$ = 1.25 mol/L and mix. Pipet 10.0 mL of this solution (1/10 of the sample weight) into a round-bottomed flask, add 20 mL $c(NaOH)$ = 1.5 mol/L, 0.5 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 30 min. Cool down the mixture, rinse out the condenser with 20 mL dist. H_2O and filter the flask's contents through a sintered glass filter into a titration beaker. Rerinse the flask and the filter several times with dist. H_2O. Add 5 mL glacial acetic acid to the combined filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{20}H_{14}I_6N_2O_6$ x 2 $C_7H_{17}NO_5$) = 1530.17 g/mol

Iohexol (Pharm.Europe & USP)

Weigh approx. 0.500 g sample into a round-bottomed flask and add 25 mL w(NaOH) = 42%, 20 mL dist. H_2O, 1 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 30 min. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 10 mL glacial acetic acid to the filtrates and titrate immediately with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{19}H_{26}I_3N_3O_9$) = 821.13 g/mol

Iopamidol (Pharm.Europe & USP)

Weigh approx. 0.300 g sample into a round-bottomed flask and add 5 mL w(NaOH) = 42%, 20 mL dist. H_2O, 1 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 30 min. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 5 mL glacial acetic acid to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{17}H_{22}I_3N_3O_8$) = 777.07 g/mol

Iopanoic acid (Pharm.Europe & USP)

Weigh approx. 0.150 g sample into a round-bottomed flask and add 5 mL w(NaOH) = 42%, 20 mL dist. H_2O, 1 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 1 hour. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 40 mL $c(H_2SO_4)$ = 1 mol/L to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{11}H_{12}I_3NO_2$) = 570.92 g/mol

Iothalamic acid (Pharm.Europe & USP)

Weigh approx. 0.150 g sample into a round-bottomed flask and add 5 mL w(NaOH) = 42%, 20 mL dist. H_2O, 1 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 30 min. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 40 mL $c(H_2SO_4)$ = 1 mol/L to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{11}H_9I_3N_2O_4$) = 613.90 g/mol

Ioversol (USP)

Weigh approx. 0.300 g sample into a round-bottomed flask and add 12 mL c(NaOH) = 5 mol/L, 20 mL dist. H_2O, 1 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 30 min. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 40 mL $c(H_2SO_4)$ = 1 mol/L to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{18}H_{24}I_3N_3O_9$) = 807.10 g/mol

Ioxaglic acid (USP)

Weigh approx. 0.500 g (0.300 g) sample into a round-bottomed flask and add 12 mL c(NaOH) = 5 mol/L, 20 mL dist. H_2O, 1 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 30 min. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 40 mL $c(H_2SO_4)$ = 1 mol/L to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{24}H_{21}I_6N_5O_8$) = 1268.86 g/mol

Ioxilan (USP)

Weigh approx. 0.500 g (0.300 g) sample into a round-bottomed flask and add 40 mL c(NaOH) = 1.25 mol/L, 1 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 1 hour. Cool the solution, rinse the condenser with 20 mL dist. H_2O, add 5 mL glacial acetic acid and leave to cool. Filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter with $c(CH_3COOH)$ = 1 mol/L. Titrate the filtrates with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{18}H_{24}I_3N_3O_8$) = 791.10 g/mol

Ipodate sodium (USP)

Weigh approx. 0.300 g sample into a round-bottomed flask and add 30 mL c(NaOH) = 1.25 mol/L, 0.5 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 1 hour. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 5 mL glacial acetic acid to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{12}H_{12}I_3N_2NaO_2$) = 619.93 g/mol

Ipratropium bromide (Pharm.Europe)

Weigh approx. 0.350 g sample into the titration beaker and dissolve in 50 mL dist. H_2O. Add 3 mL $c(HNO_3)$ = 2 mol/L and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{20}H_{30}BrNO_3$) = 412.37 g/mol

Lindane (USP)

Weigh approx. 0.400 g (0.150 g) sample into an Erlenmeyer flask, add 20 mL ethanol and heat up on a steam bath until the sample has dissolved completely. After the solution has cooled down, add 20 mL ethanolic w(KOH) = 5%, mix thoroughly and leave standing for 10 min. Neutralize with $c(HNO_3)$ = 2 mol/L, then add another 5 mL $c(HNO_3)$ = 2 mol/L. Titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_6H_6Cl_6$) = 290.83 g/mol

Lomustine (Pharm.Europe)

Weigh approx. 0.200 g sample into a round-bottomed flask and dissolve in 3 mL ethanol. Add 20 mL w(NaOH) = 20%. Mount a reflux condenser and boil for 2 hours. Add approx. 50 mL dist. H_2O, leave to cool and, using dist. H_2O, rinse quantitatively into the titration beaker. Add 4 mL $w(HNO_3)$ = 65% and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_9H_{16}ClN_3O_2$) = 233.70 g/mol

Mecamylamine hydrochloride, chloride content (USP)

Weigh approx. 0.500 g (0.250 g) sample into the titration beaker and dissolve in 5 mL dist. H_2O. Add 5 mL glacial acetic acid plus 50 mL methanol and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Multiple electrolyte injection, chloride content (USP)

Weigh into the titration beaker a sample volume corresponding to approx. 50 mg chloride. Dilute with dist. H_2O to approx. 50 mL, add 1 mL glacial acetic acid and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Melphalan (USP)

Weigh approx. 0.200 g sample into the titration beaker and dissolve in 20 mL c(NaOH) = 0.5 mol/L. Cover the beaker with a watch glass and boil the solution for 30 min. Periodically replace the water lost by evaporation by dist. H_2O. After the solution has cooled down, add 50 mL dist. H_2O and 5 mL glacial acetic acid and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{13}H_{18}Cl_2N_2O_2$) = 306.07 g/mol

Meperidine hydrochloride, chloride content (USP)

Weigh approx. 0.500 g (0.300 g) sample into the titration beaker and dissolve in 15 mL dist. H_2O. Add 5 mL glacial acetic acid plus 50 mL methanol and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Methyclothiazide (USP)

Weigh approx. 0.350 g sample into a round-bottomed flask and add 40 mL methanolic w(KOH) = 5%. Mount a reflux condenser and boil for 1 hour. After the solution has cooled down, rinse the condenser with 20 mL dist. H_2O and rinse the contents of the flask into the titration beaker with two portions of 20 mL methanol each. Add 10 mL glacial acetic acid and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_9H_{11}Cl_2N_3O_4S_2$) = 360.24 g/mol

Metrifonate (Pharm.Europe)

Weigh approx. 0.300 g sample into an Erlenmeyer flask and dissolve in 30 mL ethanol. Add 10 mL ethanolamine and leave to react for 1 hour at 20…22 °C. Add 100 mL dist. H_2O and 15 mL $w(HNO_3)$ = 65%, cool to room temperature and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_4H_8Cl_3P$) = 193.44 g/mol

Phenmetrazine hydrochloride, chloride content (USP)

Weigh approx. 0.350 g (0.250 g) sample into the titration beaker, add 125 mL dist. H_2O and 1.5 mL $c(H_2SO_4)$ = 1 mol/L and leave to react for 15 min under stirring. Titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Potassium chloride (USP)

Weigh approx. 0.200 g (0.100 g) sample into the titration beaker and dissolve in 10 mL dist. H_2O. Add 10 mL glacial acetic acid and 75 mL methanol and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight (KCl) = 74.55 g/mol

Potassium iodide, oral solution and tablets (USP)

Weigh into the titration beaker a sample quantity corresponding to approx. 200 mg KI and dissolve in 40 mL dist. H_2O. Add 25 mL ethanol and 1 mL $c(HNO_3)$ = 1 mol/L and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight (KI) = 166.00 g/mol

Pralidoxime chloride, chloride content (USP)

Weigh approx. 0.300 g (0.200 g) sample into the titration beaker and dissolve in 100 mL dist. H_2O. Add 20 mL glacial acetic acid and 10 drops of (p-tert.-octylphenoxy) nonaethoxyethanol and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Pyridoxine hydrochloride, chloride content (USP)

Weigh approx. 0.500 g (0.250 g) sample into the titration beaker and dissolve in 50 mL methanol. Add 5 mL glacial acetic acid and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Ringer's solution, Ringer's dextrose injection, chloride content (USP)

Pipet 10.0 mL sample into the titration beaker. Add 75 mL methanol and 10 mL glacial acetic acid and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Sodium amidotrizoate (Pharm.Europe)

Weigh approx. 0.150 g sample into a round-bottomed flask and add 5 mL w(NaOH) = 42%, 20 mL dist. H_2O, 1 g zinc powder and a few boiling stones. Mount a reflux condenser and boil for 30 min. Cool the solution, rinse the condenser with 20 mL dist. H_2O and filter the contents of the flask through a sintered glass filter into the titration beaker. Rerinse flask and filter several times with dist. H_2O. Add 40 mL $c(H_2SO_4)$ = 1 mol/L to the filtrates and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight ($C_{11}H_8I_3N_2NaO_4$) = 635.88 g/mol

Sodium chloride (Pharm.Europe & USP)

Weigh approx. 1.0 g sample into a 100 mL volumetric flask, dissolve in dist. H_2O, fill up to the mark with dist. H_2O and mix. Pipet 10.0 mL of this solution (1/10 of the sample weight) into the titration beaker, add 50 mL dist. H_2O and 5 mL $c(HNO_3)$ = 2 mol/L and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight (NaCl) = 58.44 g/mol

Sodium nitroprusside (Pharm.Europe & USP)

Weigh approx. 0.200 g sample into the titration beaker and dissolve in 100 mL dist. H_2O. Add 0.1 mL $c(H_2SO_4)$ = 1 mol/L and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

1 mL $c(AgNO_3)$ = 0.1 mol/L corresponds to 13.10 mg $Na_2[Fe(CN)_5NO]$ (C01)

Succinylcholine chloride, chloride content (USP)

Weigh approx. 0.400 g (0.200 g) sample into the titration beaker and dissolve in 5 mL dist. H_2O. Add 5 mL glacial acetic acid and 50 mL methanol and titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

Zolazepam hydrochloride, chloride content (USP)

Weigh approx. 0.400 g sample into the titration beaker, add 5 mL dist. H_2O, 5 mL glacial acetic acid and 50 mL methanol and dissolve the sample. Titrate with $c(AgNO_3)$ = 0.1 mol/L past the first endpoint.

Molecular weight of chloride: 35.453 g/mol

3.6 *tiamo* method: Determination of ammonium chloride

Application note

With this method the mass fraction of ammonium chloride can be determined. The method consists of six different tracks. In the start series track the rack is initialized and the system prepared for the determination series. The main track handles the dissolving and the titration followed by the rinsing of the electrode with dist. water which is done after every determination. In the exit track the results are calculated, a report is printed and the data is saved in the predefined database Robotic Chloride Analyzer (can be modified). In the series end track, the electrode is moved to a storage beaker where it is stored in dist. water for a proper electrode treatment between the determination series. In case of an error, the error track is carried out, which guarantees that the electrode is moved to the storing beaker.

