Titer determination in surfactant titration

Description

This application report describes the general procedure for the titer determination of titrants used in the titration of anionic and cationic surfactants. Common cationic titrants are Hyamin 1622 (Benzethonium chloride) and Cetylpyridiniumchloride (1-Hexadecylpyridinium chloride), the common anionic titrant is Sodiumdodecylsulfate (SDS). For cationic titrants, SDS is available as reference material, but it is no cationic reference material in the required purity available. Therefore, for titer determination of an SDS solution, a Hyamin 1622 solution (or cetylpyridinium chloride) previously set with SDS reference material is used.
When determining the titer, the pH value should be set at which the titration of the sample takes place later. The titer determination is described here at pH 3.

Instruments

Titrator	TL 7000 or higher
Electrode	TEN 1100
Reference Electrode	B 2920 + filled with 3 mol/l NaCl
Cable	2 x L1A
Stirrer	Magnetic stirrer TM 235 or similar
Lab accessoires	Glas beaker 100 ml tall form
	Magnetic stirrer bar 30 mm

Reagents

1	Sodiumdodecylsulfate (SDS) reference standard material
2	Hyamine 1622 solution 0.004 – 0,01 mol/l
3	Cetylpyridinium chloride solution 0.004 – 0,01 mol/l
4	Sodiumdodecylsulfate (SDS) 0.004 – 0,01 mol/l
5	Triton X solution
6	Buffer solution pH 3
7	Distilled water
All reagents should be in analytical grade or better.	

Titration procedure - cationic titrant

Reagents

The Sodiumdodecylsulfate (SDS) reference standard material is dried as described in the corresponding certificate of analysis.

Buffer solution pH 3:
8.45 g Citric acid (monohydrate) and 3,5g Sodium Chloride are weighted in a 1l - volumetric flask and dissolved in about 750 ml distilled water and 200 ml NaOH 0,1 mol/l are added. The pH is adjusted to pH 3.0 with NaOH 0,1 mol/l and the mixture is made up to 1 liter.

Handling the electrode

For cleaning, the electrodes are rinsed with distilled water.
Do not use organic solvents for cleaning the TEN 1100 electrode!
The TEN 1100 is stored dry.
To condition the electrode before the titration, the electrode is placed in a solution of 0.5 ml SDS-solution 0.004 mol/l and 0.5 ml Hyamin 1622 (or Cetylpyridinium chloride) 0.004 mol/l in water for a few minutes.

The reference electrode B 2920+ is filled with 3 mol/l NaCl solution (3 mol/l KCl is often usable as well). This electrode is stored in 3 mol/l NaCl solution (or 3 mol/l KCl)

Sample preparation

The amount of volumetric standard depends on the size of the burette and the concentration of the Titrant. 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 SDS can be estimated according to this rule of thumb:

$$W\ [g] = 3 * Concentration[mol/l]$$

To determine the titer of a 0.004 mol/l cationic titrant, about 0.012 g SDS reference standard material are necessary. So small amounts are difficult to weigh in accurately, so you have to proceed differently:
0.5 g SDS and 50g of distilled water are exactly weighed in a beaker and the SDS is dissolved. From this solution, 1-2 g are used for the titer determination. The weight SDS used for titration is calculated in this way:

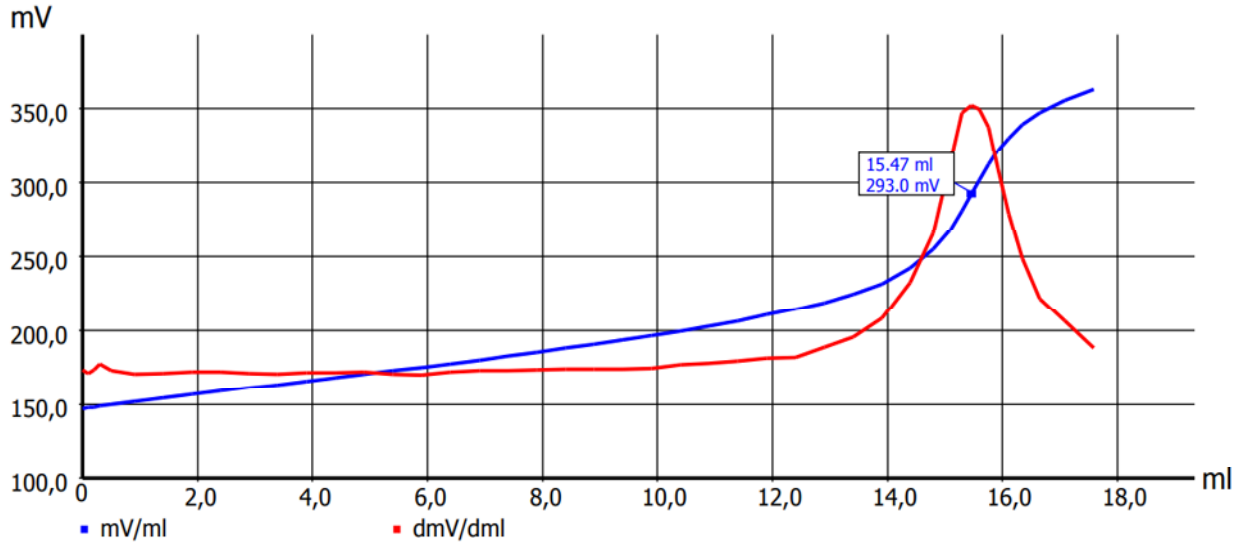
$$W = \frac{weight(SDS) * weight(used\ solution)}{weight(SDS) + weight(water)}$$

The 1-2g SDS solution are placed in a 100 ml beaker and filled up to 50 ml, 5 ml of the buffer solution pH 3 are added and titrated with the cationic titrant.

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

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

Titration parameter



Default method	-		
Method type	Automatic titration		
Modus	Dynamic		
Measured value	mV		
Measuring speed / drift	User defined	Minimum holding time	8 s
		Maximum holding time	25 s
		Measuring time	4 s
		drift	3 mV/min
Initial waiting time	0 s		
Dynamic	User-defined	Max step size	0,5 ml
		Slope max ml	7
		Min. step size	0,075 ml
		Slope min. ml	50
Damping	weak	Titration direction	increase
Pretitration	off	Delay time	0 s
End value	off		
EQ	on	Slope value	80
Max. titration volume	20 ml		
Dosing speed	100%	Filling speed	30 s

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 ml - l
EQ1		Consumption of titrant until first Equivalence point
M	288,37	Molecular mass of SDS
F1	1	Conversion factor

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

Titration procedure - anionic titrant

Reagents

The titer of the Hyamin 1622 (or Cetylpyridinium chloride) solution is determined as described above.

Sample preparation

The amount of volumetric standard depends on the size of the burette and the concentration of the Titrant. 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 SDS can be estimated according to this rule of thumb:

To determine the titer of a 0.004 mol/l SDS solution, about 10 – 15 ml of a Hyamin 1622 solution with exactly known concentration are placed in a 100 ml beaker and filled up to 50 ml, 5 ml of the buffer solution pH 3 are added and titrated with the SDS solution.

Titration parameter

For titer determination of the SDS solution the same parameters as for the cationic titrants are used.

Calculation:

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

B	0	Blank value
V	man	Volume of Hyamin 1622 solution
F2	man	Exact concentration of the Hyamin 1622 solution
EQ1		Consumption of titrant until first Equivalence point
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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