

## Application Note

# Measurement of polyethylene glycol (AMW:2000)

Industry	:	Chemical
Instrument	:	Automatic potentiometric titrator
Measurement method	:	Potentiometric titration/Ion association titration
Standards	:	-

## 1. Scope

The polyoxyethylene addition type nonionic surfactant having an ethylene oxide chain-(CH<sub>2</sub>CH<sub>2</sub>O)<sub>n</sub>- incorporates barium ions to form a cationic complex. The nonionic surfactant can be measured by titrating this cationic complex with sodium tetraphenylborate. Because polyethylene glycol has a similar structure, it can be measured by this method. However, the molar ratio of reaction with tetraphenylborate ion varies depending on the degree of polymerization. Therefore, a factor of titrant is generally calculated based on pure product or nonionic surfactant of known concentration.

In this application, we introduce example of determining the factor of the titrant by titrating the polyethylene glycol of known concentration. The sample is polyethylene glycol (average molecule weight : 2000), and its preparation concentration is 1.9995g/L.

## 2. Precautions

Measurement values may not be stable at the start of use. In this case, condition the state of the electrode by ducting the measurement two or three times.

This electrode is applicable only for titration in aqueous solution system because the sensitive membrane is weak against organic solvents.

## 3. Post-measurement procedure

Rinse the sensitive membrane with pure water every time the measurement is completed and wipe it off with a paper washer etc.

## 4. Apparatus

Main unit	:	Automatic potentiometric titration system (preamplifier:STD)
Electrode	:	Combined surfactant electrode (Fill 1mol/L sodium chloride solution as inner solution to the outer cylinder)

## 5. Reagents

Titrant	:	0.01mol/L sodium tetraphenylborate
Additive reagent	:	1mol/L barium chloride

## 6. Procedure

- 1) Accurately collect 10 mL of sample in a beaker and add 50 mL of pure water with a measuring cylinder.
- 2) Accurately add 1 mL of 1mol/L barium chloride and titrate with 0.01mol/L sodium tetraphenylborate solution.

## 7. Calculation

$$\text{Factor of titrant} = C1 \times K1 \times S / (EP1 - BL1)$$

EP1 : titration volume(mL)

BL1 : Blank level(0mL)

C1 : Concentration conversion coefficient(1.9995g/L)

K1 : Unit conversion coefficient(1)

S : sample(10mL)

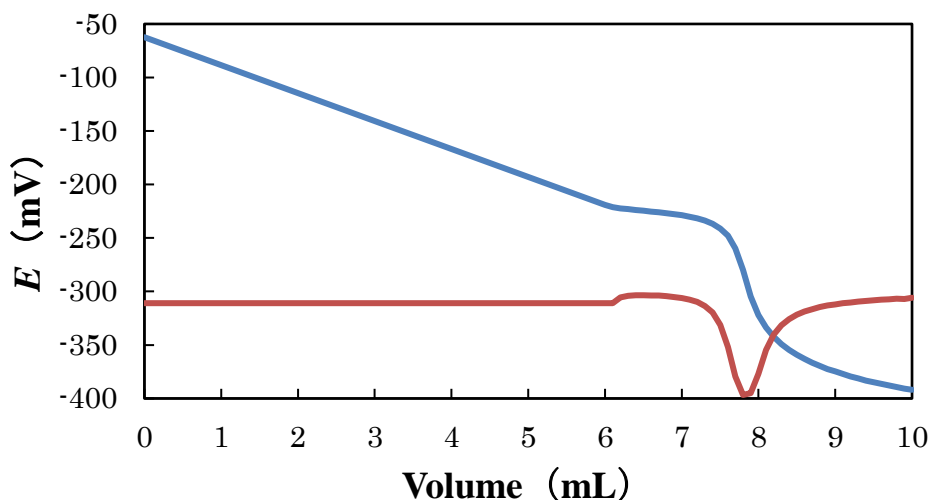
## 8. Example

-Titration parameter-

<u>&lt;Titr.Mode&gt;</u>	:Intermit	<u>&lt;Ctrl.Para&gt;</u>	
		Number of EP	: 1
<u>&lt;Titr.Form&gt;</u>	:EP Stop	End Sense	: Auto
		Gain	: 2
<u>&lt;Titr.Para&gt;</u>		Stirrer Speed	: 4
Burette No.	: 1	Data sampling	: Set
Max. Volume	: 20 (mL)	Data Samp. Pot.	: 999mV
Channel/Unit(Ctrl.)	: Ch1, mV	Data Samp. Vol.	: 0.1mV
Channel/Unit(Ref.)	: Off	Ctrl. Speed	: Set
pH Polarity	: standard	Cut off time	: 10s
Titr.Type Check	: Negative	Unit Volume	: 0.1mL
Direction	: Auto	Disp. Speed	: 1s/mL
Wait Time	: 60 (s)	Other Control	: standard
Dose mode	: None		

‘(The measurement parameter and the titration curve are an example of our automatic potentiometric titrator. In some titrators, parameter item may be different or another parameter item may be added.)

## -Titration curve and results-



## Results

	Factor (mg/mL)	Titer (mL)
1	7.8466	2.5482
2	7.8611	2.5435
3	7.8573	2.5448
4	7.8557	2.5453
5	7.8496	2.5473
Mean	7.8541	2.5458
S.D.	0.0059	0.0019
R.S.D.(%)	0.0749	0.0749

## 9. Summary

A clear inflection point was observed in the titration curve, and the potential was sufficiently changed at the end point. Since the RSD in 5 measurements is less than 1%, it is considered that good accuracy was obtained. Approximate reaction molar ratio is 1 mol of tetraphenylborate ion per 5 to 6 mol of ethylene oxide chain. In this result, the stoichiometric ratio was 5.7, which agreed with the results reported previously. It is considered possible to measure polyethylene glycol (average molecule weight : 2000) using this electrode and potentiometric titrator. However, when measuring the actual sample, the measurement result may be affected by coexisting components. For that reason, it may be necessary to consider whether measurement is We can consider the measurement availability of your sample. Please contact us in case of request.

## 10. References

Kasai Yukio et al. 『Determination of POE Type Nonionic Surface Active Agents by “Sodium Tetraphenylboron Complex-Backtitration Method”』 『Journal of the Chemical Society of Japan. Industrial chemistry』 72(4),pp.912-917.

Milan Sak-Bosnar et al.(2007) 『Nonionic surfactant-selective electrode and its application for determination in real solutions』 , 『Analytica Chimica Acta』 581,pp.355-363