Sample preparation

Approximately 50 mg of the sample are weighed into a titration beaker with an accuracy of 0.1 mg.

Procedure

The beakers are placed on the rack and the determination series started. Approximately 60 mL of dist. water and 2 mL of c(HNO3) = 2 mol/L are added automatically for dissolving. The solution is then titrated with c(AgNO3) = 0.1 mol/L and the titration stopped after the first endpoint.

The value 53.49 in the calculation formula is the molecular weight of ammonium chloride in [g/mol]. The factor 100 is needed to receive percent as result.

Remarks

To run this method the settings of the 855 Robotic Titrosampler have to be adjusted. The lift positions have to be defined according to the rack and beakers used. As the robotic swing arm is equipped with a beaker sensor the head has to touch the beaker brim when moving to the work position. If this requirement can not be fulfilled no beaker will be recognized .

Two special beaker have to be defined including their own work positions. Special beaker 1 is used for the rinsing of the electrode in case of an error. Special beaker 2 is used for the storing of the electrode between the determination series.

Result report (example)

Robotic Chloride Analyzer
Determination of ammonium chloride

Programm version tiamo 1.1

2005-09-26 10:28:10 UTC+2

Results report

Determination

Method	Determination of ammonium chloride
Method saving date	2005-09-26 09:23:18 UTC+2
Method version	1
Method state	original
Determination ID	-1667c48e:10691179cc0:-7ed9
Determination start	2005-09-26 09:52:35 UTC+2
Determination state	original
Determination version	1
Run number	5
User (full name)	Metrohm

Sample data

Sample Identification 1	Ammoniumchlorid
Sample size	0.0543 g

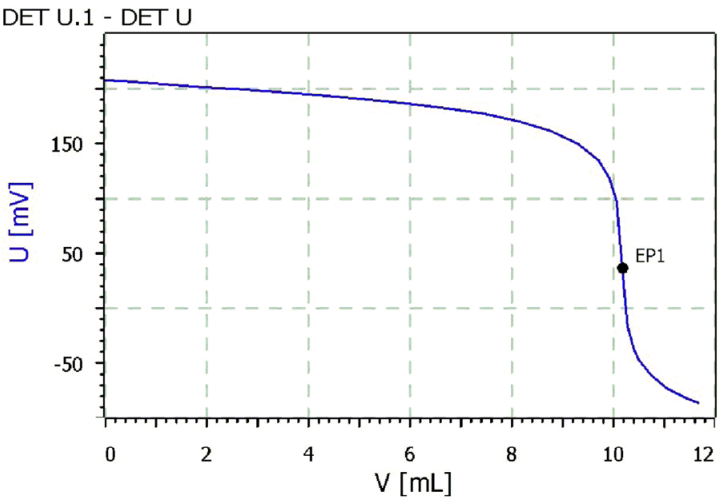
End points

DET U **DET U.1**

EP1	36.6	mV	10.1843	mL

Results

Mass fraction of chloride	**96.6114 %**



Statistical results (example)

Chloride in ammonium chloride

Sample size [mL]	Mass fraction [%]
50.0000	95.8703
50.0000	95.8037
50.0000	95.9569
50.0000	96.0416
50.0000	96.0601
50.0000	96.1211
50.0000	96.2679
50.0000	95.8551
50.0000	96.2017
50.0000	96.4129
Mean value	96.0591
abs. std. dev.	0.1961
rel. std. dev. %	0.20

3.7 Determination of Chloride content in acidic copper baths

Recommended accessories

- 6.3032.220 Dosing Unit, 20 mL
- 6.0430.100 Ag Titrode coated with Ag_2S, 6.2104.020 electrode cable

Reagents

- $c(AgNO_3)$ = 0.01 mol/L, $c(AgNO_3)$ = 0.1 mol/L diluted with dist. H_2O 1:10.

General

Acidic copper baths contain only small amounts of chloride. The titration is therefore carried out with diluted $AgNO_3$ solution. Silver nitrate solution precipitates chloride ions as sparingly soluble silver chloride.

$$NaCl + AgNO_3 \Rightarrow AgCl + NaNO_3$$

Analysis

Pipet 25.0 mL sample into the glass beaker and add approx. 35 mL dist. H_2O. Titrate with $c(AgNO_3)$ = 0.01 mol/L past the first endpoint.

Calculations

mg/L chloride = 'DET U.EP{1}.VOL' * 'DET.U TITER' * 'DET.U CONC' * 35.453 *1000 / 'MV.Sample size'

where:

mg/L NaCl	'RS. content of chloride' * 1.64898
'DET U.EP{1}.VOL'	mL $AgNO_3$ consumed up to the endpoint
'DET.U TITER'	titer of $AgNO_3$
'DET.U CONC	concentration of $AgNO_3$
35.453	molecular weight of chloride [g/mol]
1000	conversion factor for gram
'MV.Sample size'	volume of the sample [ml]
'RS. content of chloride'	determined content of chloride of the sample [mg/L]
1.64898	calculation factor

3.8 *tiamo* method: Chloride content in acidic copper baths

Application note

With this method the content of chloride in acidic copper baths can be determined. Acidic copper baths contain only small amounts of chloride. Therefore the titration is carried out

with diluted c($AgNO_3$) = 0.01 mol/L solution. The method consists of five different tracks. In the start series track the rack is initialized and the system prepared for the determination series. The main track handles the titration and the rinsing of the electrode which is done after every determination. In the exit track the results are calculated, a report is printed and the data is saved in the predefined database Robotic Chloride Analyzer (can be modified). In the series end track, the electrode is moved to a storage beaker where it is stored in dist. water for a proper electrode treatment between the determination series. In case of an error, the error track is carried out, which guarantees that the electrode is moved to the storing beaker.

Sample preparation

25 mL of the copper bath are pipetted in a sample beaker.

Procedure

The beakers are placed on the rack and the determination series is started. Approximately 30 mL of dist. water are added automatically. The solution is then titrated with $c(AgNO_3)$ = 0.01 mol/L and the titration stopped after the first endpoint.

The value 35.453 in the calculation formula is the molecular weight of chloride in [g/mol]. 1000 is a correction factor for the millilitres. The factor 1.64898 is used to calculate the content of sodium chloride.

Remarks

To run this method the settings of the 855 Robotic Titrosampler have to be adjusted. The lift positions have to be defined according to the rack and beakers used. As the robotic swing arm is equipped with a beaker sensor the head has to touch the beaker brim when moving to the work position. If this requirement can not be fulfilled no beaker will be recognized.

Two special beaker have to be defined including their own work positions. Special beaker 2 is used for a proper electrode treatment between the determination series. In case of an error the electrode is moved to special beaker 1 where it is rinsed and then it is moved to special beaker 2.

Result report (example)

Robotic Chloride Analyzer
Chloride in acidic copper baths

Programm version tiamo 1.1

2005-10-31 14:59:14 UTC+1

Results report

Determination

Method	Chloride in acidic copper baths
Method saving date	2005-09-27 10:36:36 UTC+2
Method version	1
Method state	original
Determination ID	-4194d45f:1069643070f:-7d77
Determination start	2005-09-27 10:58:57 UTC+2
Determination state	original
Determination version	1
Run number	22
User (full name)	Metrohm

Sample data

Sample Identification 1	Acidic copper bath
Sample size	25 mL

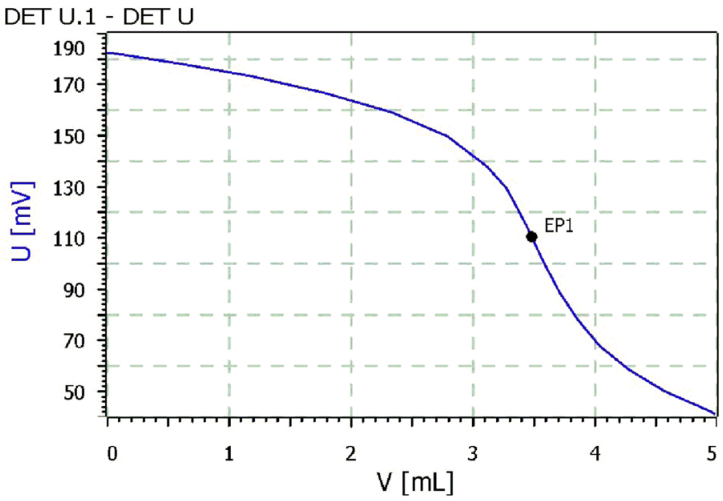
End points

DET U **DET U.1**

EP1	110.3	mV	3.4831	mL

Results

content of chloride	**49.4982**	**mg/L**
content of sodiumchlorid	**81.6215**	**mg/L**



Page 1 of 1

Statistical results (example)

Chloride in acidic copper baths

Sample size [mL]	Content [mg/L]
25.0000	81.8248
25.0000	82.1294
25.0000	81.9918
25.0000	81.8631
25.0000	81.7045
25.0000	81.6085
25.0000	81.6215
25.0000	81.3078
25.0000	81.2583
25.0000	81.4487
Mean value	81.6758
abs. std. dev.	0.2853
rel. std. dev. %	0.35

3.9 Chloride in broth

Recommended accessories

- 6.0430.100 Ag Titrode with Ag_2S coating, 6.2104.020 electrode cable
- 6.3032.220 Dosing Unit, 20 mL

Reagents

- Titrant: $c(AgNO_3)$ = 0.1 mol/L
- Nitric acid: $c(HNO_3)$ = approx. 2 mol/L
  $w(HNO_3)$ = 65% is diluted 1:5 with dist. H_2O
- Protective colloid: polyvinyl alcohol solution

  40 mg polyvinyl alcohol are dissolved in 100 mL hot dist. water and allowed to cool down.

Sample preparation

Powdered, granulated and pasty samples: 10.0 g are dissolved in approximately 500 mL hot dist. water, allowed to cool down, made up to 1 liter and mixed.
Liquid seasonings: 25.0 g are diluted to 1 liter with dist. water.

Analysis

15 mL of the prepared sample solution are pipetted into the titration beaker and diluted with dist. water to approx. 60 mL. After the addition of 2 mL $c(HNO_3)$ = 2 mol/L and 5 mL protective colloid the mixture is titrated with $c(AgNO_3)$ = 0.1 mol/L to after the first endpoint.

Calculations

The chloride content is given in % NaCl (g/100 g).

