Titer determination of $AgNO_3$

Description

This application report describes the general procedure for the titer determination of Silver nitrate solutions. The procedure is usable for silver nitrate in water and in Glacial acetic acid.
The titer is a dimensionless number about 1 for correcting the indicated concentration. In the software of the titration devices and application reports from SI Analytics®, the term “Titer“ describes the exact concentration in mol/l and not the dimensionless factor.

Instruments

Titrator	TL 5000 or higher
Exchangeable Unit	WA 20 (only for TL 7000 or higher)
Electrode	AgCl 62 or AgCl 62 RG
Cable	L 1 A (only for electrodes with plug head)
Stirrer	Magnetic stirrer TM 235 or similar
Lab accessoires	Glas beaker 150 ml
	Magnetic stirrer bar 30 mm

Reagents

1	the $AgNO_3$ solution from which the titer is to be determined
2	NaCl volumetric standard material
3	Nitric acid 4 mol/l
4	Polyvinylalkohol – solution 0.5%
5	Electrolyte solution L2114 (KNO_3 2 mol/l + KCl 0.001 mol/l)
6	Distilled Water
All reagents should be in analytical grade or better.	

Titration procedure

Reagents

The NaCl volumetric standard is dried as described in the corresponding certificate of analysis.

Polyvinyl alcohol - solution 0.5%
0.5 g of polyvinyl alcohol are dissolved in 100 ml of distilled water.

Cleaning and storage of the electrode

The electrode is rinsed with distilled water. The electrolyte solution L2114 is suitable for storage of the AgCl 62. Distilled water can be used for storage of the AgCl 62 RG.

Sample preparation

The amount of volumetric standard depends on the size of the burette and the concentration of the $AgNO_3$. The amount should be chosen so that about half of the burette volume is consumed. The most common is the 20 ml burette. The required quantity of NaCl can be estimated according to this rule of thumb:

$$W\ [g] = 0.6 * Concentration[mol/l]$$

At lower concentrations than 0.1 mol/l, the required amount of reference material is very small and difficult to weigh. Here the following method is recommended: a larger amount of NaCl (W_{NaCl}) is weighed into a flask. For this, distilled water (W_{H2O}) is weighted in and the NaCl dissolved in it. The ammount of distilled water should be 100 - 200 times of the ammount of NaCl. From this solution, an aliquot A is weighed. The amount of NaCl contained therein is calculated according to the following formula:

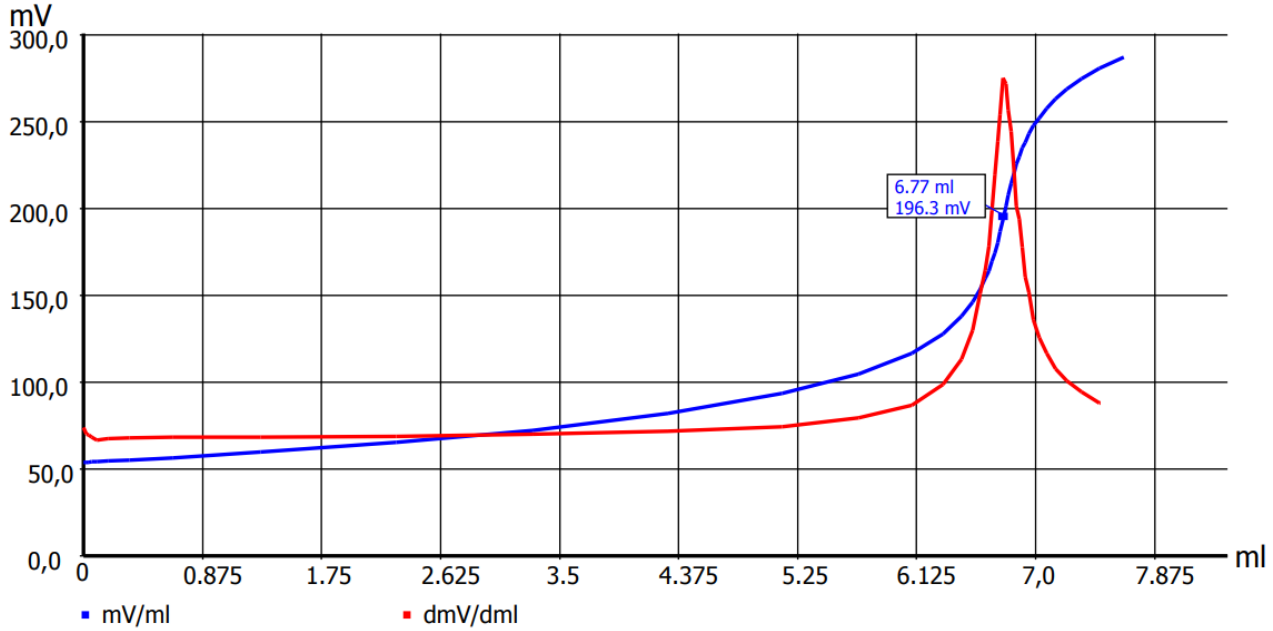
$$W\ [g] = \frac{W_{NaCl}\ [g]}{(W_{NaCl}\ [g] + W_{H2O}[g])} * A\ [g]$$

To determine the titer of a 0.1 mol/l $AgNO_3$-solution, about 0.06 g NaCl volumetric standard are weighed into a 150 ml beaker with an accuracy of 0.1 mg and filled up to 80 ml with distilled, Chloride free water. 0.5 ml 4mol/l HNO_3 and 0.5 - 1 ml of the polyvinyl alcohol solution are added. The titration is done with the $AgNO_3$ solution to an equivalence point. The consumption should be about 5 - 15 ml.

If the specified assay of the volumetric standard is significantly different from 100%, the weight for calculating the concentration must be corrected:

$$W = \frac{Weight * specified\ assay\ \%}{100}$$

Titration parameter



Default method	Titre AgNO3		
Method type	Automatic titration		
Modus	Dynamic		
Measured value	mV		
Measuring speed / drift	User defined	Minimum holding time	3 s
		Maximum holding time	15 s
		Measuring time	3 s
		Drift	10 mV/min
Initial waiting time	0 s		
Dynamic	steep	Max step size	1.0 ml
		Slope max ml	15
		Min. step size	0.02 ml
		Slope min. ml	230
Damping	none	Titration direction	increase
Pretitration	off	Delay time	0 s
End value	off		
EQ	On (1)	Slope value	400
Max. titration volume	50 ml		
Dosing speed	100%	Filling speed	30 s

When titrating with very low concentrated $AgNO_3$ solution or with $AgNO_3$ in glacial acetic acid, the minimum waiting time should be set to 6 s and the drift to 5 mV/min. In this case, the dynamics should also be set to average or flat.

Calculation:

$$T\ [mol/l] = \frac{W * F2}{(EQ - B) * M * F1}$$

B	0	Blank value
W	man	Weight of the sample [g]
F2	1000	Conversion factor
EQ1		Consumption of titrant until first Equivalence point
M	58.44	Molecular mass of NaCl
F1	1	Conversion factor

We recommend to write the exact concentration T to the Exchangable Unit (WA) automatically.

Any questions? Please contact the application team:

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