% NaCl = 'DET U.EP{1}.VOL' * 'DET.U TITER' * 'DET.U CONC' * 58.443 * 0.1 / 'MV.Sample size'

'DET U.EP{1}.VOL'	mL $AgNO_3$ consumed up to the endpoint
'DET.U TITER'	titer of $AgNO_3$
'DET.U CONC'	concentration of $AgNO_3$ [mol/L]
58.443	molecular weight of NaCl [g/mol]
0.1	conversion factor for %
'MV.Sample size'	0.15 [g] (corresponds to 15 mL of the sample solution)

3.10 *tiamo* method: Chloride in broth

Application note

This is a method to determine the content of chloride in broth. The method consists of five different tracks. In the start series track the rack is initialized and the system prepared for the determination series. The main track handles the titration followed by the rinsing of the electrode which is done after every determination.

In the exit track the results are calculated, a report is printed and the data is saved in the predefined database Robotic Chloride Analyzer (can be modified). In the series end track, the electrode is moved to a storing beaker where it is stored in dist. water for a proper electrode treatment between the determination series. In case of an error, the error track is carried out, which guarantees that the electrode is rinsed and moved to the storing beaker.

Sample preparation

Powdered, granulated and pasty samples: 10.0 g are dissolved in approximately 500 mL hot dist. water, allowed to cool down, made up to 1 liter and mixed. For a determination 15 mL of the prepared sample (corresponds to 0.15 g of the solid sample) are pipetted into a titration beaker and 5 mL of a polyvinyl alcohol solution (80 mg polyvinyl alcohol dissolved in 200 mL dist. water) are added.

Analysis

The beakers are placed on the rack and the determination series started. Approximately 35 mL of dist. water and 2 mL of c(HNO3) = 2 mol/L are added. The solution is then titrated with c(AgNO3) = 0.1 mol/L and the titration stopped after the first endpoint.

The value 58.443 in the calculation formula is the molecular weight of sodium chloride in [g/mol].

Remarks

To run this method the settings of the 855 Robotic Titrosampler have to be adjusted. The lift positions have to be defined according to the rack and beakers used. As the robotic swing arm is equipped with a beaker sensor the head has to touch the beaker brim when moving to the work position. If this requirement can not be fulfilled no beaker will be recognized.

Two special beaker have to be defined including their own work positions. Two special beaker have to be defined including their own work positions. Special beaker 1 is used for the rinsing of the electrode in case of an error. Special beaker 2 is used for the storing of the electrode between the determination series.

Result report (example)

Robotic Chloride Analyzer
Chloride in broth

Programm version tiamo 1.1

2005-10-31 14:56:35 UTC+1

Results report

Determination

Method	Chloride in broth
Method saving date	2005-10-31 14:50:37 UTC+1
Method version	1
Method state	original
Determination ID	4c621812:10745c61df2:-7bf5
Determination start	2005-09-23 09:10:25 UTC+2
Determination state	original
Determination version	1
Run number	16
User (full name)	Metrohm

Sample data

Sample Identification 1	Broth
Sample size	0.15 g

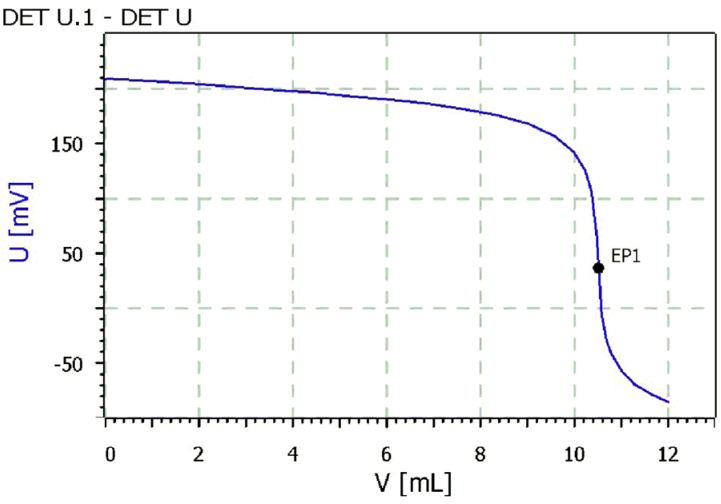
End points

DET U **DET U.1**

EP1 . . . . . 36.6 mV . . . . . 10.5224 mL

Results

content of sodium chloride . . . . . **41.0136 %**



Statistical results (example)

Chloride in broth

Sample size [mL]	Content [%]
15.0000	40.9843
15.0000	40.9898
15.0000	41.0063
15.0000	41.0145
15.0000	41.0076
15.0000	41.0059
15.0000	41.0020
15.0000	41.0287
15.0000	41.0136
15.0000	41.0249
Mean value	41.0078
abs. std. dev.	0.0138
rel. std. dev. %	0.03

3.11 Chloride (NaCl) in washing agents and soaps

Recommended accessories

- 6.3032.220 Dosing Unit, 20 mL
- 6.0430.100 Ag Titrode with Ag_2S coating
- 6.2104.020 electrode cable

Reagents

- Titrant: $c(AgNO_3) = 0.01$ mol/L

  1.699 g $AgNO_3$ (e.g. Merck no. 101512) is weighed out into a 1000 mL volumetric flask and dissolved in approx. 500 mL dist. H_2O. The solution is treated with 0.5 mL conc. HNO_3 and made up to the mark with dist. H_2O.

- Nitric acid: $c(HNO_3) = 2$ mol/L

General

Chlorides (e.g. NaCl) can be titrated with $AgNO_3$ in washing agents without any problem:

$$NaCl + AgNO_3 \rightarrow AgCl \downarrow + NaNO_3$$

To prevent other sample ingredients from interfering, the titration is carried out under acidic conditions. The Ag Titrode is provided with an Ag_2S coating to obtain a more stable signal.

Analysis

For reasons of accuracy (sample weight) a sample solution is first prepared. Approx. 8 g are weighed out into a 1 L volumetric flask with an accuracy of 0.1 mg and dissolved (as far as possible) in approx. 500 mL dist. H_2O under gentle heating (40 °C). After cooling down it is carefully made up to the mark with dist. H_2O and mixed.

50.0 mL of this sample solution are pipetted into the titration beaker and treated with 2 mL $c(HNO_3) = 2$ mol/L and approx. 10 mL dist. H_2O. The solution is titrated with $c(AgNO_3) = 0.01$ mol/L.

Calculation

% NaCl = 'DET U.EP{1}.VOL' * 'DET.U TITER' * 'DET.U CONC' * 58.443 * 100 / ('MV.Sample size' * 1000)

where:

'DET U.EP{1}.VOL	mL $AgNO_3$ consumed up to the endpoint
'DET.U TITER'	titer of $AgNO_3$
'DET.U CONC'	concentration of $AgNO_3$ [mol/L]
58.443	molecular weight of NaCl [g/mol]
100	conversion factor for %
'MV.Sample size'	0.4 [g] corresponds to 50 mL of the prepared solution
1000	correction factor for milliliters

Reference

- Metrohm Application Bulletin no. 130

  Chloride titrations with potentiometric indication

3.12 *tiamo* method: Chloride in washing agents and soaps

Application note

This is a method to determine the percentage of sodium chloride in washing agents and soaps. The method consists of five different tracks. In the start series track the rack is initialized and the system prepared for the determination series. The main track handles the determination followed by the rinsing of the electrode which is done after every determination. In the exit track the results are calculated, a report is printed and the data is saved in the predefined database Robotic Chloride Analyzer (can be modified). In the series end track, the electrode is moved to a storage beaker where it is stored in dist. water for a proper electrode treatment between the determination series. In case of an error, the error track is carried out, which guarantees that the electrode is moved to the storing beaker.

Sample preparation

For accuracy reasons a sample solution is made in a first step . Approximately 8 g are weighed out in a 1 L volumetric flask and dissolved in 500 mL dist. water at about 40°C. After cooling down the flask is filled to the mark with dist. water. For a determination 50 mL of the prepared sample (corresponds to approximately 0.4 g of the solid sample) are pipetted into a titration beaker.

Procedure

The beakers are placed on the rack and the determination series started. Approximately 10 mL dist. water and 2 mL of $c(HNO_3) = 2$ mol/L are added automatically. The solution is then titrated with $c(AgNO_3) = 0.1$ mol/L and the titration stopped after the first endpoint.

The value 58.443 in the calculation formula is the molecular weight of sodium chloride in [g/mol]. The factor 100 is needed to receive percent as result.

Remarks

To run this method the settings of the 855 Robotic Titrosampler have to be adjusted. The lift positions have to be defined according to the rack and beakers used. As the robotic swing arm is equipped with a beaker sensor the head has to touch the beaker brim when moving to the work position. If this requirement can not be fulfilled no beaker will be recognized. Two special beakers have to be defined including their work positions. Special beaker 1 is used for rinsing the electrode in case of an error. Special beaker 2 is used for a proper electrode treatment between the determination series and in case of an error.

Result report (example)

Robotic Chloride Analyzer
Chloride (NaCl) in washing agents and soaps

Programm version tiamo 1.1

2005-09-27 11:09:16 UTC+2

Results report

Determination

Method	Chloride (NaCl) in washing agents and soaps
Method saving date	2005-09-27 08:37:44 UTC+2
Method version	1
Method state	original
Determination ID	-4194d45f:1069643070f:-7f10
Determination start	2005-09-27 09:16:09 UTC+2
Determination state	original
Determination version	1
Run number	11
User (full name)	Metrohm

Sample data

Sample Identification 1	Washing agent
Sample size	0.4061 g

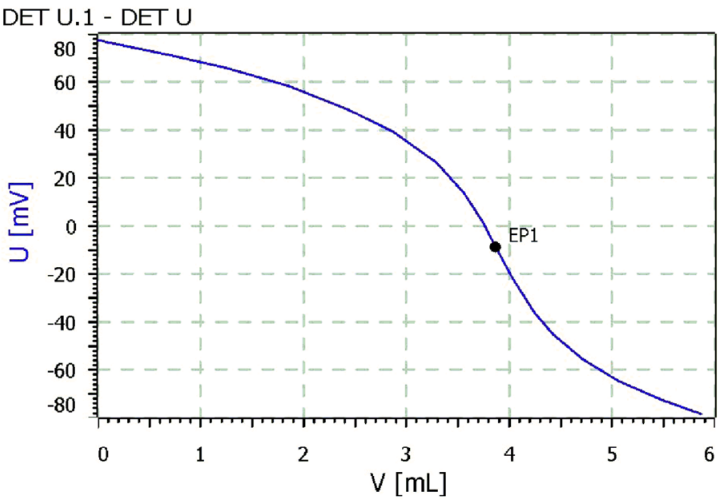
End points

DET U **DET U.1**

EP1 -9.0 mV 3.8687 mL

Results

content of sodiumchloride **0.5579 %**



Statistical results (example)

Chloride (NaCl) in washing agents and soaps

Sample size [mL]	Content [%]
50.0000	0.5624
50.0000	0.5627
50.0000	0.5598
50.0000	0.5613
50.0000	0.5600
50.0000	0.5607
50.0000	0.5644
50.0000	0.5637
50.0000	0.5626
50.0000	0.5579
Mean value	0.5616
abs. std. dev.	0.0020
rel. std. dev. %	0.35

4 Storage

Ag-Titrode: Store in dist. water only

5 Method reports

5.1 Titer determination of c($AgNO_3$) = 0.1 mol/L

License ID	124049905	Program version	tiamo 1.1 - 36
Client name	TITRATION14		
User	Metrohm	2005-10-31	14:41:51 UTC+1

Method parameters

Method . . . . . Titer determination of c(AgNO3) = 0.1 M
Method saving date . . . . . 2005-10-31 14:41:44 UTC+1
Method version 1
Method group . . . . . Robotic Chloride Analyzer
Method status . . . . . original
Method saved by (full name) . . . . . Metrohm
Method saved by (short name) . . . . . Metrohm

START **Main track**

General

Workplace view
Current view . . . . . on
Track view for live window
Live display 1 . . . . . Main track
Live display 2 . . . . . Main track
Statistics . . . . . on
Number of single determinations . . . . . not defined
Conditioning
Automatic conditioning . . . . . off

Application note

See attached documents

Method variables

Name	Type	Assignment	Value	Comment	Monitoring
Sample size	Number	Sample size		Sample size	off
Sample size unit	Text	Sample size unit		Sample size unit	off
Sample position	Number	Sample position		Sample position number	off
ID1	Text	ID1		Sample identification 1	off
ID2	Text	ID2		Sample identification 2	off
ID3	Text	ID3		Sample identification 3	off

Name . . . . . **Sample size**
Type . . . . . Number
Assignment . . . . . on. . . . . Sample size
Value . . . . . off. . . . . .
Check at start . . . . . on
Comment . . . . . Sample size
Variable monitoring . . . . . off
Lower limit . . . . . .
Upper limit . . . . . .
Message . . . . . .
Display message . . . . . on
Record message . . . . . on

Message by e-mail . . . . . off
Mail to . . . . .
Subject . . . . . Message from tiamo - Method 'New method 7' - Command 'Main track'
User . . . . .
Mail from . . . . .
SMTP Server . . . . .
POP3 Server . . . . .
Acoustic signal . . . . . off
Action . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off

Name . . . . . **Sample position**
Type . . . . . Number
Assignment . . . . . on . . . . . Sample position
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample position number
Variable monitoring . . . . . off
Lower limit . . . . .
Upper limit . . . . .
Message . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off
Mail to . . . . .
Subject . . . . . Message from tiamo - Method 'New method 7' - Command 'Main track'
User . . . . .
Mail from . . . . .
SMTP Server . . . . .
POP3 Server . . . . .
Acoustic signal . . . . . off
Action . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off

Name . . . . . **Sample size unit**
Type . . . . . Text
Assignment . . . . . on . . . . . Sample size unit
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample size unit

Name **ID1**
Type . . . . . Text

Assignment . . . . . on. ID1
Value . . . . . off. . . . . .
Check at start . . . . . on
Comment . . . . . Sample identification 1

Name **ID2**
Type . . . . . Text
Assignment . . . . . on. ID2
Value . . . . . off. . . . . .
Check at start . . . . . on
Comment . . . . . Sample identification 2

Name **ID3**
Type . . . . . Text
Assignment . . . . . on. ID3
Value . . . . . off. . . . . .
Check at start . . . . . on
Comment . . . . . Sample identification 3

MOVE **to sample**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Sample position

Beaker test
- Display message . . . . . off
- Stop determination . . . . . off
- Stop determination and series . . . . . on

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **add water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 20 s

ADD **add HNO3**

General/Hardware
Device
Device name . . . . . 855_1
Dosing device
Dosing device 2
Solution HNO3
Tandem dosing . . . . . off
Stirrer
Stirrer . . . . . off
Stirring rate 8
Switch off automatically . . . . . on
Dosing parameters
Volume . . . . . 1 mL
Dosing rate . . . . . maximum mL/min
Filling rate . . . . . maximum mL/min
Fill automatically at end . . . . . on

DET U **DET U**

General/Hardware

Device
Device name . . . . . 855_1
Dosing device
Dosing device 1
Solution AgNO3
Sensor
Measuring input 1
Sensor . . . . . Ag Titrode
Temperature measurement . . . . . automatic
Stirrer
Stirrer 1
Stirring rate 8
Switch off automatically . . . . . on

Start conditions

Initial measured value
Signal drift . . . . . off mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 1 s
Start volume
Start volume . . . . . 0 mL
Dosing rate . . . . . maximum mL/min
Start measured value
Start measured value . . . . . off mV
Dosing rate . . . . . 5 mL/min
Start slope
Start slope . . . . . off mV/mL
Dosing rate . . . . . 5 mL/min
Pause

	Pause	120	s
	Titration parameters		
	Titration rate		
	Titration rate	user	
	Measured value acceptance		
	Signal drift	50.0	mV/min
	Min. waiting time	0	s
	Max. waiting time	26	s
	Dosing of increments		
	Measuring point density	6	
	Min. increment	10.0	µL
	Max. increment	off	µL
	Dosing rate	maximum	mL/min
	Temperature		
	Temperature	25.0	°C
	Stop conditions		
	Stop volume	20	mL
	Stop measured value	off	mV
	Stop EP	1	
	Volume after EP	1	mL
	Stop time	off	s
	Filling rate	maximum	mL/min
	Potentiometric evaluation		
	Evaluation without window	on	
	EP criterion	5	
	EP recognition	greatest	
	Evaluation with measured value window (U)	off	
	Evaluation with volume window (mL)	off	
	Additional evaluations		
	Fix end point evaluation	off	
	pK/HNP evaluation	off	
	Minimum evaluation	off	
	Maximum evaluation	off	
	Break point evaluation	off	
	Additional measured values		
	Additional calculated measured values	off	
	Additional external measured values	off	
PUMP	**aspirate sample solution**		
	Device		
	Device name	855_1	
	Pumps		
	Tower	1	
	Pump(s)	2	
	Action		
	Switch on	off	
	Switch off	off	

Duration . . . . . on
Time . . . . . 10.0 s

PUMP **rinse**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) . . . . . 1+2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 10 s

PUMP **empty beaker**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 3 s

SERIES START **Series start track**

RACK **initialize rack**

Device
Device name . . . . . 855_1
Rack test . . . . . off

EXIT **Exit track**

CALC **calculation**

Result name	Formula	Unit	Decimal places	Assignment	Statistics
Titer AgNO3	= 'MV.Sample size' * 1000 / ('DET U.EP{1}.VOL' * 'DET U.CONC' * 58.442)		4	RS01	on
Mean value titer	= 'RS.Titer AgNO3.MNV'		4	RS02	off

Result name . . . . . **Titer AgNO3**
Formula . . . . . = 'MV.Sample size' * 1000 / ('DET U.EP {1}.VOL' * 'DET U.CONC' * 58.442)
Unit . . . . .

Decimal places 4
Assignment RS01
Statistics . . . . . on
Description . . . . . RS.'Result name'[.VAL]Result value.
Result monitoring . . . . . off
Save result as common variable . . . . . off
Name . . . . .
Save result as titer . . . . . off
Solution name . . . . .

Result name . . . . . **Mean value titer**
Formula . . . . . = 'RS.Titer AgNO3.MNV'
Unit . . . . .
Decimal places 4
Assignment RS02
Statistics . . . . . off
Description . . . . .
Result monitoring . . . . . off
Save result as common variable . . . . . off
Name . . . . .
Save result as titer . . . . . on
Solution name AgNO3

REPORT **report**

Report template
Report template . . . . . Titer determination AgNO3
Report output
Printer . . . . . off
PDF file . . . . . on
PDF file . . . . . C:\Programme\Metrohm\tiamo\Titer determination AgNO3.pdf
Send e-mail . . . . . off

DATABASE **database**

Database

Robotic Chloride Analyzer

SERIES END **Series end track**

MOVE **to storing beaker**

Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Special beaker

Number 1
Beaker test
Display message . . . . . on
Stop determination . . . . . off
Stop determination and series . . . . . off
Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **add dist water**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 20 s

ERROR **Error track**

MOVE **to storage beaker**
Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Special beaker
Number 1
Beaker test
Display message . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off
Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **fill beaker with water**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off

Switch off	off
Duration	on
Time	20 s

5.2 Chloride in tap water

tiamo™ titration and more

License ID	124049905	Program version	tiamo 1.1 - 36
Client name	TITRATION14		
User	Metrohm	2005-10-31	14:42:13 UTC+1

Method parameters

Method . . . . . Chloride in tap water
Method saving date . . . . . 2005-10-31 14:39:55 UTC+1
Method version 1
Method group . . . . . Robotic Chloride Analyzer
Method status . . . . . original
Method saved by (full name) . . . . . Metrohm
Method saved by (short name) . . . . . Metrohm

START **Main track**

General

Workplace view

Current view . . . . . on

Track view for live window

Live display 1 . . . . . Main track

Live display 2 . . . . . Main track

Statistics . . . . . off

Conditioning

Automatic conditioning . . . . . off

Application note

See attached documents

Method variables

Name	Type	Assignment	Value	Comment	Monitoring
Sample size	Number	Sample size		Sample size	off
Sample size unit	Text	Sample size unit		Sample size unit	off
Sample position	Number	Sample position		Sample position number	off
ID1	Text	ID1		Sample identification 1	off
ID2	Text	ID2		Sample identification 2	off
ID3	Text	ID3		Sample identification 3	off

Name . . . . . **Sample size**
Type . . . . . Number
Assignment . . . . . on . . . . . Sample size
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample size
Variable monitoring . . . . . off
Lower limit . . . . .
Upper limit . . . . .
Message . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off
Mail to . . . . .

Subject . . . . . Message from tiamo - Method 'New method 3' - Command 'Main track'
User . . . . .
Mail from . . . . .
SMTP Server . . . . .
POP3 Server . . . . .
Acoustic signal . . . . . off
Action . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off

Name . . . . . **Sample position**
Type . . . . . Number
Assignment . . . . . on . . . . . Sample position
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample position number
Variable monitoring . . . . . off
Lower limit . . . . .
Upper limit . . . . .
Message . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off
Mail to . . . . .
Subject . . . . . Message from tiamo - Method 'New method 3' - Command 'Main track'
User . . . . .
Mail from . . . . .
SMTP Server . . . . .
POP3 Server . . . . .
Acoustic signal . . . . . off
Action . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off

Name . . . . . **Sample size unit**
Type . . . . . Text
Assignment . . . . . on . . . . . Sample size unit
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample size unit

Name **ID1**
Type . . . . . Text
Assignment . . . . . on ID1
Value . . . . . off . . . . .

Check at start . . . . . on
Comment . . . . . Sample identification 1

Name **ID2**
Type . . . . . Text
Assignment . . . . . on ID2
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample identification 2

Name **ID3**
Type . . . . . Text
Assignment . . . . . on ID3
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample identification 3

MOVE **to sample**

Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Sample position
Beaker test
Display message . . . . . off
Stop determination . . . . . off
Stop determination and series . . . . . on
Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

ADD **add HNO3**

General/Hardware
Device
Device name . . . . . 855_1
Dosing device
Dosing device 2
Solution HNO3
Tandem dosing . . . . . off
Stirrer
Stirrer . . . . . off
Stirring rate 8
Switch off automatically . . . . . on
Dosing parameters
Volume . . . . . 5 mL
Dosing rate . . . . . maximum mL/min

Filling rate . . . . . maximum mL/min
Fill automatically at end . . . . . on

DET U **DET U**

General/Hardware

Device
Device name . . . . . 855_1

Dosing device
Dosing device 1
Solution AgNO3

Sensor
Measuring input 1
Sensor . . . . . Ag Titrode
Temperature measurement . . . . . automatic

Stirrer
Stirrer 1
Stirring rate 8
Switch off automatically . . . . . on

Start conditions

Initial measured value
Signal drift . . . . . off mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 1 s

Start volume
Start volume . . . . . 0 mL
Dosing rate . . . . . maximum mL/min

Start measured value
Start measured value . . . . . off mV
Dosing rate . . . . . 5 mL/min

Start slope
Start slope . . . . . off mV/mL
Dosing rate . . . . . 5 mL/min

Pause
Pause . . . . . 15 s

Titration parameters

Titration rate
Titration rate . . . . . user

Measured value acceptance
Signal drift . . . . . 50.0 mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 26 s

Dosing of increments
Measuring point density 4
Min. increment . . . . . 10.0 µL
Max. increment . . . . . off µL
Dosing rate . . . . . maximum mL/min

Temperature

	Temperature	25.0	°C	
	Stop conditions			
	Stop volume	20	mL	
	Stop measured value	off	mV	
	Stop EP	1		
	Volume after EP	1.5	mL	
	Stop time	off	s	
	Filling rate	maximum	mL/min	
	Potentiometric evaluation			
	Evaluation without window	on		
	EP criterion	10		
	EP recognition	greatest		
	Evaluation with measured value window (U)	off		
	Evaluation with volume window (mL)	off		
	Additional evaluations			
	Fix end point evaluation	off		
	pK/HNP evaluation	off		
	Minimum evaluation	off		
	Maximum evaluation	off		
	Break point evaluation	off		
	Additional measured values			
	Additional calculated measured values	off		
	Additional external measured values	off		
PUMP	**aspirate sample solution**			
	Device			
	Device name	855_1		
	Pumps			
	Tower	1		
	Pump(s)	2		
	Action			
	Switch on	off		
	Switch off	off		
	Duration	on		
	Time	10.0	s	
PUMP	**rinse**			
	Device			
	Device name	855_1		
	Pumps			
	Tower	1		
	Pump(s)	1+2		
	Action			
	Switch on	off		
	Switch off	off		
	Duration	on		
	Time	7	s	

PUMP **empty beaker**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 3 s

SERIES START **Series start track**

RACK **initialize rack**

Device
- Device name . . . . . 855_1

Rack test . . . . . off

EXIT **Exit track**

CALC **calculation**

Result name	Formula	Unit	Decimal places	Assignment	Statistics
content of chloride	= 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 35.453 * 1000 / 'MV. Sample size'	mg/L	4	RS01	off

Result name . . . . . **content of chloride**
Formula . . . . . = 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 35.453 * 1000 / 'MV. Sample size'
Unit . . . . . mg/L
Decimal places 4
Assignment RS01
Statistics . . . . . off
Description . . . . . RS.'Result name'[.VAL]Result value.
Result monitoring . . . . . off
Save result as common variable . . . . . off
- Name . . . . .

Save result as titer . . . . . off
- Solution name . . . . .

REPORT **report**

Report template
- Report template . . . . . Chloride in tap water

Report output

Printer . . . . . off
PDF file . . . . . on
PDF file . . . . . C:\Programme\Metrohm\tiamo\Chloride in tap water.pdf
Send e-mail . . . . . off

DATABASE **database**

Database

Robotic Chloride Analyzer

SERIES END **Series end track**

MOVE **to storing beaker**

Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Special beaker
Number 1
Beaker test
Display message . . . . . on
Stop determination . . . . . off
Stop determination and series . . . . . off
Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **add dist water**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 20 s

ERROR **Error track**

MOVE **to storage beaker**

Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Special beaker

Number 1
Beaker test
Display message . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off
Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **fill beaker with water**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 20 s

5.3 Determination of chloride in wine

License ID	124049905	Program version	tiamo 1.1 - 36
Client name	TITRATION14		
User	Metrohm	2005-10-31	14:41:59 UTC+1

Method parameters

Method . . . . . Determination of choride in wine
Method saving date . . . . . 2005-10-31 14:41:11 UTC+1
Method version 1
Method group . . . . . Robotic Chloride Analyzer
Method status . . . . . original
Method saved by (full name) . . . . . Metrohm
Method saved by (short name) . . . . . Metrohm

START **Main track**

General

Workplace view

Current view . . . . . on

Track view for live window

Live display 1 . . . . . Main track

Live display 2 . . . . . Main track

Statistics . . . . . off

Conditioning

Automatic conditioning . . . . . off

Application note

See attached documents

Method variables

Name	Type	Assignment	Value	Comment	Monitoring
Sample size	Number	Sample size		Sample size	off
Sample size unit	Text	Sample size unit		Sample size unit	off
Sample position	Number	Sample position		Sample position number	off
ID1	Text	ID1		Sample identification 1	off
ID2	Text	ID2		Sample identification 2	off
ID3	Text	ID3		Sample identification 3	off

Name . . . . . **Sample size**
Type . . . . . Number
Assignment . . . . . on . . . . . Sample size
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample size
Variable monitoring . . . . . off
Lower limit . . . . .
Upper limit . . . . .
Message . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off
Mail to . . . . .

Subject . . . . . Message from tiamo - Method 'New method 6' - Command 'Main track'
User . . . . .
Mail from . . . . .
SMTP Server . . . . .
POP3 Server . . . . .
Acoustic signal . . . . . off
Action . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off

Name . . . . . **Sample position**
Type . . . . . Number
Assignment . . . . . on . . . . . Sample position
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample position number
Variable monitoring . . . . . off
Lower limit . . . . .
Upper limit . . . . .
Message . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off
Mail to . . . . .
Subject . . . . . Message from tiamo - Method 'New method 6' - Command 'Main track'
User . . . . .
Mail from . . . . .
SMTP Server . . . . .
POP3 Server . . . . .
Acoustic signal . . . . . off
Action . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off

Name . . . . . **Sample size unit**
Type . . . . . Text
Assignment . . . . . on . . . . . Sample size unit
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample size unit

Name **ID1**
Type . . . . . Text
Assignment . . . . . on ID1
Value . . . . . off . . . . .

Check at start . . . . . on
Comment . . . . . Sample identification 1

Name **ID2**
Type . . . . . Text
Assignment . . . . . on ID2
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample identification 2

Name **ID3**
Type . . . . . Text
Assignment . . . . . on ID3
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample identification 3

MOVE **to sample**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Sample position

Beaker test
- Display message . . . . . off
- Stop determination . . . . . off
- Stop determination and series . . . . . on

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **add water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 6 s

ADD **add HNO3**

General/Hardware
- Device

Device name . . . . . 855_1
Dosing device
Dosing device 2
Solution HNO3
Tandem dosing . . . . . off
Stirrer
Stirrer . . . . . off
Stirring rate 8
Switch off automatically . . . . . on
Dosing parameters
Volume . . . . . 1 mL
Dosing rate . . . . . maximum mL/min
Filling rate . . . . . maximum mL/min
Fill automatically at end . . . . . on

DET U **DET U**

General/Hardware

Device
Device name . . . . . 855_1
Dosing device
Dosing device 1
Solution AgNO3 0.01
Sensor
Measuring input 1
Sensor . . . . . Ag Titrode
Temperature measurement . . . . . automatic
Stirrer
Stirrer 1
Stirring rate 8
Switch off automatically . . . . . on

Start conditions

Initial measured value
Signal drift . . . . . off mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 1 s
Start volume
Start volume . . . . . 0 mL
Dosing rate . . . . . maximum mL/min
Start measured value
Start measured value . . . . . off mV
Dosing rate . . . . . 5 mL/min
Start slope
Start slope . . . . . off mV/mL
Dosing rate . . . . . 5 mL/min
Pause
Pause . . . . . 10 s

Titration parameters

Titration rate
Titration rate . . . . . user
Measured value acceptance
Signal drift . . . . . 50.0 mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 26 s
Dosing of increments
Measuring point density 4
Min. increment . . . . . 100 µL
Max. increment . . . . . off µL
Dosing rate . . . . . maximum mL/min
Temperature
Temperature . . . . . 25.0 °C

Stop conditions

Stop volume . . . . . 20 mL
Stop measured value . . . . . off mV
Stop EP 1
Volume after EP . . . . . 2.5 mL
Stop time . . . . . off s
Filling rate . . . . . maximum mL/min

Potentiometric evaluation

Evaluation without window . . . . . on
EP criterion 5
EP recognition . . . . . all
Evaluation with measured value window (U) . . . . . off
Evaluation with volume window (mL) . . . . . off

Additional evaluations

Fix end point evaluation . . . . . off
pK/HNP evaluation . . . . . off
Minimum evaluation . . . . . off
Maximum evaluation . . . . . off
Break point evaluation . . . . . off

Additional measured values

Additional calculated measured values . . . . . off
Additional external measured values . . . . . off

PUMP **aspirate sample solution**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 10.0 s

PUMP **fill beaker**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 20 s

STIR **stir 10 sec**

Device
- Device name . . . . . 855_1

Stirrer
- Stirrer 1
- Stirrer type . . . . . unknown
- Stirring rate 13

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 10.0 s

PUMP **empty beaker**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 15 s

SERIES START **Series start track**

RACK **initialize rack**

Device
- Device name . . . . . 855_1

Rack test . . . . . off

EXIT **Exit track**

CALC **calculation**

Result name	Formula	Unit	Decimal places	Assignment	Statistics
content of chloride	= 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 35.453 / 'MV.Sample size'	g/L	4	RS01	off
content of sodium chlorid	= 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 58.442 / 'MV.Sample size'	g/L	4	RS02	off

Result name . . . . . **content of chloride**
Formula . . . . . = 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 35.453 / 'MV.Sample size'
Unit . . . . . g/L
Decimal places 4
Assignment RS01
Statistics . . . . . off
Description . . . . . RS.'Result name'[.VAL]Result value.
Result monitoring . . . . . off
Save result as common variable . . . . . off
Name . . . . .
Save result as titer . . . . . off
Solution name . . . . .

Result name . . . . . **content of sodium chlorid**
Formula . . . . . = 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 58.442 / 'MV.Sample size'
Unit . . . . . g/L
Decimal places 4
Assignment RS02
Statistics . . . . . off
Description . . . . . RS.'Result name'[.VAL]Result value.
Result monitoring . . . . . off
Save result as common variable . . . . . off
Name . . . . .
Save result as titer . . . . . off
Solution name . . . . .

REPORT **report**

Report template
Report template . . . . . Chloride in wine
Report output
Printer . . . . . off
PDF file . . . . . on
PDF file . . . . . C:\Programme\Metrohm\tiamo\Chloride in wine.pdf
Send e-mail . . . . . off

DATABASE **database**

Database

Robotic Chloride Analyzer

SERIES END **Series end track**

MOVE **to storing beaker**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Special beaker
- Number 2

Beaker test
- Display message . . . . . on
- Stop determination . . . . . off
- Stop determination and series . . . . . off

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **add dist water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 20 s

ERROR **Error track**

MOVE **to storage beaker**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Special beaker
- Number 2

Beaker test
- Display message . . . . . off
- Stop determination . . . . . on
- Stop determination and series . . . . . off

Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **aspirate**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 5 s

PUMP **rinsing**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) . . . . . 1+2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 10 s

PUMP **empty rinsing beaker**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 3 s

PUMP **fill beaker with water**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action

Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 20 s

5.4 Determination of ammonium chloride

tiamo™ titration and more

License ID	124049905	Program version	tiamo 1.1 - 36
Client name	TITRATION14		
User	Metrohm	2005-10-31	14:42:12 UTC+1

Method parameters

Method . . . . . Determination of ammonium chloride
Method saving date . . . . . 2005-10-31 14:40:27 UTC+1
Method version 1
Method group . . . . . Robotic Chloride Analyzer
Method status . . . . . original
Method saved by (full name) . . . . . Metrohm
Method saved by (short name) . . . . . Metrohm

START **Main track**

General

Workplace view
Current view . . . . . on
Track view for live window
Live display 1 . . . . . Main track
Live display 2 . . . . . Main track
Statistics . . . . . off
Conditioning
Automatic conditioning . . . . . off

Application note

See attached documents

Method variables

Name	Type	Assignment	Value	Comment	Monitoring
Sample size	Number	Sample size		Sample size	off
Sample size unit	Text	Sample size unit		Sample size unit	off
Sample position	Number	Sample position		Sample position number	off
ID1	Text	ID1		Sample identification 1	off
ID2	Text	ID2		Sample identification 2	off
ID3	Text	ID3		Sample identification 3	off

Name . . . . . **Sample size**
Type . . . . . Number
Assignment . . . . . on . . . . . Sample size
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample size
Variable monitoring . . . . . off
Lower limit . . . . .
Upper limit . . . . .
Message . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off

Mail to
Subject Message from tiamo - Method 'New method 5' - Command 'Main track'
User
Mail from
SMTP Server
POP3 Server
Acoustic signal off
Action off
Stop determination on
Stop determination and series off

Name **Sample position**
Type Number
Assignment on Sample position
Value off
Check at start on
Comment Sample position number
Variable monitoring off
Lower limit
Upper limit
Message
Display message on
Record message on
Message by e-mail off
Mail to
Subject Message from tiamo - Method 'New method 5' - Command 'Main track'
User
Mail from
SMTP Server
POP3 Server
Acoustic signal off
Action off
Stop determination on
Stop determination and series off

Name **Sample size unit**
Type Text
Assignment on Sample size unit
Value off
Check at start on
Comment Sample size unit

Name **ID1**
Type Text
Assignment on ID1

Value . . . . . off.
Check at start . . . . . on
Comment . . . . . Sample identification 1

Name **ID2**
Type . . . . . Text
Assignment . . . . . on. ID2
Value . . . . . off.
Check at start . . . . . on
Comment . . . . . Sample identification 2

Name **ID3**
Type . . . . . Text
Assignment . . . . . on. ID3
Value . . . . . off.
Check at start . . . . . on
Comment . . . . . Sample identification 3

MOVE **to sample**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Sample position

Beaker test
- Display message . . . . . off
- Stop determination . . . . . off
- Stop determination and series . . . . . on

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **add water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 18 s

ADD **add HNO3**

General/Hardware

Device
Device name . . . . . 855_1
Dosing device
Dosing device 2
Solution HNO3
Tandem dosing . . . . . off
Stirrer
Stirrer . . . . . off
Stirring rate 8
Switch off automatically . . . . . on
Dosing parameters
Volume . . . . . 2 mL
Dosing rate . . . . . maximum mL/min
Filling rate . . . . . maximum mL/min
Fill automatically at end . . . . . on

DET U **DET U**

General/Hardware

Device
Device name . . . . . 855_1
Dosing device
Dosing device 1
Solution AgNO3
Sensor
Measuring input 1
Sensor . . . . . Ag Titrode
Temperature measurement . . . . . automatic
Stirrer
Stirrer 1
Stirring rate 8
Switch off automatically . . . . . on

Start conditions

Initial measured value
Signal drift . . . . . off mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 1 s
Start volume
Start volume . . . . . 0 mL
Dosing rate . . . . . maximum mL/min
Start measured value
Start measured value . . . . . off mV
Dosing rate . . . . . 5 mL/min
Start slope
Start slope . . . . . off mV/mL
Dosing rate . . . . . 5 mL/min
Pause
Pause . . . . . 200 s

Titration parameters

Titration rate

Titration rate . . . . . user

Measured value acceptance

Signal drift . . . . . 50.0 mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 26 s

Dosing of increments

Measuring point density 4
Min. increment . . . . . 100.0 µL
Max. increment . . . . . off µL
Dosing rate . . . . . maximum mL/min

Temperature

Temperature . . . . . 25.0 °C

Stop conditions

Stop volume . . . . . 20 mL
Stop measured value . . . . . off mV
Stop EP 1
Volume after EP . . . . . 1.5 mL
Stop time . . . . . off s
Filling rate . . . . . maximum mL/min

Potentiometric evaluation

Evaluation without window . . . . . on
EP criterion 5
EP recognition . . . . . all
Evaluation with measured value window (U) . . . . . off
Evaluation with volume window (mL) . . . . . off

Additional evaluations

Fix end point evaluation . . . . . off
pK/HNP evaluation . . . . . off
Minimum evaluation . . . . . off
Maximum evaluation . . . . . off
Break point evaluation . . . . . off

Additional measured values

Additional calculated measured values . . . . . off
Additional external measured values . . . . . off

PUMP **aspirate sample solution**

Device

Device name . . . . . 855_1

Pumps

Tower 1
Pump(s) 2

Action

Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on

Time . . . . . 10.0 s

PUMP **fill beaker**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 20 s

STIR **stir 10 sec**

Device
Device name . . . . . 855_1
Stirrer
Stirrer 1
Stirrer type . . . . . unknown
Stirring rate 13
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 10.0 s

PUMP **empty beaker**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 15 s

SERIES START **Series start track**

RACK **initialize rack**

Device
Device name . . . . . 855_1
Rack test . . . . . off

EXIT **Exit track**

CALC **calculation**

Result name	Formula	Unit	Decimal places	Assignment	Statistics
Mass fraction of chloride	= 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 53.49 * 100 / ('MV.Sample size' * 1000)	%	4	RS01	off

Result name . . . . . **Mass fraction of chloride**
Formula . . . . . = 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 53.49 * 100 / ('MV. Sample size' * 1000)
Unit . . . . . %
Decimal places 4
Assignment RS01
Statistics . . . . . off
Description . . . . . RS.'Result name'[.VAL]Result value.
Result monitoring . . . . . off
Save result as common variable . . . . . off
Name . . . . .
Save result as titer . . . . . off
Solution name . . . . .

REPORT **report**

Report template
Report template . . . . . Determination of ammonium chloride
Report output
Printer . . . . . off
PDF file . . . . . on
PDF file . . . . . C:\Programme\Metrohm\tiamo\Ammonium chloride.pdf
Send e-mail . . . . . off

DATABASE **database**

Database

Robotic Chloride Analyzer

SERIES **Series end track**
END

MOVE **to storing beaker**

Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Special beaker
Number 2
Beaker test
Display message . . . . . on

Stop determination . . . . . off
Stop determination and series . . . . . off
Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **add dist water**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 20 s

ERROR **Error track**

MOVE **to rinse beaker**
Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Special beaker
Number 1
Beaker test
Display message . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off
Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **aspirate**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 5 s

PUMP **rinsing**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) . . . . . 1+2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 10 s

PUMP **empty rinsing beaker**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 3 s

PUMP **fill beaker with water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 20 s

5.5 Chloride content in acidic copper baths

tiamo™ titration and more

License ID	124049905	Program version	tiamo 1.1 - 36
Client name	TITRATION14		
User	Metrohm	2005-10-31	14:42:45 UTC+1

Method parameters

Method . . . . . Chloride content in acidic copper baths
Method saving date . . . . . 2005-10-31 14:38:55 UTC+1
Method version 1
Method group . . . . . Robotic Chloride Analyzer
Method status . . . . . original
Method saved by (full name) . . . . . Metrohm
Method saved by (short name) . . . . . Metrohm

START **Main track**

General

Workplace view
Current view . . . . . on
Track view for live window
Live display 1 . . . . . Main track
Live display 2 . . . . . Main track
Statistics . . . . . off
Conditioning
Automatic conditioning . . . . . off

Application note

See attached documents

Method variables

Name	Type	Assignment	Value	Comment	Monitoring
Sample size	Number	Sample size		Sample size	off
Sample size unit	Text	Sample size unit		Sample size unit	off
Sample position	Number	Sample position		Sample position number	off
ID1	Text	ID1		Sample identification 1	off
ID2	Text	ID2		Sample identification 2	off
ID3	Text	ID3		Sample identification 3	off

Name . . . . . **Sample size**
Type . . . . . Number
Assignment . . . . . on. . . . . Sample size
Value . . . . . off. . . . . .
Check at start . . . . . on
Comment . . . . . Sample size
Variable monitoring . . . . . off
Lower limit . . . . . .
Upper limit . . . . . .
Message . . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off

Mail to
Subject Message from tiamo - Method 'New method 4' - Command 'Main track'
User
Mail from
SMTP Server
POP3 Server
Acoustic signal off
Action off
Stop determination on
Stop determination and series off

Name **Sample position**
Type Number
Assignment on Sample position
Value off
Check at start on
Comment Sample position number
Variable monitoring off
Lower limit
Upper limit
Message
Display message on
Record message on
Message by e-mail off
Mail to
Subject Message from tiamo - Method 'New method 4' - Command 'Main track'
User
Mail from
SMTP Server
POP3 Server
Acoustic signal off
Action off
Stop determination on
Stop determination and series off

Name **Sample size unit**
Type Text
Assignment on Sample size unit
Value off
Check at start on
Comment Sample size unit

Name **ID1**
Type Text
Assignment on ID1

Value . . . . . off
Check at start . . . . . on
Comment . . . . . Sample identification 1

Name **ID2**
Type . . . . . Text
Assignment . . . . . on ID2
Value . . . . . off
Check at start . . . . . on
Comment . . . . . Sample identification 2

Name **ID3**
Type . . . . . Text
Assignment . . . . . on ID3
Value . . . . . off
Check at start . . . . . on
Comment . . . . . Sample identification 3

MOVE **to sample**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Sample position

Beaker test
- Display message . . . . . off
- Stop determination . . . . . off
- Stop determination and series . . . . . on

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **add water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 8 s

DET U **DET U**

General/Hardware

Device
Device name . . . . . 855_1
Dosing device
Dosing device 1
Solution AgNO3 0.01
Sensor
Measuring input 1
Sensor . . . . . Ag Titrode
Temperature measurement . . . . . automatic
Stirrer
Stirrer 1
Stirring rate 8
Switch off automatically . . . . . on

Start conditions

Initial measured value
Signal drift . . . . . off mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 1 s
Start volume
Start volume . . . . . 0 mL
Dosing rate . . . . . maximum mL/min
Start measured value
Start measured value . . . . . off mV
Dosing rate . . . . . 5 mL/min
Start slope
Start slope . . . . . off mV/mL
Dosing rate . . . . . 5 mL/min
Pause
Pause . . . . . 10 s

Titration parameters

Titration rate
Titration rate . . . . . user
Measured value acceptance
Signal drift . . . . . 50.0 mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 26 s
Dosing of increments
Measuring point density 4
Min. increment . . . . . 10.0 µL
Max. increment . . . . . off µL
Dosing rate . . . . . maximum mL/min
Temperature
Temperature . . . . . 25.0 °C

Stop conditions

Stop volume . . . . . 20 mL
Stop measured value . . . . . off mV

Stop EP 1
Volume after EP . . . . . 1.5 mL
Stop time . . . . . off s
Filling rate . . . . . maximum mL/min

Potentiometric evaluation

Evaluation without window . . . . . on
EP criterion 5
EP recognition . . . . . greatest
Evaluation with measured value window (U) . . . . . off
Evaluation with volume window (mL) . . . . . off

Additional evaluations

Fix end point evaluation . . . . . off
pK/HNP evaluation . . . . . off
Minimum evaluation . . . . . off
Maximum evaluation . . . . . off
Break point evaluation . . . . . off

Additional measured values

Additional calculated measured values . . . . . off
Additional external measured values . . . . . off

MOVE **to rinsing beaker**

Device

Device name . . . . . 855_1

Target

Tower 1
Move . . . . . Special beaker
Number 1

Beaker test

Display message . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off

Parameters

Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **asirate sample solution**

Device

Device name . . . . . 855_1

Pumps

Tower 1
Pump(s) 2

Action

Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 10.0 s

PUMP **rinse**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) . . . . . 1+2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 7 s

PUMP **empty beaker**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 3 s

SERIES START **Series start track**

RACK **initialize rack**

Device
- Device name . . . . . 855_1

Rack test . . . . . off

EXIT **Exit track**

CALC **calculation**

Result name	Formula	Unit	Decimal places	Assignment	Statistics
content of chloride	= 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 35.453 * 1000 / 'MV. Sample size'	mg/L	4	RS01	off
content of sodiumchlorid	= 'RS.content of chloride' * 1.64898	mg/L	4	RS02	off

Result name . . . . . **content of chloride**

Formula . . . . . = 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 35.453 * 1000 / 'MV. Sample size'

Unit . . . . . mg/L

Decimal places 4
Assignment RS01
Statistics . . . . . off
Description . . . . . RS.'Result name'[.VAL]Result value.
Result monitoring . . . . . off
Save result as common variable . . . . . off
Name . . . . .
Save result as titer . . . . . off
Solution name . . . . .

Result name . . . . . **content of sodiumchlorid**
Formula . . . . . = 'RS.content of chloride' * 1.64898
Unit . . . . . mg/L
Decimal places 4
Assignment RS02
Statistics . . . . . off
Description . . . . . RS.'Result name'[.VAL]Result value.
Result monitoring . . . . . off
Save result as common variable . . . . . off
Name . . . . .
Save result as titer . . . . . off
Solution name . . . . .

REPORT **report**

Report template
Report template . . . . . Chloride in acidic copper baths
Report output
Printer . . . . . off
PDF file . . . . . on
PDF file . . . . . C:\Programme\Metrohm\tiamo\Acidic copper bath.pdf
Send e-mail . . . . . off

DATABASE **database**

Database

Robotic Chloride Analyzer

SERIES **Series end track**
END

MOVE **to storing beaker**

Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Special beaker
Number 2

Beaker test
- Display message . . . . . on
- Stop determination . . . . . off
- Stop determination and series . . . . . off

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **fill beaker with water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 20 s

ERROR **Error track**

MOVE **to rinse beaker**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Special beaker
- Number 1

Beaker test
- Display message . . . . . off
- Stop determination . . . . . on
- Stop determination and series . . . . . off

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **aspirate**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 2

Action
- Switch on . . . . . off
- Switch off . . . . . off

Duration . . . . . on
Time . . . . . 3 s

PUMP **rinsing**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) . . . . . 1+2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 10.0 s

PUMP **empty rinsing beaker**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 3 s

MOVE **to storage beaker**

Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Special beaker
Number 2
Beaker test
Display message . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off
Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **add dist water**

Device
Device name . . . . . 855_1
Pumps
Tower 1

Pump(s) 1

Action

Switch on . . . . . off

Switch off . . . . . off

Duration . . . . . on

Time . . . . . 20 s

5.6 Chloride in broth

tiamo™ titration and more

License ID	124049905	Program version	tiamo 1.1 - 36
Client name	TITRATION14		
User	Metrohm	2005-10-31	14:42:39 UTC+1

Method parameters

Method . . . . . Chloride in broth
Method saving date . . . . . 2005-10-31 14:39:31 UTC+1
Method version 1
Method group . . . . . Robotic Chloride Analyzer
Method status . . . . . original
Method saved by (full name) . . . . . Metrohm
Method saved by (short name) . . . . . Metrohm

START **Main track**

General

Workplace view

Current view . . . . . on

Track view for live window

Live display 1 . . . . . Main track

Live display 2 . . . . . Main track

Statistics . . . . . off

Conditioning

Automatic conditioning . . . . . off

Application note

See attached documents

Method variables

Name	Type	Assignment	Value	Comment	Monitoring
Sample size	Number	Sample size		Sample size	off
Sample size unit	Text	Sample size unit		Sample size unit	off
Sample position	Number	Sample position		Sample position number	off
ID1	Text	ID1		Sample identification 1	off
ID2	Text	ID2		Sample identification 2	off
ID3	Text	ID3		Sample identification 3	off

Name . . . . . **Sample size**
Type . . . . . Number
Assignment . . . . . on . . . . . Sample size
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample size
Variable monitoring . . . . . off
Lower limit . . . . .
Upper limit . . . . .
Message . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off
Mail to . . . . .

Subject . . . . . Message from tiamo - Method 'New method 2' - Command 'Main track'
User . . . . .
Mail from . . . . .
SMTP Server . . . . .
POP3 Server . . . . .
Acoustic signal . . . . . off
Action . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off

Name . . . . . **Sample position**
Type . . . . . Number
Assignment . . . . . on . . . . . Sample position
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample position number
Variable monitoring . . . . . off
Lower limit . . . . .
Upper limit . . . . .
Message . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off
Mail to . . . . .
Subject . . . . . Message from tiamo - Method 'New method 2' - Command 'Main track'
User . . . . .
Mail from . . . . .
SMTP Server . . . . .
POP3 Server . . . . .
Acoustic signal . . . . . off
Action . . . . . off
Stop determination . . . . . on
Stop determination and series . . . . . off

Name . . . . . **Sample size unit**
Type . . . . . Text
Assignment . . . . . on . . . . . Sample size unit
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample size unit

Name **ID1**
Type . . . . . Text
Assignment . . . . . on ID1
Value . . . . . off . . . . .

Check at start . . . . . on
Comment . . . . . Sample identification 1

Name **ID2**
Type . . . . . Text
Assignment . . . . . on ID2
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample identification 2

Name **ID3**
Type . . . . . Text
Assignment . . . . . on ID3
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample identification 3

MOVE **to sample**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Sample position

Beaker test
- Display message . . . . . off
- Stop determination . . . . . off
- Stop determination and series . . . . . on

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **add water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 10 s

ADD **add HNO3**

General/Hardware
- Device

Device name . . . . . 855_1
Dosing device
Dosing device 2
Solution HNO3
Tandem dosing . . . . . off
Stirrer
Stirrer . . . . . off
Stirring rate 8
Switch off automatically . . . . . on
Dosing parameters
Volume . . . . . 2 mL
Dosing rate . . . . . maximum mL/min
Filling rate . . . . . maximum mL/min
Fill automatically at end . . . . . on

DET U **DET U**

General/Hardware

Device
Device name . . . . . 855_1
Dosing device
Dosing device 1
Solution AgNO3
Sensor
Measuring input 1
Sensor . . . . . Ag Titrode
Temperature measurement . . . . . automatic
Stirrer
Stirrer 1
Stirring rate 8
Switch off automatically . . . . . on

Start conditions

Initial measured value
Signal drift . . . . . off mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 1 s
Start volume
Start volume . . . . . 0 mL
Dosing rate . . . . . maximum mL/min
Start measured value
Start measured value . . . . . off mV
Dosing rate . . . . . 5 mL/min
Start slope
Start slope . . . . . off mV/mL
Dosing rate . . . . . 5 mL/min
Pause
Pause . . . . . 15 s

Titration parameters

Titration rate
Titration rate . . . . . user
Measured value acceptance
Signal drift . . . . . 50.0 mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 26 s
Dosing of increments
Measuring point density 4
Min. increment . . . . . 100 µL
Max. increment . . . . . off µL
Dosing rate . . . . . maximum mL/min
Temperature
Temperature . . . . . 25.0 °C

Stop conditions
Stop volume . . . . . 20 mL
Stop measured value . . . . . off mV
Stop EP 1
Volume after EP . . . . . 1.5 mL
Stop time . . . . . off s
Filling rate . . . . . maximum mL/min

Potentiometric evaluation
Evaluation without window . . . . . on
EP criterion 5
EP recognition . . . . . all
Evaluation with measured value window (U) . . . . . off
Evaluation with volume window (mL) . . . . . off

Additional evaluations
Fix end point evaluation . . . . . off
pK/HNP evaluation . . . . . off
Minimum evaluation . . . . . off
Maximum evaluation . . . . . off
Break point evaluation . . . . . off

Additional measured values
Additional calculated measured values . . . . . off
Additional external measured values . . . . . off

PUMP **aspirate sample solution**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 10 s

PUMP **rinse**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) . . . . . 1+2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 10 s

PUMP **empty beaker**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 3 s

SERIES START **Series start track**

RACK **initialize rack**

Device
- Device name . . . . . 855_1

Rack test . . . . . off

EXIT **Exit track**

CALC **calculation**

Result name	Formula	Unit	Decimal places	Assignment	Statistics
content of sodiumchloride	= 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 58.443 * 0.1 / 'MV.Sample size'	%	4	RS01	off

Result name . . . . . **content of sodiumchloride**
Formula . . . . . = 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 58.443 * 0.1 / 'MV. Sample size'
Unit . . . . . %
Decimal places 4
Assignment RS01

Statistics . . . . . off
Description . . . . . RS.'Result name'[.VAL]Result value.
Result monitoring . . . . . off
Save result as common variable . . . . . off
Name . . . . .
Save result as titer . . . . . off
Solution name . . . . .

REPORT **report**

Report template
Report template . . . . . Chloride in broth
Report output
Printer . . . . . off
PDF file . . . . . on
PDF file . . . . . C:\Programme\Metrohm\tiamo\Chloride in broth.pdf
Send e-mail . . . . . off

DATABASE **database**

Database

Robotic Chloride Analyzer

SERIES END **Series end track**

MOVE **to storing beaker**

Device
Device name . . . . . 855_1
Target
Tower 1
Move . . . . . Special beaker
Number 2
Beaker test
Display message . . . . . on
Stop determination . . . . . off
Stop determination and series . . . . . off
Parameters
Shift rate . . . . . 20 °/s
Shift direction . . . . . auto
Swing rate . . . . . 55 °/s

PUMP **add dist water**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 20 s

ERROR **Error track**

MOVE **to rinse beaker**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Special beaker
- Number 1

Beaker test
- Display message . . . . . off
- Stop determination . . . . . on
- Stop determination and series . . . . . off

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **aspirate**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 5 s

PUMP **rinsing**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) . . . . . 1+2

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 10 s

PUMP **empty rinsing beaker**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 3 s

PUMP **fill beaker with water**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 20 s

5.7 Chloride in washing agents and soaps

tiamo™ titration and more

License ID	124049905	Program version	tiamo 1.1 - 36
Client name	TITRATION14		
User	Metrohm		2005-10-31 14:42:41 UTC+1

Method parameters

Method . . . . . Chloride (NaCl) in washing agents and soaps
Method saving date . . . . . 2005-10-31 14:37:46 UTC+1
Method version 1
Method group . . . . . Robotic Chloride Analyzer
Method status . . . . . original
Method saved by (full name) . . . . . Metrohm
Method saved by (short name) . . . . . Metrohm

START **Main track**

General

Workplace view
Current view . . . . . on
Track view for live window
Live display 1 . . . . . Main track
Live display 2 . . . . . Main track
Statistics . . . . . off
Conditioning
Automatic conditioning . . . . . off

Application note

See attached documents

Method variables

Name	Type	Assignment	Value	Comment	Monitoring
Sample size	Number	Sample size		Sample size	off
Sample size unit	Text	Sample size unit		Sample size unit	off
Sample position	Number	Sample position		Sample position number	off
ID1	Text	ID1		Sample identification 1	off
ID2	Text	ID2		Sample identification 2	off
ID3	Text	ID3		Sample identification 3	off

Name . . . . . **Sample size**
Type . . . . . Number
Assignment . . . . . on . . . . . Sample size
Value . . . . . off . . . . .
Check at start . . . . . on
Comment . . . . . Sample size
Variable monitoring . . . . . off
Lower limit . . . . .
Upper limit . . . . .
Message . . . . .
Display message . . . . . on
Record message . . . . . on
Message by e-mail . . . . . off

Mail to
Subject Message from tiamo - Method 'New method 1' - Command 'Main track'
User
Mail from
SMTP Server
POP3 Server
Acoustic signal off
Action off
Stop determination on
Stop determination and series off

Name **Sample position**
Type Number
Assignment on Sample position
Value off
Check at start on
Comment Sample position number
Variable monitoring off
Lower limit
Upper limit
Message
Display message on
Record message on
Message by e-mail off
Mail to
Subject Message from tiamo - Method 'New method 1' - Command 'Main track'
User
Mail from
SMTP Server
POP3 Server
Acoustic signal off
Action off
Stop determination on
Stop determination and series off

Name **Sample size unit**
Type Text
Assignment on Sample size unit
Value off
Check at start on
Comment Sample size unit

Name **ID1**
Type Text
Assignment on ID1

Value . . . . . off.
Check at start . . . . . on
Comment . . . . . Sample identification 1

Name **ID2**
Type . . . . . Text
Assignment . . . . . on. ID2
Value . . . . . off.
Check at start . . . . . on
Comment . . . . . Sample identification 2

Name **ID3**
Type . . . . . Text
Assignment . . . . . on. ID3
Value . . . . . off.
Check at start . . . . . on
Comment . . . . . Sample identification 3

MOVE **to sample**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Sample position

Beaker test
- Display message . . . . . off
- Stop determination . . . . . off
- Stop determination and series . . . . . on

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **add water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 5 s

ADD **add HNO3**

General/Hardware

Device
Device name . . . . . 855_1
Dosing device
Dosing device 2
Solution HNO3
Tandem dosing . . . . . off
Stirrer
Stirrer 1
Stirring rate 8
Switch off automatically . . . . . on
Dosing parameters
Volume . . . . . 2 mL
Dosing rate . . . . . maximum mL/min
Filling rate . . . . . maximum mL/min
Fill automatically at end . . . . . on

DET U **DET U**

General/Hardware

Device
Device name . . . . . 855_1
Dosing device
Dosing device 1
Solution AgNO3 0.01
Sensor
Measuring input 1
Sensor . . . . . Ag Titrode
Temperature measurement . . . . . automatic
Stirrer
Stirrer 1
Stirring rate 8
Switch off automatically . . . . . on

Start conditions

Initial measured value
Signal drift . . . . . off mV/min
Min. waiting time . . . . . 0 s
Max. waiting time . . . . . 1 s
Start volume
Start volume . . . . . 0 mL
Dosing rate . . . . . maximum mL/min
Start measured value
Start measured value . . . . . off mV
Dosing rate . . . . . 5 mL/min
Start slope
Start slope . . . . . off mV/mL
Dosing rate . . . . . 5 mL/min
Pause
Pause . . . . . 10 s

Titration parameters

Titration rate

Titration rate . . . . . user

Measured value acceptance

Signal drift	50.0	mV/min
Min. waiting time	0	s
Max. waiting time	26	s

Dosing of increments

Measuring point density	4	
Min. increment	50	µL
Max. increment	off	µL
Dosing rate	maximum	mL/min

Temperature

Temperature . . . . . 25.0 °C

Stop conditions

Stop volume	20	mL
Stop measured value	off	mV
Stop EP	1	
Volume after EP	2	mL
Stop time	off	s
Filling rate	maximum	mL/min

Potentiometric evaluation

Evaluation without window	on
EP criterion	5
EP recognition	all
Evaluation with measured value window (U)	off
Evaluation with volume window (mL)	off

Additional evaluations

Fix end point evaluation	off
pK/HNP evaluation	off
Minimum evaluation	off
Maximum evaluation	off
Break point evaluation	off

Additional measured values

Additional calculated measured values	off
Additional external measured values	off

PUMP **aspirate sample solution**

Device

Device name . . . . . 855_1

Pumps

Tower	1
Pump(s)	2

Action

Switch on	off
Switch off	off
Duration	on

Time . . . . . 15 s

PUMP **fill beaker**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 20 s

STIR **stir 10 sec**

Device
Device name . . . . . 855_1
Stirrer
Stirrer 1
Stirrer type . . . . . unknown
Stirring rate 13
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 10.0 s

PUMP **empty beaker**

Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 15 s

SERIES START **Series start track**

RACK **initialize rack**

Device
Device name . . . . . 855_1
Rack test . . . . . off

EXIT **Exit track**

CALC **calculation**

Result name	Formula	Unit	Decimal places	Assignment	Statistics
content of sodiumchloride	= 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 58.443 * 100 / ('MV.Sample size' * 1000)	%	4	RS01	off

Result name . . . . . **content of sodiumchloride**
Formula . . . . . = 'DET U.EP{1}.VOL' * 'DET U.TITER' * 'DET U.CONC' * 58.443 * 100 / ('MV. Sample size' * 1000)
Unit . . . . . %
Decimal places 4
Assignment RS01
Statistics . . . . . off
Description . . . . . RS.'Result name'[.VAL]Result value.
Result monitoring . . . . . off
Save result as common variable . . . . . off
Name . . . . .
Save result as titer . . . . . off
Solution name . . . . .

REPORT **report**

Report template
Report template . . . . . Chloride in washing agents and soaps
Report output
Printer . . . . . off
PDF file . . . . . on
PDF file . . . . . C:\Programme\Metrohm\tiamo\Chloride in washing agents and soaps.pdf
Send e-mail . . . . . off
Mail to . . . . .
Subject . . . . . Message from tiamo - Method 'Titer determination of c (AgNO3) = 0.1 mol_L' - Command 'Report 9'
Configuration
User . . . . .
Password . . . . . *******
Mail from . . . . .
SMTP Server . . . . .
POP3 Server . . . . .

DATABASE **database**

Database

Robotic Chloride Analyzer

SERIES **Series end track**
END

MOVE **to storing beaker**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Special beaker
- Number 2

Beaker test
- Display message . . . . . on
- Stop determination . . . . . off
- Stop determination and series . . . . . off

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **add dist water**

Device
- Device name . . . . . 855_1

Pumps
- Tower 1
- Pump(s) 1

Action
- Switch on . . . . . off
- Switch off . . . . . off
- Duration . . . . . on
- Time . . . . . 20 s

ERROR **Error track**

MOVE **to rinse beaker**

Device
- Device name . . . . . 855_1

Target
- Tower 1
- Move . . . . . Special beaker
- Number 1

Beaker test
- Display message . . . . . off
- Stop determination . . . . . on
- Stop determination and series . . . . . off

Parameters
- Shift rate . . . . . 20 °/s
- Shift direction . . . . . auto
- Swing rate . . . . . 55 °/s

PUMP **aspirate**

Device

Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 5 s

PUMP **rinsing**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) . . . . . 1+2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 10 s

PUMP **empty rinsing beaker**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 2
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 3 s

PUMP **fill beaker with water**
Device
Device name . . . . . 855_1
Pumps
Tower 1
Pump(s) 1
Action
Switch on . . . . . off
Switch off . . . . . off
Duration . . . . . on
Time . . . . . 20 s

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